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The Canadian Engineer.

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

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CONTENTS OF THIS NUMBER.

THE TELEPHONE IN PARLIAMENT.

We are pleased to note that since the last issue of the "Canadian Engineer," the Dominion Government has appointed a select committee to "enquire into and report regarding the various public telephone systems in operation in Canada and elsewhere," also to "consider and report what changes, if any, are advisable in respect of the methods at present in force for furnishing telephone service to the public." This is a move in the right direction, and if the members of the committee will realize the responsibility resting upon their labors and thoroughly investigate the many phases of this important question in an absolutely impartial manner, the final issue can only result in a greatly improved service at rates which will establish the telephone as a convenience to the many, instead of a luxury to the few.

The committee will have no reason to complain of lack of material to work upon, indeed the vastness of the evidence available renders the task the more difficult. We have no doubt that much testimony will be given on both sides which will require very careful analysis. We may be certain that the monopoly and its friends will see that the committee is well supplied with carefully prepared and plausible evidence showing the telephone to be a natural monopoly, and that the public cannot be better served, while on the other hand enthusiasts will claim that a service can be provided at less than cost, and that the maintenance charges should be, nil. Much of the evidence will be so contradictory that it will require the most unbiassed judgment to determine which is worthy of credence.

We venture to hope that the committee will secure information from every available source calculated to throw light upon this important subject and will satisfy themselves as to the actual conditions existing elsewhere. We would point out that the most valuable information, namely, that referring to State and Municipal services, and independent competition, will have to be sought for, whereas that relating to the "Bell" monopoly, both in Canada and the United States will be unremittingly placed at the disposal of the committee with a view of crowding out testimony from other sources.

It should be recognized that in this matter, the public have no representation other than the members of the committee, to study their interests, whereas the monopoly has at its command all the machinery of a vast organization whose ramifications extend all over the United States and Canada. It is therefore very essential that while the Bell Telephone Company is afforded every opportunity of stating its case fairly, every effort should be made to secure reliable evidence from independent sources regarding the different systems in operation in Canada, the United States, and elsewhere. We are satisfied that if this policy is adopted, the information obtained will be a revelation to Canadians, and will more than repay the Government for the labor and expense entailed by the investigation.

We regret to note in Sir William Mulock's resolution the qualifying words, "if any" used in regard to what changes are advisable in the present service. We do not see the necessity of any doubt or hesitation in regard to the existing state of affairs. It must be admitted that the public in all parts of the Dominion are clamouring for some change in the present law regarding telephones. Even the Government recognized this fact when it inserted clauses regarding the interchange of connections, and other matters, in the recent North-West Telephone Company's bill. The Manitoba Legislature also realizes the necessity for a change in the present law, and has given notice of its intention to introduce a bill regulating the telephone service in its own Province. We therefore think that the resolution appointing the Select Committee should have stated in no uncertain terms that a change in the law is expedient, and that the point to be determined is in what respect the law should be changed or amended.

We have already referred to the necessity of compelling the Bell Telephone Company to submit to the control of the municipalities in regard to the use of the streets. Another matter requiring urgent attention is the interchange of long distance communication.

Legislation should be enacted providing for the compulsory interchange of telephone connections over long distance lines in Canada, upon conditions similar

to those prevailing in Great Britain where the subscribers to the local exchanges of the Government, Municipal, or National Telephone Company's systems enjoy equal privileges in regard to the use of the long distance lines, and can converse with any telephone user in the kingdom on payment of the proper terminal fee in addition to the long distance charge. This matter surely does not present such a difficult problem to our legislators, as to require even a Select Committee to waste time over. The drafting of an amendment to the present law, providing for the interchange of telephone connections and fixing a terminal fee of five per cent. of the company's long distance charge, with a minimum of five cents, payable to the municipality or company receiving the distant call is a simple matter, and moreover is an arrangement which would be perfectly fair to all parties.

In order to furnish some idea of the practical working of this system in Great Britain we give the following list of the Government long distance charges for a three minute conversation, also the terminal fees payable to the local telephone exchange in each town:—

Long Distance Telephone Charges, and Terminal Fees in Great Britain and Ireland.

	Distance miles.	Long distance charge. $	Terminal fee cents.	Total $
Up to	25	0.06	6	0.12
" "	50	0.12	6	0.18
" "	70	0.18	6	0.24
" "	100	0.24	6	0.30
London to Birmingham.	105	0.36	6	0.42
Nottingham	110	0.36	6	0.42
Manchester	165	0.48	8	0.56
Swansea	170	0.48	8	0.56
Liverpool	180	0.48	8	0.56
Plymouth	200	0.60	8	0.68
Newcastle-on-Tyne	260	0.72	8	0.80
Edinburgh	340	0.96	12	1.08
Glasgow	365	1.10	12	1.22
Dundee	377	1.10	12	1.22
Belfast	404	1.34	12	1.46
Aberdeen	435	1.22	12	1.34
Inverness	453	1.34	12	1.46
Dublin	491	1.58	12	1.70
Cork	619	1.94	12	2.06

The iniquitous compact existing between the Bell Telephone Company and certain railway companies for the purpose of depriving municipal and independent telephone users of the right to communicate with the freight and passenger departments of the railway systems of Canada, is also an evil which should have been remedied long ago. Instead of this we find the president of a "Bell" subsidiary company using his position as chairman of the Railway Commission to veto the finding of his colleagues on this question by raising a legal difficulty as to the payment of compensation to the offending companies, while the Government looks on and denies legislation which would finally settle the matter. The action of the Government on this question is reprehensible. In the first place the agreement between these corporations was made for the sole object of restraining trade in telephones, and in the second the railway companies by adopting it are discriminating in favor of one section of the public to the disadvantage and personal loss of another section. Both these acts are, we believe, contrary to the laws of the Dominion, and for that reason alone, these corporations would not be entitled to compensation even if they had any other ground to base such a claim upon, which we are satisfied they have not. As well might the Canadian Pacific claim compensation from the Grand Trunk Pacific for building a second transcontinental line, as that the "Bell" should be entitled to compensation because its competitor is permitted to place a telephone for the convenience of its own subscribers in an office where the monopoly is already enjoying that privilege.

It is a regretable fact that in all matters relating to telephone legislation up to the present time, the Government has shown an apparent disposition to uphold the "Bell" monopoly, and to disregard the wishes of the people, voiced through the municipalities. Deputation after deputation has waited upon the Government only to meet with honeyed words and half-hearted promises, which have ended in nothing.

We are glad, however, that the Government has at last decided to act and we trust the efforts of Sir William Mulock and his colleagues will result in securing to the people an efficient and popular telephone service, of which they have so long been deprived by the monopolistic rule of the Bell Telephone Company. In conclusion, we must congratulate the Government on its representation upon the Select Committee by the Postmaster General. This augurs well for the outcome of the investigation, as no minister is so qualified to direct the work of the committee, nor as far as we know, could anyone have been selected with so wide a knowledge of the subject or a better appreciation of the important bearing it has upon the city and rural life of hundreds of thousands of Canadians.

Whatever may be the final outcome of the Government's investigation, we are persuaded that the only satisfactory solution of the telephone problem will be found in the State ownership of the long distance lines, and the local control (municipal or otherwise), of the local exchanges. We are not prepared to endorse the proposal to nationalize the telephone service, as a whole, for the reason that we do not think any system of centralized management could be devised which would satisfy the different local conditions existing in each of the numerous municipalities in all parts of the Dominion. In the matter of local telephone service the people desire to cater for themselves just as they do to-day in regard to electric lighting, street railways, gas and water. If this right were taken away, while the service as a whole might be improved and rates lowered, many of the present grievances would be merely transferred from the "Bell" monopoly to the Government, as it would be manifestly impossible to accede to all the demands which would be made upon the State, and at the same time carry on the business with that rigid uniformity so essential in the administration of a government department. Further than this, the creation of a State monopoly of the telephone business and the consequent adoption of a fixed standard type of equipment would take away all incentive for the development of inventive genius, and retard the introduction of improvements, whereas if the municipalities established or controlled the local systems there would always exist a friendly rivalry to secure the best service, and competition in the invention and manufacture of telephone equipment would be encouraged. These are points which should be carefully considered before

any decision is arrived at in regard to the public ownership of this utility. That public ownership is the proper solution of this question we are satisfied, but we contend that the municipalities are in the best position to satisfy the requirements of local telephone users, while the long distance service can only be properly administered by the Dominion Government.

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—We are glad to be able to say that the new Ontario Government, in reorganizing the Temiskaming Railway Commission, has made the appointments from the ranks of practical railway men, as this journal contended should be done, and not from the ranks of politicians. In Cecil B. Smith, the chief of the new commission, they have a first-class engineer of wide knowledge and high character, and the others, we understand, are men of practical experience in work of this kind. The Globe is among the opposition journals who are fair enough to approve of this application of common-sense business methods to affairs of state.

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—The mathematicians, Atcherley and Pearson, of University College, London, have developed a new point in dam construction, and acting on this discovery, Sir William Garstin has abandoned the attempt to raise the great dam at Assuan, Egypt, another 20 feet as intended. This discovery is that in vertical sections of dams under water the pressure is more severely strained than in horizontal ones. Therefore, while a dam designed under rules which have hitherto applied may be safe from cracking horizontally, it may be liable to crack vertically. Sir Benjamin Baker, consulting engineer of the Nile reservoir, accepts this theory and advises against raising the dam further. He says, however, that the vibrations on the masonry due to rush of water through the sluices are negligible, and adds that the dam as it stands, will last for centuries.

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—It is a most fortunate thing in the interests of the people in general, and particularly the business community, that the special committee appointed by the Dominion Parliament to investigate the telephone question has a man of the character of Sir William Mulock as its chairman. The people of both sides of politics will acknowledge that Sir William has proved to be the ablest Postmaster-General Canada has ever had, not only in the number of domestic abuses he has reformed in the administration of the post-office, but in the effect of his advanced statesmanship upon the postal policy of the whole British Empire. It has required no common courage to carry out these reforms, and it will require no common courage to save the people of Canada from the dangers that threaten them in the present telephone crisis. We believe Sir William, if he is spared, will be able with the help of the few earnest reformers who are in the house, to deliver the country from the false position in which it finds itself by reason of the unwise telephone legislation of the past, and if he does, his name will be held in grateful remembrance by future generations, even if the results are not fully seen or appreciated by his immediate contemporaries.

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—The city council of Hamilton, after a heated debate, has awarded a contract for cement to the amount of $23,325 to the Cayuga Lake Cement Co., a New York State concern, whose tender was $1.55½ per barrel, as against $1.58 per barrel quoted by the Grey & Bruce Cement Co., of Owen Sound, Ont. The latter was the lowest tender from a Canadian firm, and the difference was so small that it was thought the contract would be awarded to the Canadian firm, the tenderers having been notified that the lowest bid would not necessarily be accepted. The city engineer reported that the Canadian cement had shown on the tests a slight superiority over that of the United States tenderer, and he would have preferred carrying the tests still further in order to make a fuller proof of the relative qualities. No delay was permitted, however, and the tender of the Cayuga Lake Co. was accepted by a vote of 16 to 5. The cement thus to be purchased is made in a state which forbids any contract from being executed within its borders by a foreign firm, or even the employment of foreign workmen brought into the state to work on a contract. It is moreover pointed out by the Hamilton Times that the tender made by the New York firm is so far below its normal prices on home sales as to be subject to the charge of dumping, as the freight of 33¼ cents per barrel, and duty of 43½ cents per barrel, besides the cost of teaming in the city, and cost of returning the bags to the works would all have to be deducted from the contract price. These deductions would bring the net price down to about 75 cents per barrel, whereas the prices of standard brands of United States cement quoted on the New York market range from $1.10 to $1.40. If the anti-dumping act were put into effect in this case, the city would have to pay the extra duty if this contingency is not specifically provided against in the contract, and in such case, the patronage of the foreign article would be rather a costly experiment. It may be well to call the attention of other Canadian municipalities to the fact that within the past few months two western towns have paid pretty dear for like experiments. In one case a town "saved" $200 on a contract for iron pipe imported from Scotland,, but found that when a case of dumping was made out the importation cost $1,000 extra. As the canny Scotch firm had quoted its price on board car or steamer on the other side, the net loss of $800 fell on the Canadian town. There is no use in a law which is not fairly carried out, and under the anti-dumping law bargain-counter prices for foreign supplies may often turn out to be dear investments.

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THE CANADIAN FAIRBANKS COMPANY, LIMITED.

The business of the Fairbanks Co., in Canada, including all their selling agencies, contracts, organization and warehouse stocks of goods at Montreal, Toronto, Winnipeg and Vancouver, has been purchased by Henry J. Fuller.

Mr. Fuller started the business of the Fairbanks Co. in Canada six years ago, and since that time it has rapidly grown. The Fairbanks Co., not seeing their way clear to manufacture in Canada, Mr. Fuller offered to buy the business in order to re-organize it as a Canadian institution, and the business has been conducted, since March 15th, as the Canadian Fairbanks Co., Limited, recently incorporated with $500,000 capital. Mr. Fuller is president and treasurer, and the other incorporators are C. M. Rudel, T. A. Pownell, C. A. Duclos, and E. J. Sarle. It is the company's intention to begin, very shortly, the erection of a large plant for manufacturing, in Canada, specialties which they have heretofore imported.

They will continue to represent the following concerns: The American Tool Works Company, Cincinnati, O.; American Wood-Working Machinery Co., New York City;

American Spiral Pipe Works, Chicago, Ill.; American Steam Gauge & Valve Co., Boston, Mass.; Buhl Malleable Co., Detroit, Mich.; Brown & Sharpe Mfg. Co., Providence, R.I; Bignall & Keeler Mfg. Co., Edwardsville, Ill.; Messrs. H. A. Cole & Co., Liverpool, Eng.; Emmert Manufacturing Co., Waynesboro, Pa.; Foster Engineering Co., Newark, N.J.; E. M. Dart Mfg. Co., Providence, R.I.; Goubert Manufacturing Co., New York City; H. W. Johns-Manville Co., New York City; Johns-Pratt Co, Hartford, Conn.; J. J. McCabe, New York City; Niles-Bement-Pond Co., New York City; Norton Emery Wheel Co., Worcester, Mass.; Oneida Steel Pulley Co., Oneida, N.Y.; Oster Manufacturing Co., Cleveland, O.; G. M. Parks Co., Fitchburg, Mass.; Wm. Rutherford & Sons Co., Montreal, Que.; Messrs. Randolph-Clowes Co., Waterbury, Conn.; Reed Manufacturing Co., Erie, Pa.; Reliance Machine Tool Co., Cleveland, O.; Reihle Bros., Testing Machine Co., Philadelphia, Pa.; Taunton Loco. & Mfg. Co., Taunton, Mass.; Messrs. J. B. Treasure & Co., Liverpool, Eng.; Warner Instrument Co., Beloit, Wis.; Union Manufacturing Co. (Chuck Depart.), New Britain, Conn.; S. A. Woods Machine Co., Boston, Mass.; T. B. Wood's Sons Co., Chambersburg, Pa.; Messrs. Wilmarth & Morman Co., Grand Rapids, Mich.; Warnock Mfg. Co., Worcester, Mass.

The first change will be to move the Montreal warehouse into new quarters at 444-446 St. James St., on the 1st of May next, the old quarters on Craig Street being retained for the present, as the extra space will be needed for the increase of business. Among the appointments already made by the new company is that of C. G. Landes to be head of the machine tool department at the Toronto branch. C. M. Rudel becomes manager of the Montreal branch.

ESSENTIAL ELEMENTS IN THE DESIGN OF DAMS.

JOHN S. FIELDING, C.E., TORONTO.

(Continued from last issue.)

Dependence upon wedges of the material composing the structure, projecting downwards into the substrata, must also be deceptive, for the reason that it will be impossible to secure a maximum pressure upon the vertical faces of these wedges, until the structure shall have moved sufficiently to take up the decrement of length (actually width), of part of the sub-base that each wedge bears against, and if such necessary movement should take place the seal under the whole structure would be instantly impaired, and pressure would enter to the destruction of the structure. It may be claimed that shear must accrue at the points ab, cd, and ef, before the structure could be pushed out of its position, but it is clear that it would be difficult to induce shear in these points without impairing the seal, as above described, (see Fig. 12.)

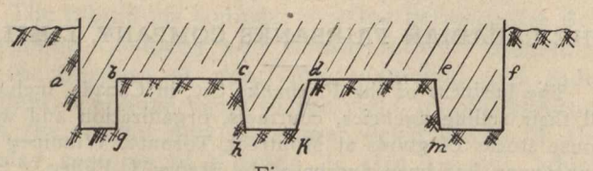


Fig. 12.

We also have the further knowledge that the line g-h and k-m may coincide with a natural strata of the sub-base, in which case there would be no possibility of sufficient strength being in the sub-base to induce shearing at ab, cd, or ef.

It is clear that under these conditions that a straight level surface would be equally effective.

In the case of the foundations of a dam being carried into the sub-strata to a great depth (Fig. 13), we will have two things to consider: First, if the resilience of the structure material admits of its being pushed forward against the sub-strata wall m-n, so as to bear securely against it, thus enabling the structure to deliver pressure to this wall, the structure material will also have resilience sufficient to cause decrement of length in o-p sufficient to break all bond that existed between o-p and m-n before the structure was put under pressure.

It is admitted that the pressure will likely reach the face of the dam f-s, and it is also probable that the assistance of the wall m-n could not be of maximum advantage to the dam while the adhesion of the structure to its sub-base remained at

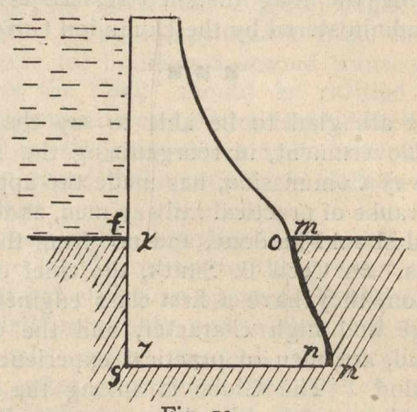


Fig. 13.

a maximum. As to how much actual assistance the wall m-n could impart to the structure, and the structure at the same time retain its maximum adhesion upon s-n would be difficult to determine.

A very great degree of mathematical refinement could be imparted to this question and the answer would still be in doubt.

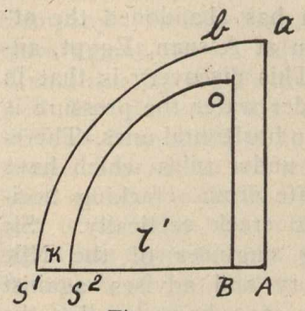


Fig. 14.

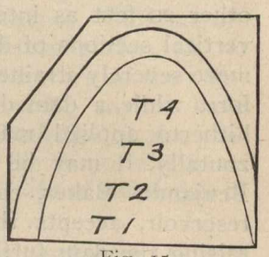


Fig. 15.

Since, as has been pointed out in a previous article, the water pressure per square foot, and consequently the liability to deterioration of the seal on sub-base increases with each foot of depth the foundation may be carried to, it is only a fair proposition to say that no reliance should ever be placed upon the strength of the wall m-n, but that whatever its strength may be, it should be considered as off-set by the greater liability of the seal to deterioration.

Pressure should always be conceded to reach to the lowest portion of the dam.

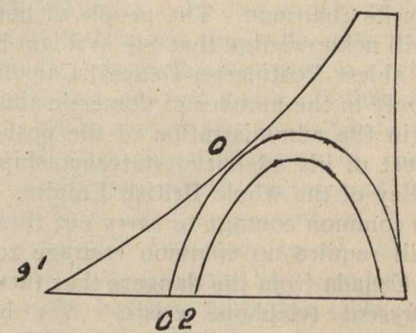


Fig. 16.

In excavating for the foundations of a dam, it is usual to continue through any rock that does not show the proper qualities of impermeability and strength for the pressures to be imposed.

If the rock, f s n m, was defective, it is likely that the strata above stream from f-s will be defective also, and that the water will reach the face of the dam at f-s.

The difficulty in making the line f-s water-tight, the probability that decrement of length of the portion x-y would destroy all bond of f-s with x-y, and the further fact that forward movement of the dam at the top when under full pressure

of the water will tend to part x from f, are strong arguments against any belief in the tightness of the vertical joint f-s, y-x.

When the dam is under pressure, there is a tendency to relieve the front part of the sub-base of pressure and to transfer this weight to some portion near the toe, and the constant pressure of the water practically raises or supports that much weight. It does not raise it, because the dam has a safety-factor against overturning.

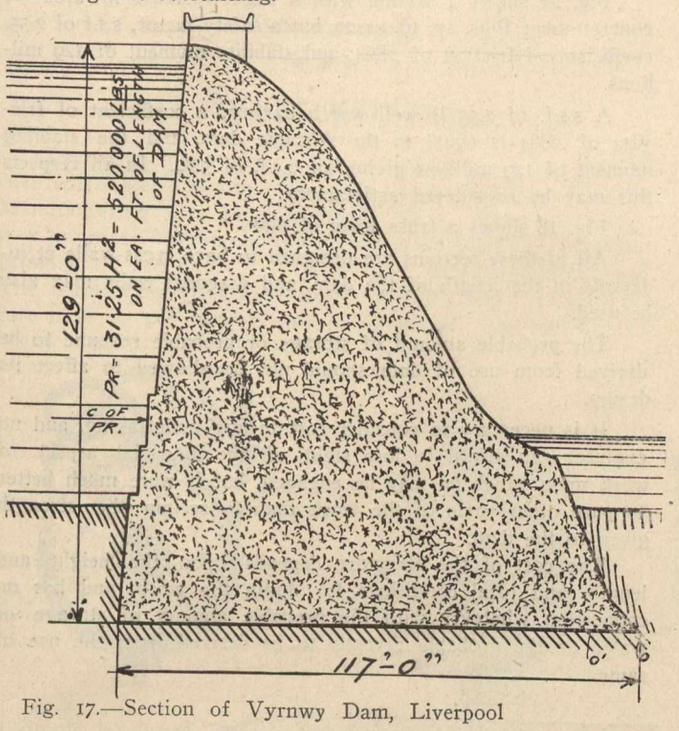


Fig. 17.—Section of Vyrnwy Dam, Liverpool

Area of wall, 8,972 sq. ft.; weight per lin. ft., 1,256,080 lbs.; pressure of water, 520,000 lbs.; overturning moment, 22,360,000 lbs.; stability moment about O, 86,000,000 ft. lbs.; stability moment about O, 74,000,000 ft. lbs.; coefficient of friction, .414; sliding safety factor, $\frac{.73}{.414} = 1.76$; overturning safety factor, 3.31 to 3.85.

Cost, 332 cu. yds. concrete at $6 = $1,992 lin. ft.

Test of efficiency and economy: lbs. of material per lb. of pr. $\div$ margin of safety $= \frac{2.415}{.76} = 3.18$; or, $\frac{.76}{2.415} = .3147$; or cost per ft. $= \frac{\$1,992}{\text{margin of safety}} = \frac{\$1,992}{.76} = \$2,621.$

Now the advocates of the Scientific Profile would have us believe that the pressure goes straight to the centre of gravity of the mass and acts only through that.

It may be, however, that something different occurs.

The most effective stability lever arm will be l^1, and the most effective weight will be a slice of wall such as A.B. (Fig. 14.)

The portion of the base under the least pressure from weight of mass will be s^1-s^2. s^1-s^2 will be the most likely point for effort to take place to prevent overturning, and since the other

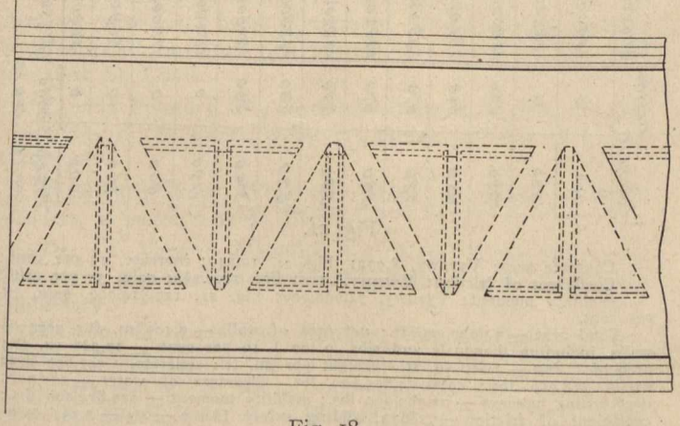


Fig. 18.

portions of base are under a greater pressure, and the sub-base will seek to present equal reactions to all points, thus s^1-s^2 will be most likely to receive this overturning pressure.

The dam having a safety-factor, it is only necessary for sufficient units of the mass at abAB lever arm, l^1, and bearing value of s^1-s^2 to act in conjunction, and we would have:

$$wl^1 = pL,$$

in which w = weight of ABba.

p = pressure of water.

L = overturning lever arm = 1-3 depth of water.

This would leave all of the interior of the mass practically inert, and resting upon the sub-base.

The necessary adhesion to make up the strength against sliding would be provided by this mass, with the addition of the weight at s^1-s^2, and the vertical component of pressure at s^1-s^2. The extent of the areas of s^1-s^2 affected, and the area of column s^1b,a,s^2, would depend upon the value of l^1 first of all, which would be determined by the safety-factor given the structure, then upon the freedom of column from other stresses, and also the modulus of elasticity of the material.

The extent of the area baAB downward from ba will depend upon the tensile strength of the material.

With a tensile strength of 200 lbs. per sq. inch, it would be possible for a depth of material at $\frac{140}{1,728}$ lbs. per cub. ft. = 200 ft. to be hung upon the upper end of column at ab.

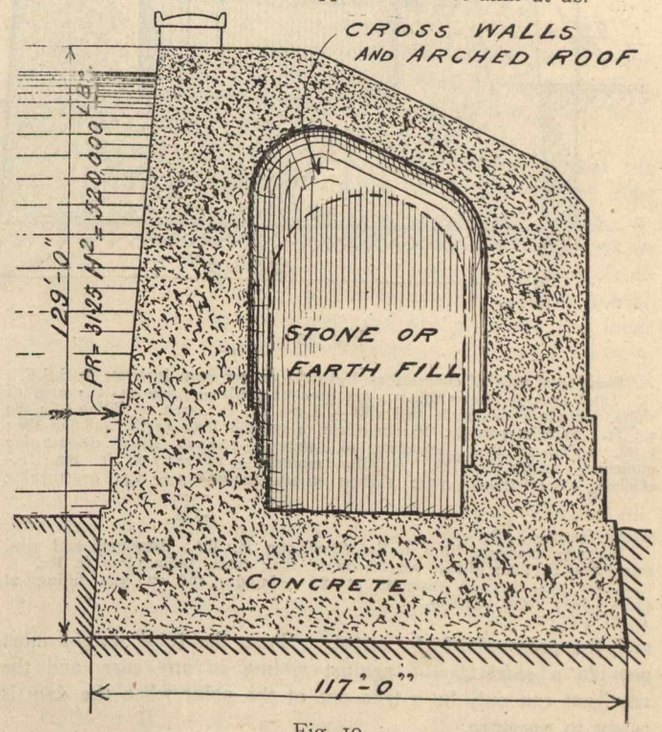


Fig. 19.

Same total area of concrete as Vyrnwy; 20 per cent. increase in S.S.F. Total area = 11,800 sq. ft.; net area of walls = 8,160 sq. ft.; area of walls, including diagonal walls, 8,160 + 10 per cent. = 8,972 sq. ft.; area of filling = 2,828 sq. ft. Weight per lin. ft. concrete, 1,256,080 lbs.; earth, 282,800 lbs.; total, 1,538,880 lbs. Pressure of water = 520,000 lbs.; overturning moment = 22,360,000 lbs.; stability moment = 98,500,000 lbs.; coefficient of friction = .338; sliding safety factor = $\frac{.73}{.338} = 2.16$; overturning safety factor = 4.42.

Cost: 332 cu. yds. concrete at $6 = $1,992; 150 cu. yds. filling at 40c. = $42; total, $2,034.

Is it not fair to assume that these effective elements may come into play to take care of the overturning moment, and that any fixed rule that the resultant must act through the centre of gravity may be in error.

It must be conceded, of course, that the modulus of the material must govern the formation of any thrusting area of column s^1b or s^2a, etc., but the value of the combination of the greatest lever arm obtainable l^1, and the most effective area weight present ab BA cannot be ignored. If the width of base equals the depth of water, the length of l^1 will be nearly 3 when the length of the overturning area L equal 1. The weight of abAB will require then to equal $\frac{pr.}{3\text{-}x}$ since pr. = 31.25 aA^2.

$$\therefore \text{ wt. of abAB will equal } \frac{31.25}{3\text{-}x}\ aA^2.$$

For a dam 20-ft. height, 20-ft. base, and material weigh- 140 lbs., ab will equal 1.6-ft.

This value 1.66 would be corrected by substituting $\frac{1.66}{3}$ x 3-x, and would also be reduced by considering the stability value of the column ba s^1-s^2.

It is unnecessary to follow this to search for any finality, as to the exact value of ab.

Sufficient has been shown to make it clear that a small area weight acting at ab with the lever arm l^1 could take up the overturning moment. If this is taken up there is no advantage in finding resultants due from the combination of the total weight

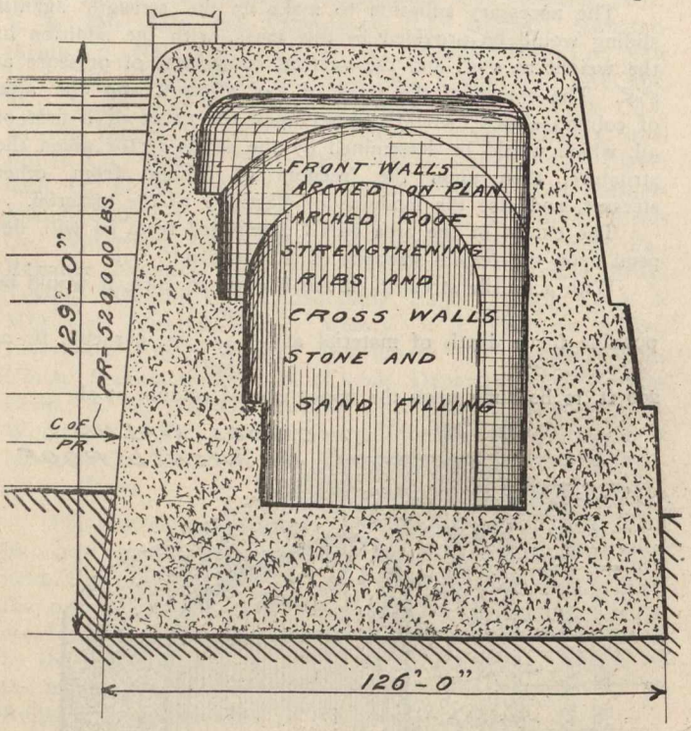


Fig. 20.

Same total area of concrete as Vyrnwy; 32 per cent. increase in S.S.F. Total area = 13,440 sq. ft.; net area of walls = 7,840 sq. ft.; area of walls, including diagonals and ribs = 8,960 sq. ft.; area of filling = 4,480 sq. ft. Weight per lin. ft.: concrete, 1,255,400 lbs.; earth, 448,000 lbs.; total, 1,703,400 lbs. Pressure of water = 520,000 lbs.; overturning moment = 22,360,000 lbs.; stability moment = 108,201,700 ft. lbs.; coefficient of friction = .305; sliding safety factor $\frac{.73}{.305} = 2.4$; overturning safety factor = 4.85.

Stability moment from walls, 68,285,700 ft. lbs.; diagonals and ribs, 10,348,000 ft. lbs.; filling, 29,568,000 ft. lbs.; total, 108,201,700 ft. lbs.

Cost: 332 cu. yds. concrete at \$6 = \$1,992; 166 cu. yds. filling at 40c. = \$67; total, \$2,059.

and the pressure of the water. Since the total weight must provide a safety-factor against sliding in any case, and the resultant can only be a true one at the point when the dam is ready to overturn.

The theory advanced is merely assuming that the level arm acting in the structure will take hold at the most advantageous point, and exert itself to the most advantage.

Column s^1-s^2ba must deliver to the sub-base at an angle that will not give a horizontal component of an amount greater than the tensile strength of the material will withstand. There will be tensile stress at all horizontal planes, such as $T^1T^2T^3T^4$, and it may be that the column assumes the shape shown in Fig. 15.

With an assumption of this kind accepted as a probability, we can then say that it is better to have a dam sectioned similar to Fig. 15, than as per Fig. 16, since the o o^1 o^2 would be better employed at some other part higher up in the section.

If the arguments and deductions given in the preceding pages are correct, we are getting back to the profile of the old Spanish dams, such as the Alicante or the Val De Infierno.

As the use of such profiles would result in enhanced cost, the writer has a proposal to make, to the effect that dams should be built with upper and lower faces, floor and roof of concrete, leaving an interior space that may be filled up cheaply with broken stone, gravel, sand, or any material, excepting clay. The actual expenditure for concrete being made to equal the cost of a dam with a s.s.f. of 1.8, and the interior loading to bring the s.s.f. up to about 2.4 or 2.5 or over.

Fig. 17 to Fig. 21 show such a dam.

Fig. 17 representing the Vyrnwy dam for Liverpool waterworks, having a safety-factor of 1.76, a coefficient of friction of .414, and a stability moment of 74 millions.

Fig. 19 shows a section having an area of concrete equal to No. 17, but with greatly increased strength, having a safety-factor of 2.16, a coefficient of friction of .338, and a stability moment of 98 millions.

Fig. 20 shows a section having an area of concrete similar to Fig. 17 and Fig. 19, but with larger interior space, showing safety-factor of 2.4, a coefficient of friction of .305, and a stability moment of 108 millions.

Fig. 21 shows a section with a slight increase in area of concrete over Figs. 17, 19, or 20, but a safety-factor, s.s.f of 2.55, coefficient of friction of .2864, and stability moment of 129 millions.

A s.s.f. of 2.55 is well worth having; a coefficient of friction of .2864 is equal to the Alicante dam, and the stability moment of 129 millions giving an o.s.f. of 5.82. In all respects this may be considered satisfactory.

Fig. 18 shows a truss form of plan.

All of these sections are designed to have cross-walls at intervals in the length of the dam, and diagonal walls may also be used.

The probable amount of storage or probable revenue to be derived from use of dam should not be allowed to affect its design.

It is necessary to consider cost in any undertaking, and no engineer can afford to lose sight of the financial aspect of work upon which he may be engaged, but it were much better to pare other parts of the work than to scrimp the strength given to the dam.

The cost of the structure depends upon the height and length, and local conditions for doing the work, and has no connection whatever with the probable amount of storage of water or the probable revenue to be derived from the use of same.

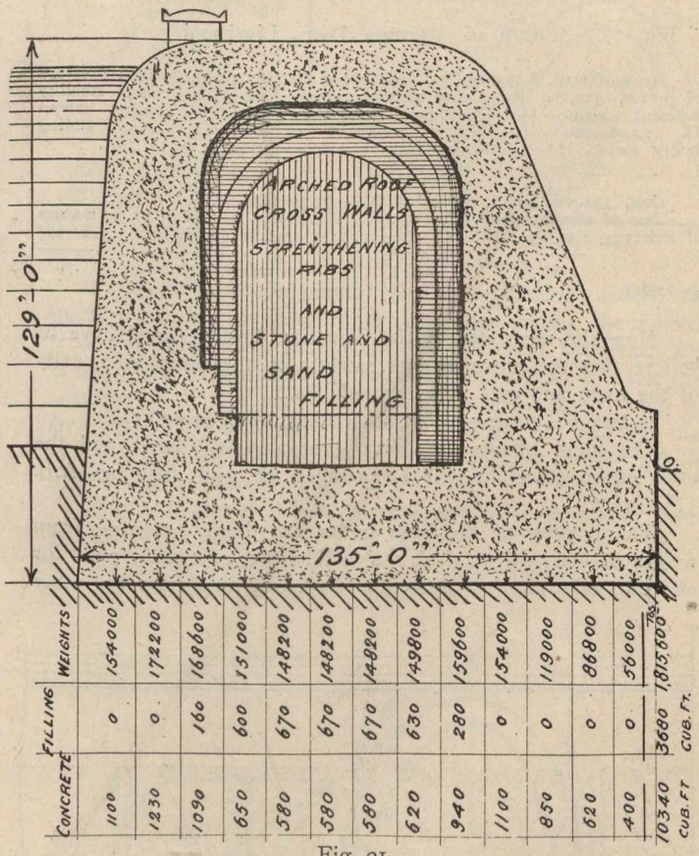


Fig. 21.

Concrete area: Vyrnwy, 8,972; Fig. 21, 10,340; increase, 15 per cent. Coefficient of friction: Vyrnwy, .414; Fig. 21, .286; gain, 30 per cent. Stability moment: Vyrnwy, 74,000,000; Fig. 21, 129,814,000, gain, 75 per cent.

Total area = 14,020 sq. ft.; net area of walls = 9,400 sq. ft.; area of walls, including diagonals and ribs, 9,400 + 10 per cent. = 10,340 sq. ft.; area of filling = 3,680 sq. ft. Weight per lin. ft.: concrete, 1,447,600 lbs.; earth, 368,000 lbs.; total, 1,815,600 lbs. Pressure of water = 520,000; overturning moment = 22,360,000 lbs.; stability moment = 129,814,000 lbs.; coefficient of friction = .28645; sliding safety factor $\frac{.73}{.286} = 2.55$; overturning safety factor = 5.82.

Cost: 382 yds. concrete at \$6 = \$2,292; 136 yds. filling at 40c. = \$55; total, \$2,347.

Test of efficiency: lbs. of concrete per lb. of pr. = 2,783 ÷ margin of safety = $\frac{1.55}{1.55} = \frac{2.783}{2.783} = 1.80$, or $\frac{1.55}{2.783} = .5566$; or, rest per foot = margin of safety \$2,347 = \$1,514.

The pressure will be the same with a small length of reservoir as with a long one, and it may as well be admitted at the outset that the pressure is the all-controlling factor.

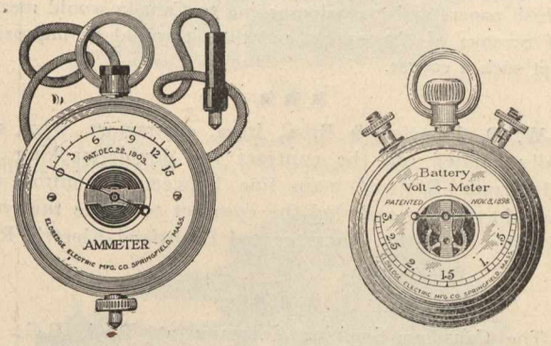
DEAD WEIGHT AND ADHESION.

Dead weight of the structure, resulting in adhesion to the sub-base, and inertia to resist the pressure of the water, is the desirable and necessary factor in a dam.

(To be continued.)

POCKET METERS.

Two convenient meters, here illustrated, are the watch-case volt meter and ammeter, made by the Eldredge Electric Manufacturing Co., of Springfield, Mass. The volt meter is a practical instrument for all users of batteries, whether primary or secondary. It is of soft iron, solenoid type. The connecting-posts have non-removable nuts, which feature adds to the convenience in handling. The instrument



is simple in design, neat in appearance, and not liable to injury with ordinary use. The ammeter shown is specially designed for automobile and launch use. It has a short, flexible cord attached, which may be drawn back into case when not in use. The meter can be used in any position, and works in either direction of the current.

CATALOGUES RECEIVED.

Royce, Limited, Manchester, Eng.—Hundred-page catalogue, 7 by 9, Overhead Travelling and Jib Cranes, fully illustrated.

Murphy Iron Works, Detroit and Toronto—Catalogue of the Murphy Automatic Smokeless Furnace; 30 pages, 6 by 9, illustrated.

Allis-Chalmers-Bullock, Limited, Montreal—Catalogue 81, Ingersoll-Sergeant Rock Drills and Mining Machinery; 60 pages, 6 by 9. Printed in two colors.

Packard Electric Co., St. Catharines—Bulletin No. 21, Jandus Series Alternating Arc Lighting System and Apparatus; 30 pages, 9 by 11, illustrated. For interchangeability and hours of burning this system was awarded the gold medal at St. Louis.

Canada Foundry Co., Toronto—Bulletin 26, Air and Gas Compressors, 12 pages, 9 by 11; tables and list of goods. Illustrated.

Washburn Shops, Worcester, Mass.—Catalogue C, Drill-grinders, 20 pages, 6 by 9. Illustrated.

De La Vergne Machine Co., New York—Illustrated folder of gas engines and refrigerating and ice-making machinery.

Easton & Anderson, London, Eng.—"Pluto" Incandescent Regenerative Hot-air Furnace. Illustrated folder.

Merryweather & Sons, London, Eng.—Fire apparatus, engines, pumps, hose, etc. Illustrated price list No. 539K.

Holtzer-Cabot Electric Co., Boston, Mass.—24-page booklet, 3 by 6, the Ness Automatic Telephone System. Illustrated.

Westinghouse Electric and Manufacturing Co., Pittsburg, Pa.—Illustrated booklets on Wattmeters, and How to Read Them, Induction Motors, Type F, and Direct Current Motors, Type R.

The following catalogues may be obtained on mentioning The Canadian Engineer:

Goheen Manufacturing Co., Canton, Ohio—Illustrated folder on carbonizing coating for structural steel.

Canadian Westinghouse Co., Hamilton—Circular 1098, Switchboard Indicating Instruments; also circular No. 1099, Bi-polar Motors, Type R; also booklet on Voltmeters and Ammeters.

C. W. Hunt Co., West New Brighton, Staten Island—Pamphlet 051, "Industrial Railways"; also Pamphlet 052 on general machinery manufactured by this firm. A conversion table for the metric system, ready for insertion in memorandum book, accompanies these catalogues.

Diamond Saw and Stamping Works, Buffalo—Hack-saw Blades and Frames. Illustrated booklet.

National Electric Co., Milwaukee, Wis.—Electrical Catechism, eight-page illustrated booklet; also cards showing photos of various products of this firm.

LITERARY NOTES.

The Insulation of Electric Machines.—By H. W. Turner, Associate A.I.E.E., and H. M. Hobart, M.I.E.E., Mem. A.I.E.E., 300 pages, 5½ by 7½; 162 illustrations. Whittaker & Co., London and New York. Price, 10s. 6d.

The authors of this book in their preface combat the idea that any high degree of accuracy is at the present time attainable in information relating to insulation. In the insulation of cables the use of materials has been reduced to some degree of exactness, but this subject is excluded from the book, which is devoted to insulation in machines, where the properties of the materials used are probably the most indefinite of those employed by engineers. The authors have had twenty years' practical experience and study in insulating materials, and it is to render available the results of this experience and study that the book has been brought out. The book deals with agencies affecting insulation, such as moisture, temperature, time, etc., and discusses the insulating properties of mica, celluloid, paper, cloths, oil, varnishes, and other materials. It also treats of the insulation problems met in various parts of machines, such as in dealing with commutators, bushings, laminations, etc. Chapters are added on taping machines, drying ovens and other tools employed in insulation. Valuable tables occur in the course of the text, and at the end is added a bibliography of the subject.

Railway Right-of-Way Surveying.—By Albert I. Frye, S.B., M. Am. Soc. C.E. 45 pages, 6 by 9. Engineering News Publishing Co., New York. Price, $1.

This little book is devoted to the outlining of a modern system of right-of-way surveying, leveling and mapping. Though the system as a whole applies particularly to railroads, some of the features will be found useful in connection with streets, canals, highways, etc. Hints are given on collecting data, indexing the same, field work, the book-keeping of the survey, monumenting, and mapping.

Field Practice of Railway Location.—By Willard Beahan, B.C.E. 250 pages, 6 by 9. Engineering News Publishing Co., New York. Price $3.

"The object of this book," says the author, "is to record the methods commonly used by American engineers in the west in the location of railroads built since the civil war." During the past thirty years more miles of railroads have been located in the United States than ever before in the history of any country during the working years of a man's lifetime, and the author believes that before the locating engineers shall have all passed away, a statement of their methods should be made. This statement the author is in a position to make, as he was Chief of Locating Party on Gould's south-western system of railroads, and now is Division Engineer on the Chicago and North-Western. The books contains a great deal of information treating of subjects as diverse as train resistance and the equipment of the surveying party's medicine chest, and the whole is written in an extremely readable style. Some idea of the scope of the subject matter may be had from the chapter titles, which are as follows: The Character of the Road; Reconnaissance for

Route; Organization, Subsistence and Equipment of Parties; Preliminary Survey; Geology in its Relation to Topography; The Locomotive; Train Resistances; The Located Line; Records and Costs of Surveys.

NAVIGATION NOTES.

It is announced in marine circles that the St. Lawrence canals will be opened about May 1st. The Welland Canal will be cleared for traffic about April 15th.

The steamer Corsican, now Picton, of the Montreal-Toronto-Hamilton line, will make her first trip on April 29th. The Spartan, now the Belleville, and the Hamilton will commence running between Montreal and Hamilton on May 2nd and 6th, respectively. The Spartan has been lengthened by 25 feet at the dry dock in Kingston.

The Niagara River Line will open its season on May 15th, the Chicora making two round trips daily from that date. The six round trip time-table of last year will be put into effect this season.

The propeller China, now the City of Montreal, has been purchased by the Merchants' Line, of Montreal, and will be put on the route between Montreal and Fort William calling at Toronto, Cleveland, Port Stanley, Toledo, Detroit, Windsor, and other points.

News of the following appointments of marine engineers has been received too late for insertion in the general list, which appears on another page:

St. Lawrence River Steamboat Company—America, Captain James F. Allen, Chief Engineer James Gillie; Jessie Bain and Pierrepont, appointments not yet made.

Thousand Island Steamboat Company—St. Lawrence, Capt. Milo D. Estes, Chief Engineer Barney Farrell; New Island Wanderer, Captain W. C. Hudson, Chief Engineer Nicholas Larson; Islander, Captain Charles H. Kendall, Chief Engineer (not appointed); Ramona, Captain John Bertrand, Chief Engineer L. Nosworthy; New York, (appointments not yet made.)

SURVEYORS' ASSOCIATION FOR NEW BRUNSWICK.

At a meeting of the Deputy Land Surveyors of the Province of New Brunswick, held at the Crown Land Office, Fredericton, on the 23rd inst., it was resolved to form an organization to be known as the "Association of New Brunswick Land Surveyors." It is the intention of the Association to endeavor to elevate the standard among the land surveyors of New Brunswick, and with this end in view, legislation will be sought along lines similar to the Act now in force in Ontario. The following officers were elected for the ensuing year: Hon. president, Hon. Francis J. Sweeny, Surveyor-General; president, William E. Fish; vice-president, William Murdock; secretary-treasurer, Gilbert G. Murdock.

—Twenty-one spans of the 40-span bridge over the South Saskatchewan river, at Saskatoon, were carried away by an ice jam. This is the third time the bridge has been destroyed.

—F. Dagger, telephone engineer, of Toronto, has been appointed expert to the Select Committee of the House of Commons, which is investigating the telephone systems in operation in Canada and elsewhere.

—Morrisburg, Ont., has granted J. W. Allison $2,250 toward a site for a factory to produce tin plate, sheet steel, and Canada plate. The company will also have free power, water, light and exemption from taxation.

—The Levis Electric Railway is completely tied up as a result of the difficulties which overtook the enterprise eight or nine months ago, and which have increased until it is impossible to operate the road. The bondholders are moving to foreclose the road.

—The cement works at Point Ann, near Belleville, which have been under construction for a year and a half, are completed, and production will commence this month.

—The firm of E. J. Fetherstonhaugh & Co., patent solicitors, Montreal, has been changed to Fetherstonhaugh & Blackmore. The new firm has offices in the Liverpool & London & Globe building, Montreal, also Toronto, Ottawa and Washington.

—E. H. Keating, formerly engineer and manager for the Toronto Railway Co., has been appointed manager and engineer of electric railway, power and light franchises, owned by the Mackenzie & Mann syndicate in and around Monterey, Mexico. Mr. Keating and family will reside in that city.

—Replying to the deputation of members of the British Parliament, Lord Stanley stated that the proposed reduction on British papers and magazines going to Canada would mean a loss of revenue of £3,000,000, and that it would be impossible to adopt such a course.

—W. O. Johnston & Bros., Iowa, contractors, who successfully carried out the contract for double-tracking the Grand Trunk Railway main line between Hamilton and London, have been awarded the contract to grade the roadbed for the Hamilton, Ancaster and Brantford Electric Railway.

—The Canadian Smelting Company at Trail, B.C., has closed a contract for handling the output of Le Roi No. 2 Company of Rossland. This plant is receiving large quantities of custom ore from all over southern British Columbia, besides handling the product of the Centre Star, War Eagle and Spitzee. A new 250-ton furnace is being installed.

—Owen Sound has given the Eugenia Falls Electrical Power Company permission to dispose of their power to Owen Sound manufacturers. Eugenia Falls are situated 33 miles south of Owen Sound, and have a head of 100 feet higher than that of Niagara. The construction of a plant will be commenced immediately, and will be completed in about a year.

—The Richelieu Light and Power Company, with an authorized capital of $500,000, has been formed by several Montreal financiers, and is now seeking incorporation. The company proposes to supply Farnham, St. Cesaire, Iberville, St. Johns and many other surrounding towns with electricity for light and power purposes.

—The annual convention of the Canadian Association of Stationary Engineers is to be held this year in Chatham on August 22nd. The Ontario Government is being petitioned by the Stationary Engineers to pass a bill restricting the running of boilers of 25-h.p. to certificated engineers. Certificates would be granted to persons who had served in the Province for four years, by a board composed of representatives of the engineers, the boiler insurance companies and the factory inspectors.

—A delegation of Canadian shipbuilding representatives waited on the Government recently asking for a bounty of six dollars per ton to encourage the shipbuilding industry in this country. Mr. Fielding promised consideration. Among the deputation were. F. H. Clergue, of the Collingwood Co.; Mr. Bertram, of the Bertram Co.; Frederic Nicholls, of the Canadian Shipbuilding Co.; J. E. Dewolfe, president of the Halifax Board of Trade; Ald. J. A. Johnson, J. P. Longard, and J. W. Allison, all of Halifax; Mayor Scarf, Dartmouth; Messrs. Roche, Carney, Macdonald, and Johnston, Nova Scotia members; and G. H. Robertson, of St. John, N.B.

MACHINE SHOP NOTES FROM THE STATES.

By Chas. S. Gingrich, M.E.

XIV.

Cutter Grinding.

In the previous papers we have given particular attention to the exceedingly rapid development of the process of milling for machining metals. Since the success of this process depends largely upon the condition of the cutting tools, we give below a few illustrations showing a modern cutter grinding machine, and methods for handling some of the work.

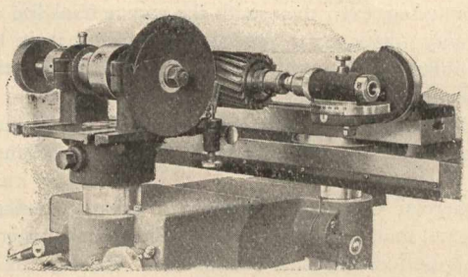


Fig. 1.

Fig. 1 shows the operation of sharpening a standard spiral milling cutter, such as are in common use.

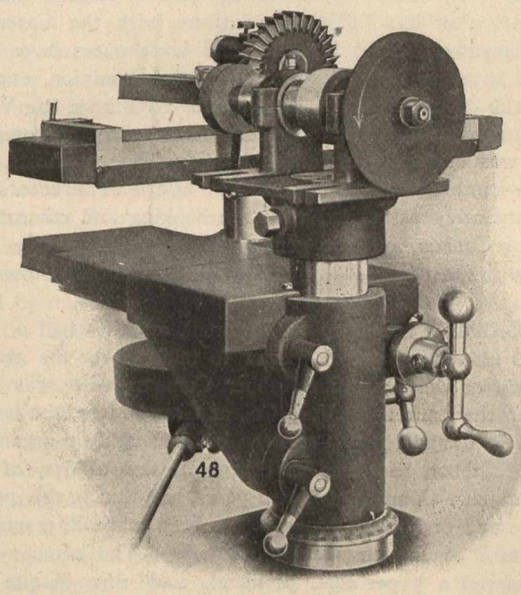


Fig. 2.

Fig. 2 shows the machine in a different position, sharpening the right side teeth of a side-milling cutter. By setting the machine at right angles to this position the peripheral teeth can also be sharpened and then by reversing the cutter on the holder, the teeth on the opposite side can be sharpened, performing the three operations practically at one setting. From the illustration it is clear that face-milling cutters can be ground in exactly the same manner.

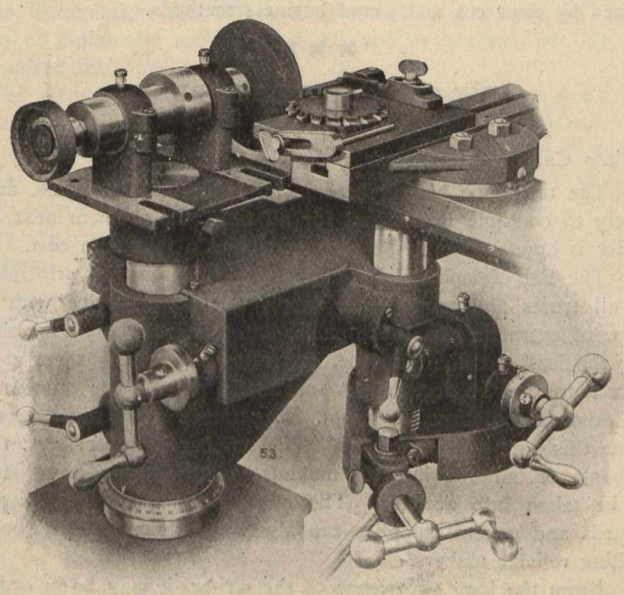


Fig. 3.

Fig. 3 shows a job of sharpening the teeth of a gear cutter. One of the things manufacturers of such cutters insist upon strongly, is, that the cutter be kept sharp, that the same amount be at all times ground off each tooth, and that the faces of the teeth be ground radial and straight across, and if these directions are followed, the cutter will be practically as good as new as long as there are any teeth left. If they are not followed, the cutter may be ruined the first time it is sharpened. The illustration above mentioned accomplishes all the requirements of cutter sharpening, and does it in very much less time than is usually spent by attempting to hold the cutter against an emery wheel by hand.

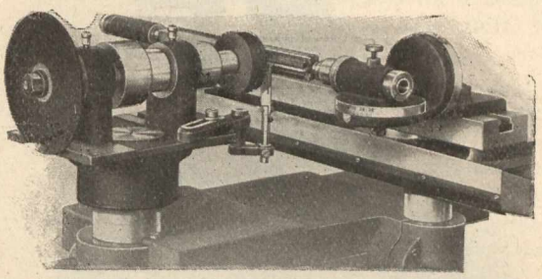


Fig. 4.

Reamer sharpening is accomplished in the manner shown in Fig. 4. For all of these operations it will be noticed, a cup-shaped wheel is used, giving the much desired straight line clearance. This is considered particularly important in the case of reamers, as it enables the operator to sharpen them exactly to size, using a very narrow land back of the cutting edge, and prevents cupping out the metal immediately back of the cutting edge, which results when a disk wheel is used. The cup wheel leaves the land flat, and therefore gives a stronger backing for the cutting edge, making a very much longer lived reamer and materially reducing the tendency to chatter.

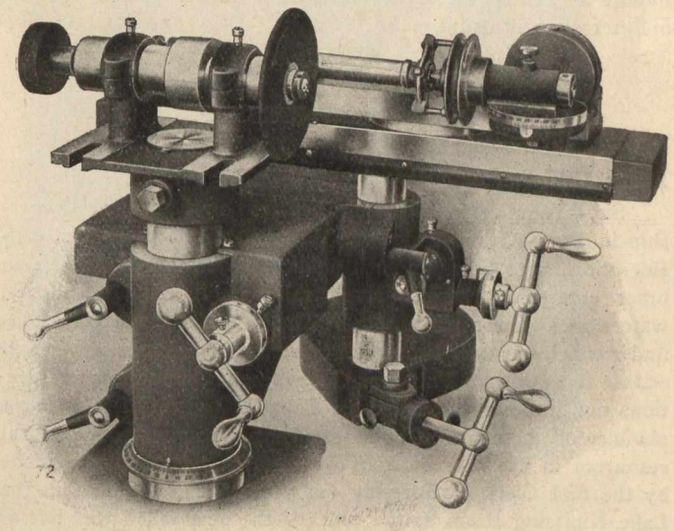


Fig. 5.

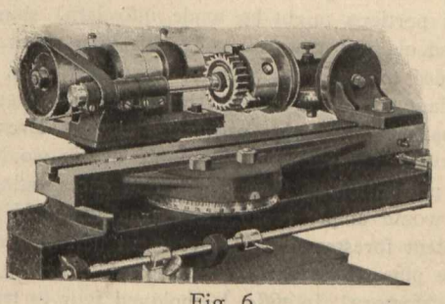


Fig. 6.

In addition to sharpening a general line of milling cutters

and reamers on this machine, it is equally well adapted to grinding small machine parts, such as mandrels, shown in Fig. 5, or internal grinding, as shown in Fig. 6, and a great variety of other work besides. The machine itself is shown in Fig. 7.

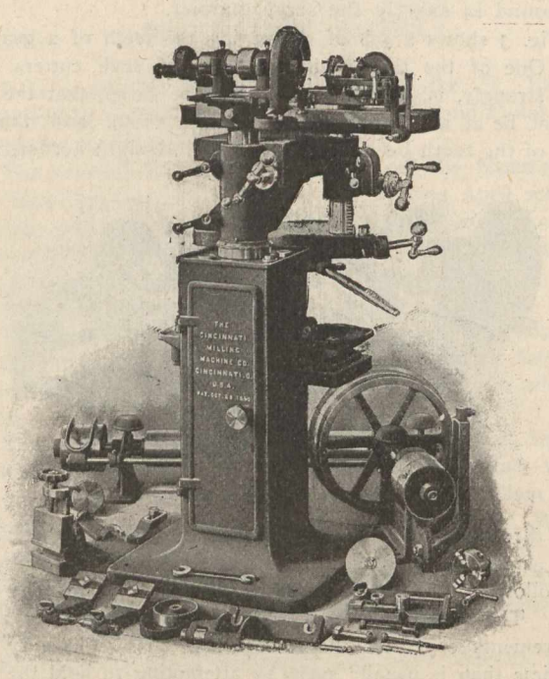


Fig. 7.

While there are a great many other cutter grinders to be had, I have selected this particular one as it seems to me to handle a greater variety of work and does this in a simpler manner than is usual.

PUBLIC OWNERSHIP.

Editor Canadian Engineer:

Sir,—Your very instructive articles on Municipal Ownership in Port Arthur and Fort William, afford food for consideration as to how far such public co-operation is feasible in other enterprises besides street railways, lighting, telephones, waterworks, power plants, etc. The very favorable conditions under which our new Provincial Government assumes power will enable it to initiate Public or Government Ownership in directions not hitherto attempted in Canada. One of the most obvious of these would be in the conservation of our natural resources in the new portions of Ontario. An estimate made by the first Clerk of Forestry (21 years ago), was that in the Lake Nipissing Basin 60 per cent. of the pine felled was left at the stump; and that half the remainder was lost in sawing, planing and fitting, leaving only 20 per cent. in efficient service. A few companies have made use of a large portion of the mill waste; but none attempt to save the carbon, turpentine, tar, and acids left to perish in the woods. This might be attempted with a carbonizer, made of old boiler shells, pipes, etc., to condense the vapors from the tops and chips, also grinding and compressing charcoal produced into blocks for handy export. Many short portions might be made into lath, shingles, and boxes; or spools and matches. In this way about one-third could be added to the gross value of standing timber. It might not repay plant and labor at first; but experience would doubtless soon make it a valuable provincial asset. Even if not a direct gain, the removal of inflammable debris would aid immensely in prevention of forest fires, and encouraging clearing operations, would amply repay the expenditure. If performed by a competent forester, on a Government berth, where all the value of the pine would be pooled for public benefit, it would likely be satisfactory. In 1884, I employed four to ten men for three weeks in keeping a forest fire from spreading, in the vicinity of Warren, in West Nipissing, for which I was blamed by some officials as being an expensive man. But I knew there were hundreds of millions of B.M. under my lee. The cost was about $250—actual damage about $2,000—and the whole valley of the Sturgeon River and the Temagami Forest Reserve was the stake for which we fought fire under a burning sun for 25 days; then came the welcome rain, and our greatest forest asset was saved.

Little Current, Ont. THOMAS FROOD.

HALF A CENTURY IN BUSINESS.

Few companies have played a more prominent part in the commercial life of the Dominion than the Canadian Rubber Company, of Montreal. Established way back in the early fifties by men who had the true business instincts, and who were intimately connected, even then, with the commercial life of Canada, the company has grown apace, until to-day it is by far the largest rubber company in Canada, and one of the largest in the world.

The late Sir Hugh Allan was president of the company for many years, and since his death, Sir Montagu Allan has occupied this position.

Commercial Canada has expanded greatly during the past twenty years, and the growth of the Canadian Rubber Company during this period has been phenomenal. To-day the floor area of this company's factories, on the banks of the St. Lawrence river, Montreal, cover over twelve acres, and between two thousand five hundred to three thousand employees are engaged constantly all the year round.

Almost every large manufacturing or constructive concern in the Dominion has business relations with the Canadian Rubber Company. Sales branches and warehouses have been established in every important centre of the Dominion, extending from the Atlantic on the East to the Pacific on the West.

A feature worthy of note in connection with this company is that it was originally organized by Canadian capitalists, and to-day the same condition exists. The board of directors are all men intimately associated with the banking and commercial interests of Canada, and the general manager, D. Lorne McGibbon, is one of the best known of the Dominion's industrial organizers.

Mr. McGibbon was born in Montreal, and has had a very varied and interesting career. Prior to taking over the general managership of the Canadian Rubber Company, he was connected with the Laurentide Pulp Co., at Grand Mere, the largest paper mill in Canada, which concern he thoroughly reorganized.

Mr. McGibbon has been in charge of the affairs of the Canadian Rubber Company for two years, and during this period remarkable and permanent progress has been made in practically every feature of the company's business. The company recently declared a 5 per cent. dividend, and this despite the high prices of crude rubber, cottons, etc., obtaining during the year that has just closed.

All interested in the progress of the Dominion are likewise interested in the permanent success of the Canadian Rubber Company, as its present successful position has been attained by clear cut and sound business methods.

THE TELEPHONE PROBLEM.

Editor Canadian Engineer:

The telephone having become an indispensable article, and likely to continue in demand for all time, the problem next in order is how to obtain this convenience at a minimum cost.

The Bell Telephone Co., acting upon the business principles of all trusts and monopolies, supply telephone service with a view of extracting from the public the greatest possible amount for the least possible expense, and rates charged by them cannot, therefore, be accepted as sufficiently reliable for municipal or other corporations to adopt. Experience alone must determine this part of the business. The number of subscribers, the expense of building lines or making conduits will always have to be taken into account. The expense of telephone switchboards and general supplies can always be determined by consulting reliable makers.

From the long experience of the writer, it may be in order to say to persons who may wish to build private telephone lines, that a 22 ft. cedar pole, not less than 5 inches at the small

end and 12 inches at the large end, placed four feet in the ground, is good for one generation or thirty or more years. These poles will carry from one to ten wires. No. 12 BB iron wire should always be used.

Municipal ownership is unquestionably going to solve the problem of cheap telephone service, and when this plan has become general, there will be no room for other corporations. It must not be assumed, however, that the rates charged by Port Arthur and Fort William are to be taken as a standard for other municipalities. It is true these municipalities have installed the best up-to-date central energy system, but this system is maintained and operated at far less cost than the magneto system, and rates should be lower than charged by these corporations for business purposes.

So long as patrons insist upon having a lone wire at their disposal, they must expect to pay extra for such convenience. In cities, towns and rural parts, in all the States, it is a universal custom to supply telephone service over party lines. These lines to a limited extent can be so arranged that the party wanted only can be called.

The so-called long distance telephone should alone be provided. The expense for this 'phone will range from $7 to $10.50, with duties added. Makers in Canada do not, for the present, supply a reliable article, for the reason that the demand is not sufficient to stimulate competition. The Bell Telephone Co. have adopted a very innocent way of obtaining advanced rates for a long distance telephone. It should be known that all up-to-date systems at present are supplied with long-distance telephones at no extra charge. The Bell Co. provide these so-called long distance 'phones by substituting a long-armed transmitted new coil and receiver. In this way they remodel their old instruments at a cost of from $3 to $4, and for this alteration and privilege of using the remodelled 'phone, a customer is charged $5 per annum extra. The Bell Telephone Co., on the other side of the line, owing to competition, have altogether abandoned this extraction business and are everywhere supplying the improved telephones at no extra charge. The one great impediment in the way of independent telephone service, whether operated by municipalities or private corporations, is the present deal of the Bell Telephone Co. with the C.P.R. and the G.T.R. companies for the exclusive privilege of telephone connections with their several railway departments. This should be resented by all the powers vested in a governing people. The Railway Commission, who have been entrusted to settle this matter, have thus far failed altogether, and the responsible Minister appears to have shielded his responsibility behind this commission. The fact that this commission are consenting to arbitrate upon what compensation shall first be paid to the Bell Co. for the expense incurred for installation of telephone service in railway stations, is too absurd to be seriously considered, for the reason that this expense has been and is already being compensated for by the free transportation over the respective railways of all the officials and employees of the Bell Telephone Co., and compensation, however small, that may be determined by the Commission for others to pay will be regarded as a species of diplomatic robbery, and will not be accepted by any independent telephone company.

The member from South York, W. F. McLean, has placed the matter before the Government in a few words. He first attacks the Government for its failure to dissolve the monopolistic contract between the Bell Telephone Co. and the C.P.R. and G.T.R. companies, by which none but Bell Telephone Co. 'phones are connected to their railway stations, in the following words: "Why should this iniquitous agreement be allowed to continue? Why should the Bell Telephone Co. be allowed to ride rough-shod over the rights of the people of Canada? Was it that the men behind the Bell Co. were warm political friends of the present administration?"

C. SKINNER,
Gen. Mgr. Peoples Telephone Co.

Sherbrooke, Que., March 1st, 1905.

Thirty men with sixty pack horses have left Edmonton for the Peace River to cut a trail to Dawson City entirely on Canadian territory. The trail will be over a thousand miles long, and will be provided with shelter huts at the end of each day's march, twenty or thirty miles apart.

CONSTRUCTION OF CANADIAN NIAGARA POWER COMPANY'S 100,000 H.P. HYDRO ELECTRIC PLANT AT NIAGARA FALLS, ONT.*

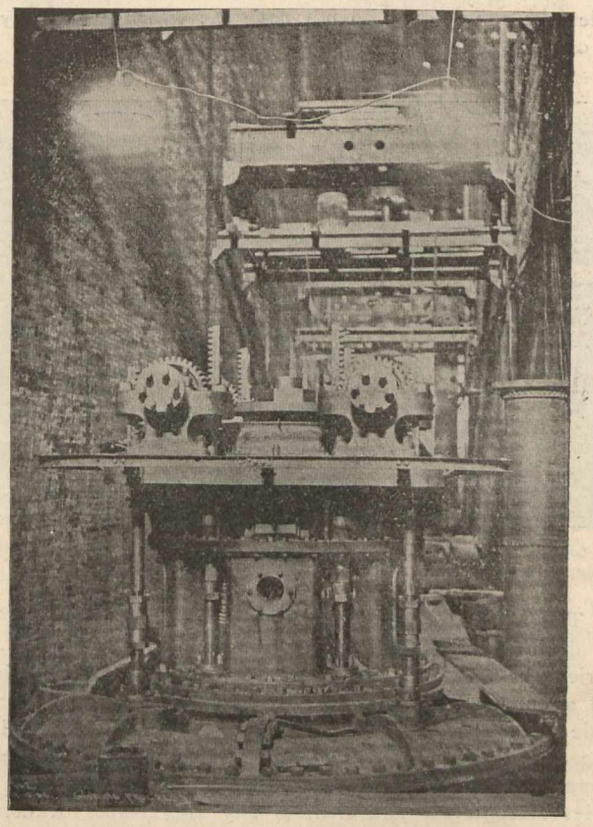
By CECIL B. SMITH, MA. E., M. CAN. SOC. C.E.

(Continued from last issue.)

Power House.

The superstructure covering the generators and switchboard, etc., is a heavy steel framed building, at present covering five 10,000 h.p. units, but the design is for a complete building 600 feet long, covering 11 10,000 h.p. units, with main entrance at the north end.

The main building is 40 feet high to the eaves, and has crane girders 31 feet above the floor, this height being necessary for proper movement of large loads from one part of the power house to another, after the machinery was installed. The proper light effect is obtained by large arch windows below the crane girders, and a series of smaller square ones just below the eaves. The exterior



Ten Thousand H.P. Turbine Unit at Balancing Piston.

walls are of Queenston gray limestone, with sufficient tooling for rich, quiet appearance; and the interior lining consists of a wainscotting of enamelled brick up to the window sills, then a belt course of green-veined Vermont marble in line with marble window sills. Above this the lining will be buff brick, which will give ample light in the daytime, while at night there is an arc light on each side of the power house every 24 feet.

The roof of the main power house is of steel and terra cotta tile only, the tiles being interlocking green Ludowici, pointed with mortar; and the eaves are carried well out with a slight upward curve, ending in heavy copper gutters.

The forebay room is attached to the east side of the power house, and has a flat steel and concrete promenade roof, with an asphalt and tile floor. It is surmounted by a stone parapet wall with 24 foot panels, it being proposed to place electric light columns and flower vases at the panel posts; while, for the purpose of throwing light into the room itself, in addition to arch windows every 24 feet, there is a wide continuous skylight in the roof adjacent to the power house; in the forebay room a five-ton travelling crane

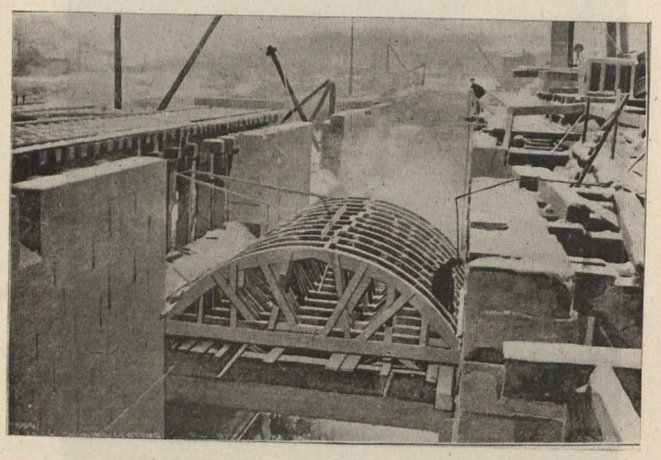
* A paper presented at annual meeting, Canadian Society of Civil Engineers, January, 1905.

spans the whole width, and will assist in keeping racks clean, and lifting them when necessary.

All the main window frames are metal, which leaves only the window sash and small upper window frames of wood, so that, practically speaking, the building is strictly fireproof. At the north end the main entrance door will be of bronze, with carved side columns, and surmounted by a panel containing the company's seal; while stretching across the north end of the power house will be a visitors' gallery, from which the best view of the interior of the building can be obtained.

Underground Conduits.

In order to convey current from the power house two lines of conduits were constructed of the style shown in Fig. 5, one of which, 2,200 feet long, leads to a transformer station located outside the public park, and the other, one and a quarter miles long, extends from the power house through the park to the upper steel arch bridge. The four-way ducts are embedded in a one to seven gravel concrete, and are spaced generously so as to provide proper heat radiation, it being found that in a large group of cables the centre ones do not have the carrying capacity of the outer ones.



Centres for Generator Arch No. 4.

The manholes are also entirely of gravel concrete, and are drained thoroughly with six-inch tile, into which are carried the farm tile, laid alongside the ducts themselves; and a curtain wall divides the manholes into two parts, while a further separation in case of fire is obtained by soapstone slab partitions lying horizontally between each group of cables. The ordinary type of manhole carries the cables straight through without any appreciable bends, the plan shown in Fig. 6 being a special, and the 12-inch water main shown is for carrying water from the pumps, located in the power house, to the water-cooled transformers and standpipe situated outside the park on the company's land.

Transformer Station, Etc.

On the tableland, immediately west of its works, the company has acquired a large tract of land, and on it has been built a transformer station of 25,000 h.p. capacity, 80 feet wide by 120 feet long, having a main central room 38 feet wide equipped with a 15-ton Whiting electric travelling crane, copper oil tank, suction pump and motor, and cast iron jack rails, resting on concrete foundations. On these rails there have been installed, for the present, twelve transformers of 15,000 K.W. total capacity, fully equipped with water cooling, drainage, and lead-lined oil drainage systems. These transformers are for 40,000 or 60,000 volt transmission, and are separated from the low tension and high tension switchboards by solid brick curtain walls, the cables being brought to the transformers through passages underneath the concrete floors, and carried from them through overhead arches in the curtain wall, thence to the high-tension switches, from which the wires will pass out of the building through specially designed windows.

The building itself is of pressed brick, with stone sills and Ludowici tile roof, and is entirely fireproof, except window frames. It has a central monitor roof for light and offices near the front entrance, which is a door of capacity for fully loaded freight cars to enter far enough to transfer loads to the crane.

Adjacent to this station has been built a stand pipe 30 feet diameter by 116 feet high, which is connected to the main water system, from wheelpit to transformer station, and the flow of water from which is controlled by a motor-driven valve operated from the transformer station, the object of which is that in case of fire the stand pipe can be cut out, and the two pumps at the wheelpit, by working tandem, can raise the pressure of water to 120 lbs. at transformer station floor line during the fire period.

The function of this standpipe, however, is purely one of reserve in case of a breakage of the pumping and pipe systems, supplying the transformers with water for cooling, in which event the standpipe capacity is estimated as being sufficient for 50,000 h.p. for 24 hours, or for 48 hours for the present station.

In view of the importance of continuity of operation this safeguard, although costly, was considered necessary; indeed, speaking of the equipment in general, every effort was made to design the plant so as to obtain a maximum of reserve in cases of breakdown.

Power House Machinery.

For handling materials two fifty-ton four motor electric travelling cranes were installed, which, by working with a carrier, can together handle practically 100 tons. These cranes operate with 125 volt D.C. current, and have auxiliary five-ton hooks for fast service and light loads. The Sellers cranes, which are the ones here used, have as a distinctive feature, fixed drums, the carriage only travelling. The speed requirements with full loads were: Main hook, 10 ft. per min.; auxiliary hook, 50 ft. per min.; trolley travel 25 to 50 ft. per min.; and bridge travel 200 ft. per min.

The main turbines have twin draft tubes emerging into the sides of the pit immediately above the invert, and, owing to the great depth of water, which there will be normally in the pit with the whole plant in operation, not to speak of the effect of back water during high water in the lower river, it was necessary to locate the turbines about 47 feet above the invert of the tunnel, and although air pressure is equivalent to about 33 feet water head, it has not been found practicable to operate safely with more than 25 feet of draft tube effect, which necessitated some artificial means of creating a pondage in the wheelpit with only a few wheels in operation.

This result was obtained by installing a huge regulating lift gate at the extreme lower end of wheelpit, where connection is made with the tunnel, and operating the same by lift screws, overhead girder, and 85-h.p. 125 volt D.C. motor (a second motor in reserve). The water will pass under the gate, and in order to resist the constant vibration, very heavy cast iron grooves, grouted and bolted into the brick lining walls of the wheelpit, rest against masonry specially cut and built into these walls to receive the grooves, and the gate is equipped with an oiling system fed from a flexible piping.

The 10,000-h.p. turbines are described as twin inward discharge, Francis type, operating at 250 revolutions per minute under 136 feet net effective head, and have solid bronze runners 5 ft. in diameter, and cylinder gates, controlled each by four racks and pinions. The racks move on opposite sides of the pinions, so that one gate rises as the mate to it lowers, the whole movement for each unit being controlled by a connecting rod from the Escher Wyss governor situated on the power house floor.

The revolving parts of a turbine and generator, and the shaft connecting them, are supported as follows: In addition to the upward thrust on the lower runner, there is a balancing piston located immediately above the wheel case, and the piston for each unit is directly supplied with water from the forebay by a twelve-inch pipe, but as a reserve, in case of accident, there is also a connection with each penstock.

In addition to this there is attached to each main shaft immediately beneath the generator a thrust bearing, capable, when operated with high pressure oil, of carrying the whole

weight of the revolving parts of a unit, which amounts to about 243,000 lbs. This bearing is fed from the oil chamber with oil, which is raised to a high pressure by a pump located immediately alongside on the thrust deck; after leaving the bearing the oil flows back to the chamber to be cooled, clarified, and pumped back again to the thrust deck. The turbine shafts are hollow, seamless cylinders 40 inches in diameter with weldless flanges, which connect by couplings to nickel steel bearing shafts 14 inches in diameter, bored out 8-in., at the various bearings and connections, there being, as shown in Fig. 3, two intermediate bearings for supporting the shaft between the thrust bearing and balancing piston.

The main penstocks each consist of a lower cast steel elbow in two sections, weighing 49 tons, which sits astride of the pit and carries the weight of the penstock and the water contained therein; above this are five straight sections of rivetted pipe ten feet two and a half inches in diameter, having weldless steel flanges, and an expansion joint connecting to the cast iron mouthpiece in wheelpit wall by a steel upper elbow. The calculated speed of the water with full load on a unit is about 11 feet per second.

Five units of 7,500-K.W. output each, makes the present installation, but the plant is built for eleven such machines, the eleventh being counted a spare, and in order to increase the present output it will only be necessary to extend the power house building and install such machinery as may be required.

For supplying the various water-driven machines in the chambers, an independent water system has been installed, which consists of a 36-inch rivetted main with weldless flanges, along the rack deck, fed from the canal by two 36-inch and five 24-inch vertical pipes. Of these, one 36-inch and two 24-inch pipes are in the first installation. From this main, which is sub-divided by valves at various points, rising pipes enter the chambers and, after operating the machines, the water passes by draft tubes into the tail-race below.

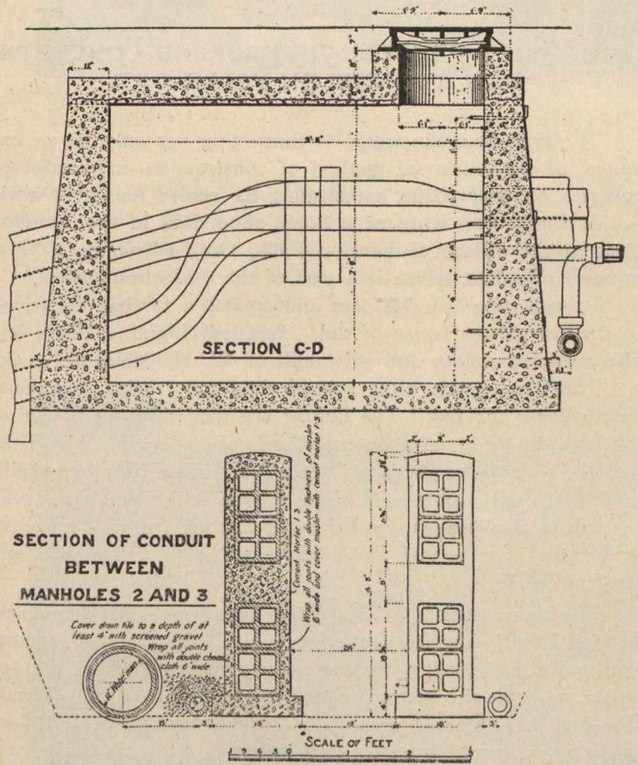


Fig. 5.—Section C-D of Manhole (see Fig. 6) and Section of Conduit.

In one chamber is located an exciter plant, making 125 volt D.C. current, which is used not only for excitation of large generators, but for operating cranes, switches, various gate and pump motors, and lights, etc. This plant consists of three vertical direct-connected units of 332-h.p. each, the turbines being single, spiral case, inward and downward discharge, running at 600 revolutions per minute under 131 ft. head, and controlled by Lombard governors. These units have oil bearings supplied with low pressure oil from the oil chamber, and are each quite independent, so that any unit can run with the other two shut down for repairs.

In a second chamber are located two pump units. Each unit consists of a horizontal turbine direct-connected to a centrifugal pump of 3,000,000 gallons per 24 hours capacity. These pumps can, as before remarked, be run in tandem in case of fire, so as to produce a fire pressure at the transformer station of 120 lbs., with a pressure at the pump of 210 lbs. per sq. inch. The turbines are driven from the 36-in. auxiliary main and discharge into the tail-race by draft tubes built into the brick wheelpit lining, while the pumps draw their water from one of the 24-in. supply pipes from the canal and discharge by a 24-in. pipe up the wheelpit, and thence out and to the transformer station, a half mile distant, by a 12-in. water main.

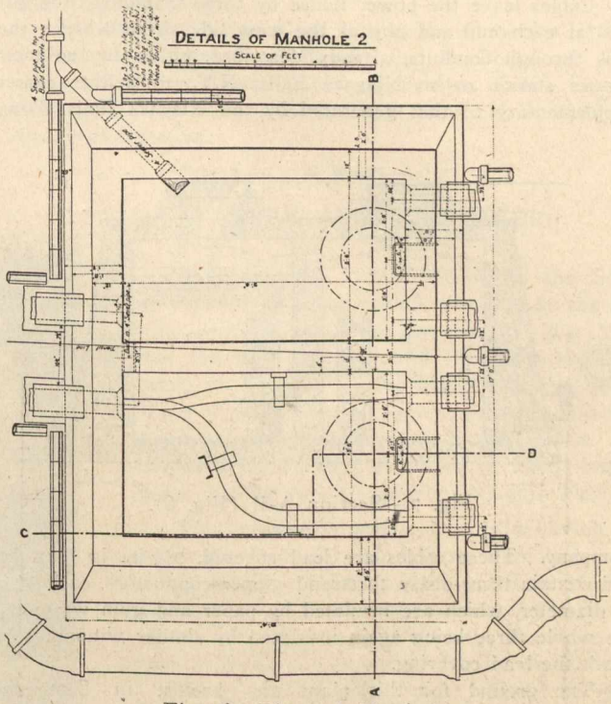


Fig. 6.—Plan of Manhole.

In a third chamber there is a very complicated system of motor and Pelton driven Quimby screw oil pumps, oil tanks, filter tanks, and cooling tanks, all so inter-connected as to produce necessary circulation, which consists, briefly in there being two circuits, one for low pressure and one for high pressure oil. The oil traverses from a machine back to the cooling and filter tanks, thence to the suction tanks, from which it is again pumped back to the machine. The high pressure oil is handled in the same manner, except that a special pump is located at each thrust bearing, and raises the oil pressure at these bearings, after which this oil also flows back to the oil chamber to be cooled and clarified. In this chamber is also a specially designed Pelton driven air compressor, and in a chamber on the upper level adjacent to the main subway are located storage tanks of large capacity for storing oil, while a pressure oil tank is also located in the roof of the power house.

The main power house floor will contain only three items of equipment, namely, the 7,500-K.W. generators, the turbine governors, and the main switchboard. So that the view from the visitors' gallery will be one of extreme simplicity, as the armatures of the generators are external and stationary, and the governors are very innocent looking machines in line with the generators, and not observable from the north end of the power house. The generators are about eighteen feet in diameter, with internal revolving fields, and deliver three-phase 25 cycle current at 12,000 volts, which was adopted in order to enable local distribution for several miles to be made without transforming.

As these generators were both too large and too heavy for transportation, it was necessary to have them completely assembled at the shops, then taken apart and packed in hundreds of boxes, and shipped knocked down to the works, where it took several months to re-build the fields and armatures piece by piece, there being, it is understood, 47,000 punchings in each armature.

Fig. 3 shows two subways just below the power house floor, one to the right being for cables, and the main one to the left for cables and for the substructure of the main switch-

board, which, for each 50,000-h.p., is about 150 feet long. The subway itself runs the full 600 feet length of the plant, and has a series of chambers opening off to the left, one at each inlet breast wall, which will be devoted to miscellaneous purposes, such as location for small transformers, etc. The main switchboard consists of a lower part in the subway, made up of bus-bar compartments, divided up vertically by brick walls and horizontally by soapstone slabs, and containing motor operated oil switches, and above the power house floor the switchboard proper from the gallery of which a full view of the power house is had, and which is equipped with switches necessary for full control of the station.

Cables leave the power house by three manholes, one situated at each end and one at the west side, from whence they pass through conduits, already described, either to the transformer station or to Niagara Falls, N.Y., to deliver current supplementary to that generated by the Niagara Falls Power

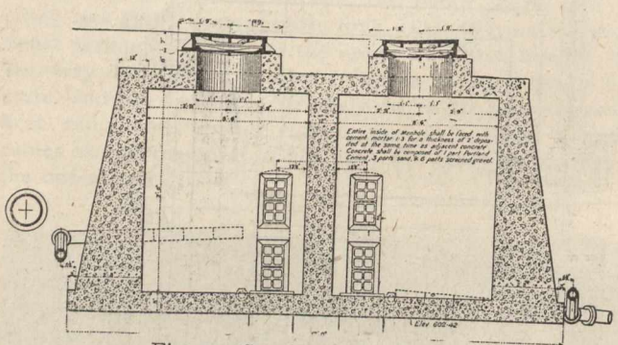


Fig. 7.—Section A-B (Fig. 6).

Company. These cables are lead covered, 2½-in. in diameter, and contain three-phase 19 strand copper conductors, each ½-in. in diameter, which are insulated by paper and gum wrappings, the whole three being again insulated by similar wrappings beneath the lead covering.

The ground for this plant was broken in September, 1901, although the tunnel and cofferdam had been nominally commenced somewhat earlier, and water was turned into the forebay November 9th, 1904, the exciter chamber was ready for operation November 24th, 1904, and the first 10,000-h.p. unit, December 23rd, 1904—while two 10,000-h.p. units were ready for operation January 1st, 1905. The third unit will be put in operation in a few months, and the fourth and fifth units during the summer of 1905, while the extension of wheel-pit complete, brick lined, and ready for the machinery of the remaining six units should be completed during 1905.

It will be understood that during this period Queen Victoria Park, with two other large and one smaller plant under construction, was in a state of great chaos, and this is largely the case at the present time, but the companies are under obligations to place their respective areas in good condition as soon as construction is finished, and when this has been done the southern part of the park, which was always in a state of nature, will be vastly improved. The Canadian Niagara Power Company, in process of construction, filled in the foreshore of the river for about 100 ft. in width from the Horseshoe Falls southward for over one-half mile, and this will be also sodded and added to the park area.

The principal contractors connected with the works were: James Barry, cofferdam; Dawson & Riley, wheelpit and canal; Queenston Quarry Co., arch bridge; A. C. Douglas, tunnel and portal; Wm. Grace Co., power house; Brass Bros., transformer station; Escher, Wyss & Co., turbine units Nos. 1, 2, 3; I. P. Morris Co., turbine units Nos. 4, 5; General Electric Co., generators and main switchboard; Jenckes Machine Co., exciter turbines; Westinghouse Electric and Manufacturing Co., exciter generators; Canadian General Electric Co., transformers; Canada Foundry Co., various lift gates, etc.; Hamilton Bridge Co., power house steel work; in addition to which a great many contracts were placed in Canada and the United States for various pipings, steel floors, smaller machinery, etc. The policy was at once established of having continuous and thorough inspection in keeping with the rigid specifications and high-class of work demanded, and a large number of inspectors were employed, who were located at the various manufacturing centres and on the works itself. As these men were all the best that could be found for the various classes of work being done, it is believed that the results warrant the large attendant expenditure. For mill material, the Pittsburg testing laboratory did the inspection.

For the complete study, design, and execution of such an undertaking as has just been described, the engineering department was necessarily somewhat complex, there never having been any chief engineer, either nominal or actual, the organization being as follows: Chief mechanical engineer, Dr. Colman Sellers; consulting hydraulic engineer until December 31st, 1903, Clemens Herschel; consulting engineer until March 1st, 1904, W. A. Brackenridge; resident engineer in charge of construction, Cecil B. Smith; electrical engineer, H. W. Buck.

Speaking generally, the designing was done under the direction of Consulting Engineer Brackenridge and by the designing staff of the Niagara Falls Power Company in charge of A. H. Van Cleve until March, 1904, since which time the writer assumed Mr. Brackenridge's functions, but the liberal policy of the company was, that all the main points of design were determined after full discussion by the various engineers mentioned.

In carrying on the work of construction, the company allowed the writer full choice of whatever staff was considered necessary, and to employ also such inspectors in different branches as were needed. The chief assistants were as follows: Principal assistant engineer, G. A. McCarthy; assistant mechanical engineer, C. C. Egbert; assistant electrical engineer, G. E. Brown; assistant engineer of wheelpit and canal, Wm. Macphail; assistant engineer of tunnel, L. Sherwood.

To these gentlemen the writer wishes to here tender his extreme appreciation of those qualities which made it possible to carry on such an extensive work with satisfactory results, and in that harmonious spirit which prevailed from the commencement of the work until the time (December, 1904), when the writer completed his engagement with the company.

A QUICKLY ERECTED REINFORCED CONCRETE DAM AT FENELON FALLS, ONT.

The dam here illustrated is interesting not only as an example of the advanced method of construction in reinforced concrete, but as probably establishing the record for quick work.

It forms one wing of a horse-shoe dam in the Fenelon river at the village of Fenelon Falls, Ont., adjoining a Government crib dam, which is a part of the navigation system.

It replaces a wooden dam and creates a forebay delivering to the new power house of the Municipal Lighting Plant, and also serves the flour and grist mill of W. H. Meldrum & Co.

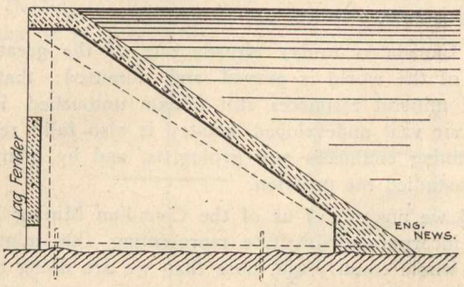
The dam stands on a smooth limestone ledge the total length being 194 feet. The line of the dam takes in a pier of the highway bridge at about two-thirds of its length. Above the pier the average height is 9½ feet, this portion forming a spillway which also contains a sluice closed with stop logs (seen just above the bridge), for releasing floating trash. Below the bridge the crest is one foot higher, acting as a bulkhead and flood spillway.

The dam consists of triangular buttresses 12 inches thick, 10 feet C to C, doweled to the ledge with steel pins and supporting an inclined deck increasing from 7 inches thick at the top to 10 inches at the bottom, where it enlarges to a cut-off wall. The deck is reinforced with steel Thatcher bars ¾-in. and ⅞-in. in diameter, spaced from 6.3 to 7 inches C to C. Secondary reinforcing for hair cracks is provided for by fence wire. The deck shows a factor of safety of five under a 5 ft. flood calculated by Thatcher's formula. The buttresses nowhere sustain a load greater than 4.5 tons per sq. foot.

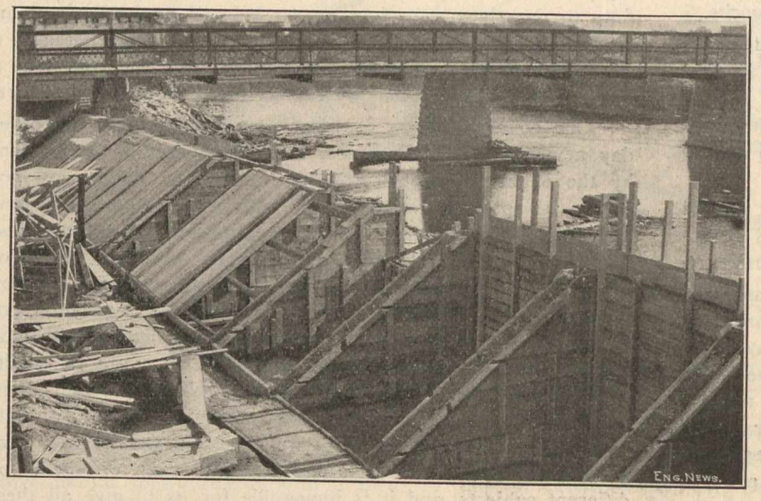
The main current of the river falling over the Government dam runs parallel to the face of the new dam. It was, therefore, necessary to defend the buttresses against a jam of ice or logs which might otherwise pile up against them. This was done by means of a skirting of reinforced concrete 5 ft. high along the face of the buttresses, as shown in Fig. 1, which is the general cross-section of the rollway. The skirting is open underneath, so that the water rises equally on both sides thereby equalizing the pressure.

Owing to the lighting requirements of the village, it was

necessary that power be restored without the needless loss of a day. The contract was closed on September 28th, 1904, under a time penalty for non-completion, taking effect Nov. 1st. The village undertook to supply crushed stone, sand and cement to the contractors. Work was commenced on October 4th. Fig. 2 shows the state of the work October 18th, at the end of the



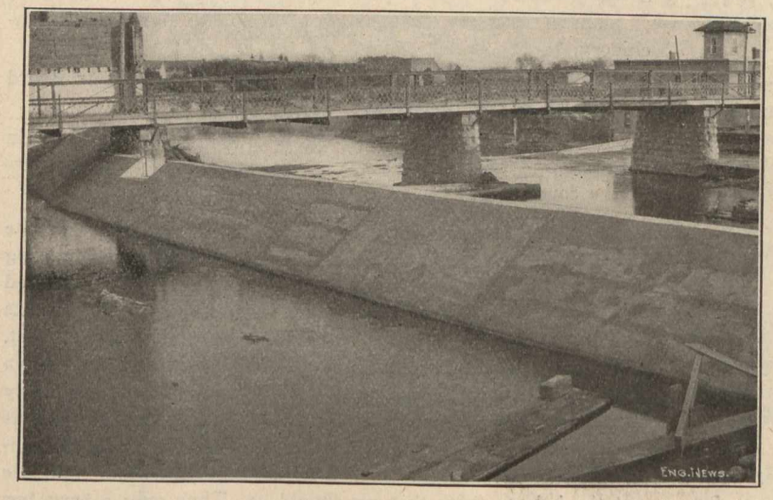
Fenelon Falls Dam—Fig. 1.



Fenelon Falls Dam—Fig. 2.—Condition of Work at End of Second Week, Oct. 18, 1904.

second week. This view is from the up-stream side or back of the dam, and shows the buttress forms filled, the cut-off wall started, and shows a part of the deck forms in place. On October 25th, at the end of the third week, about half the deck had been laid. October 26th was lost through failure of the quarrymen to supply stone.

On November 1st at 4 p.m. the last concrete was laid, thus



Fenelon Falls Dam—Fig. 3.—Completed Dam, Nov. 9, 1904.

completing the dam without forfeiture. Water to the depth of 3 feet was at once admitted, the green concrete in the closing bay being protected from wash.

The concrete was allowed to harden until November 19th, when it was found to be "bottle tight," and full head was admitted.

No night or Sunday work was done, and allowing for one day lost for non-delivery of stone, the actual time of building a dam 194 feet long and substantially 10 feet high was 22 ordinary working days. By working a night crew this time could doubtless have been reduced to two weeks, but this was not considered practicable.

Commenting on this dam, the Engineering News remarks: "To build a permanent concrete dam nearly 200 feet in length and 10 feet in height in 22 working days is a feat hitherto unrecorded to say the least. We need hardly point out that such rapidity of construction enabling a dam to be built entire during a low water period and reducing the risk of flood damage during construction must form a strong recommendation of this type of construction."

The dam was designed and built by the Ambursen Hydraulic Construction Company, of Boston, for the Board of Water, Light and Power Commissioners of Fenelon Falls. Earnshaw Bradley, C.E., 3 Place D'Armes Hill, Montreal, is the Canadian representative.

S.P.S. ANNUAL DINNER.

The sixteenth annual dinner of the School of Practical Science, which was held at the King Edward Hotel, on Tuesday evening, March 7th, was the best attended and the most successful event of the kind in the history of the School. Many graduates were present from considerable distances, in one case from South Africa. The largest group, which consisted of about twenty, came over by special car from Niagara Falls.

The committee was fortunate in having as a guest the Hon. Dr. Montague, who delivered a telling address, breathing the spirit of steadfast Canadianism. He strongly advocated the furtherance of technical education in the Province, as a force making pre-eminently for its development. A Canadian chair, he thought, should be established in the Provincial University to especially set forth the history, resources and possibilities of our country. Members of the faculty should be sent abroad at the expense of the Government to acquaint themselves with all that is best and newest in the scientific world.

W. K. George, president of the Canadian Manufacturers' Association, spoke of the great importance of manufacturing in this country, and expressed the hope that technical education, which was of such value in the industrial world, should not be neglected.

Principal Galbraith said that, although much good work had been performed at the School, yet faculty and students were laboring under great disadvantages. A state of over-crowding had long existed, and even with the new Chemistry and Mining Building, would continue to exist, unless another building at least as large as the latter were commenced at once. He regretted that the very small salaries paid at the School made it impossible to retain many excellent men as instructors, because they could make very much more in actual engineering work.

At the conclusion of his address, Principal Galbraith was able to make the pleasing announcement that the Hon. Dr. Montague and Mr. W. K. George had each signified their desire to give twenty-five dollars annually for a number of years, as prizes, to be allotted as the Faculty thought best. E. A. James was chairman of the committee; C. W. Graham, secretary.

UNIFORM MINING STATISTICS IN CANADA.

At the annual meeting of the Canadian Mining Institute last month, Eugene Coste, E.M., past president, made a suggestion as to the preparation of provincial reports on mines. His remarks were as follows.

It is, I think, admitted by the members of this Institute that an annual uniform presentment of mining statistics by the mining bureaus of the different Provinces of Canada would be an immense step forward in the interests of the mining industries of the country. The Dominion Government could then readily publish annually, through the mining division of the Geological Survey, or otherwise, complete uniform mining statistics of the whole country by simply adopting the uniform tables of the different Provinces. A great deal would thus be gained and nothing could possibly be lost.

For this important reason and other reasons, I suggest the adoption of the annual publication by the mining bureaus of the different Provinces of the following two tables:

Table A.—Mineral Production, in which the first marketed products of all mines, quarries and concentrating mills would be recorded by quantities valued at the places of production.

Table B.—Manufactured Products from Minerals, in which the quantities of metallic or other manufactured products from smelting, metallurgical, chemical or other works, would be recorded as finally produced and marketed at these works, and with the value they are sold at, at these works.

A short correspondence between the heads of the different mining bureaus would soon establish the place for each mineral or manufactured product, whether in table A or table B, and we would then have the perfect uniform presentment so much desired and which would be of so much value to us all and to the country.

I append below for illustration a list of the present annual products of Canada thus grouped in two tables, A and B, according to their more or less advanced state of manufacture,

Table A.—Mineral Production.—1, actinolite; 2, asbestos, different grades; 3, asbestic; 4, baryte; 5, chromite; 6, coal; 7, corundum; 8, feldspar; 9, fire clay; 10, gold; 11, granite; 12, graphite; 13, grindstone; 14, limestone for flux; 15, gypsum; 16, marls; 17, mica; 18, mineral water; 19, molybdenite; 20, moulding sand; 21, natural gas; 22, ochre; 23, ores of any metals when sold as such; 24, peat; 25, petroleum, crude; 26, phosphate; 27, platinum; 28, precious stones; 29, pyrites; 30, salt; 31, sands and gravel; 32, stones, (all sorts).

Table B.—Production of Manufactures from Minerals.—1, aluminum; 2, arsenic; 3, bricks (all sorts); 4, carbide of calcium; 5, cement; 6, coke; 7, copper, matte; 8, Ferro-chrome; 9, fertilizers; 10, lead; 11, lime; 12, mattes or metal of any other mineral; 13, nickel, matte; 14, nickel-steel; 15, oils (refined), illuminating oil, lubricating oil, benzine and naphtha, gas, fuel oils and tars, paraffine and wax candles; 16, pig iron, from Canadian ores, from foreign ores; 17, pigments; 18, quicksilver; 19, pottery and terra cotta; 20, phosphorus; 21, sewer pipe; 22, steel; 23, sulphuric acid; 24, tiles and drains; 25, zinc.

I suggest the annual publication of these two tables by the mining bureaus of the different Provinces in addition and independently from the way the statistics have been presented by these bureaus in the past, as for the sake of comparisons, or for other very good reasons it might be found desirable by these bureaus to continue their annual presentation of other tables, with fine values "or otherwise," exactly as done before.

CANADIAN MINING INSTITUTE.

Last month we published the programme of the annual meeting of the Canadian Mining Institute, which was held in Montreal just as the Canadian Engineer went to press. The election of officers resulted as follows:

President, George R. Smith, of Thetford Mines, Que.; vice-president, for Nova Scotia, Thomas Cantley, New Glasgow; for Ontario, Dr. W. L. Goodwin, Kingston, Ont.; for Quebec, Dr. Frank D. Adams, Montreal; secretary, H. Mortimer Lamb, Victoria, B.C.; treasurer, J. Stevenson Brown, Montreal; council, for Nova Scotia, Charles J. Coll, Stellarton; C. A. Meissner, Sidney, and W. B. Robb, Amherst; for Ontario, Dr. A. E. Barlow, Ottawa, and A. B. Willmott, Sault Ste. Marie.; for Quebec, R. T. Hopper, Montreal; J. Obalski, M.E., Quebec, and H. J. Williams, Danville; for British Columbia, R. R. Hedley, Nelson.

Mr. Lamb, the new secretary, has been till recently editor and publisher of the British Columbia Mining Record, which he has sold out, and will come East to assume the duties of his new office, which have been temporarily filled by Mr. Coste, since the death of the late secretary, B. T. A. Bell.

The presidential address, delivered by Eugene Coste, E.M., of Toronto, showed the need for enlarging the scope of the Institute. A summary of the address follows:

That Canada is to-day already one of the great mining countries of the world is proved and admitted; that untold wealth of mineral resources still remain untouched in many parts of our vast undeveloped country is also fully recognized by our mining engineers and geologists, and by many others who have studied the question.

Could we not, all of us of the Canadian Mining Institute, the only incorporated Institute representing the mining men from the whole country, do more than we are doing to hasten a more rapid and healthy development and progress of this immense mineral wealth of Canada? I have no hesitation in saying yes, we can do much more, and it is our duty to do it; our duty to ourselves; our duty to our beloved profession and industry; our duty to our great country. We are already a strong organization of some 500 members, and we have done a great deal in the past, but we can do much more in the future.

Our country is now growing very rapidly—only the other day new twin sister Provinces were announced in Parliament by the Right Honorable Premier—millions of dollars are going to be spent in constructing railways through vast new stretches of our country, and many opportunities to open and develop new mining districts will thus be presented to all of us. Thus the problems confronting us in our mining profession and industry, whether scientific, economic, of legislation, of transportation, of treatment or of any other nature, will soon multiply even more rapidly, and we must be ready to creditably consider and overcome all these problems and difficulties. Already our mining interests have expanded largely of late years, and as an instance of it we have this year on our programme not less than fifty papers almost all of them on different subjects, and it is impossible for us to give all these papers the necessary attention and discussion at this, our only meeting. We are outgrowing our old clothes, and we must cut out next suit on larger and broader lines.

The Constitution or By-laws of any Institute or Society is of course the final guide and mainstay of it, and once a provision or rule is adopted and placed there the officers of that Institute or Society have then the necessary machinery to work with and the power to put this machinery in motion. It only remains for them to watch its work with zeal, care and intelligence.

These necessary changes or additions to our present machinery, briefly stated, are:

(a) A larger representation of the members on our Board or Council of the Institute.

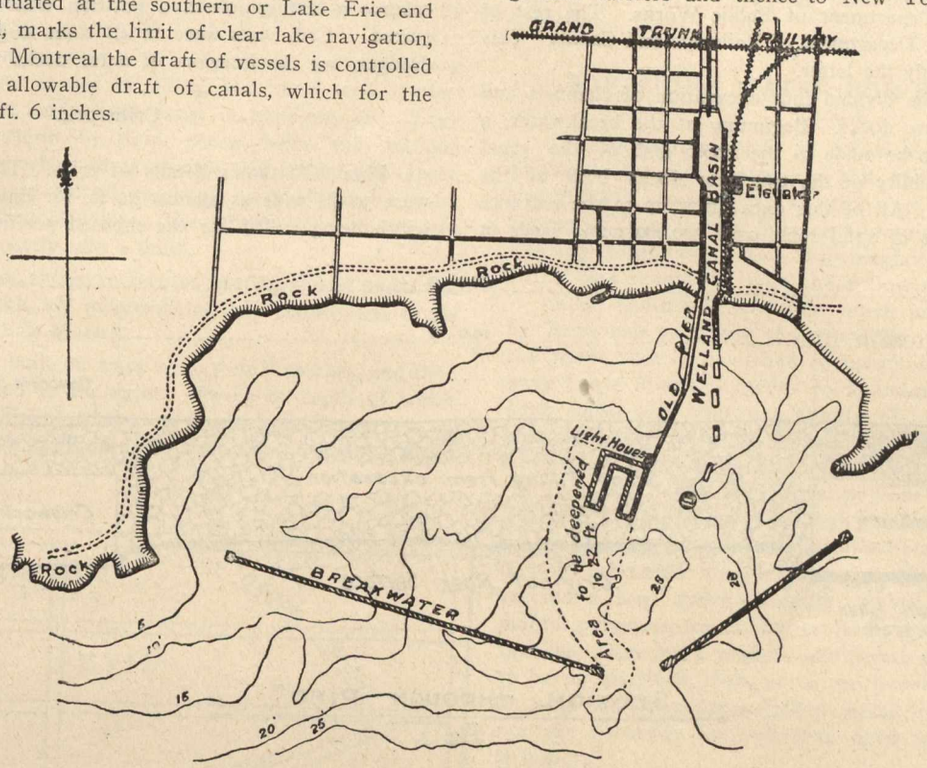
(b) The formation of strong branches of the Institute in different provinces and in some of the important mining districts of the country.

Those who have taken an active part in the affairs of the Institute in the past are a unit, I believe, with me in admitting that it has been very often next to impossible to have a good representative meeting of the Board or Council of the Institute as at present constituted, with twelve or thirteen members of it, or about one-half, belonging to British Columbia and Nova Scotia. The gentlemen from these provinces are so far away that they can hardly ever attend the Council meetings, and as at present organized, one-half of our Council is practically unavailable to us, while on the other hand we, the other half, are not the help to them that we should be. Thus only a very few of our Quebec and Ontario members have in the past actively participated in the management of the work of the Institute. This state of affairs is not broad enough, and is not conducive to our acquiring a thorough knowledge of, or to our giving the necessary attention to the many questions and problems affecting at all times the mining industries in the different provinces or districts of our vast country. Nor is it promoting the mutual help and intercourse among the members, which is one of the most important objects and mission of our Institute.

PORT COLBORNE HARBOR WORKS.

By J. M. Hogan, S. Can. Soc. C.E.*

Port Colborne, situated at the southern or Lake Erie end of the Welland Canal, marks the limit of clear lake navigation, for from this point to Montreal the draft of vessels is controlled directly by the legal allowable draft of canals, which for the Welland Canal is 13 ft. 6 inches.

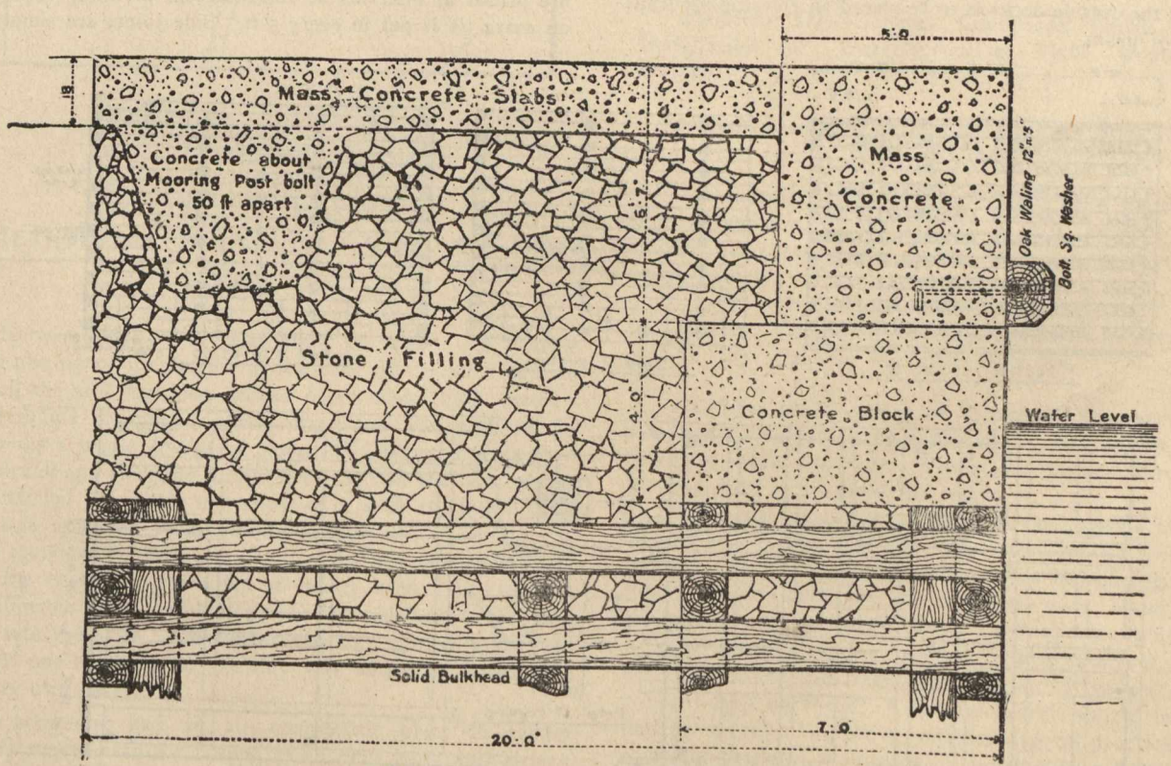


PORT COLBORNE HARBOUR IMPROVEMENTS

Fig. 1.

The Canadian Government has, since 1900, been engaged in extensive harbor improvements with a view to making Port Colborne a transhipping point of large dimension and a rival, small, especially considering the facilities offered and the excellent design of the canals.

Much of the grain, which at present goes to Buffalo in the large lake carriers and thence to New York by rail or Erie Canal might be diverted to the St. Lawrence route were proper facilities provided at Port Colborne for transhipment, and it was to provide just such facilities that the works were undertaken.



SECTION INSIDE HARBOUR WALLS.

Fig. 2.

if possible, to Buffalo. Should the Port Colborne scheme work cut as intended, the navigation of the canal system would be largely augmented, where at present, despite free tolls, it is very

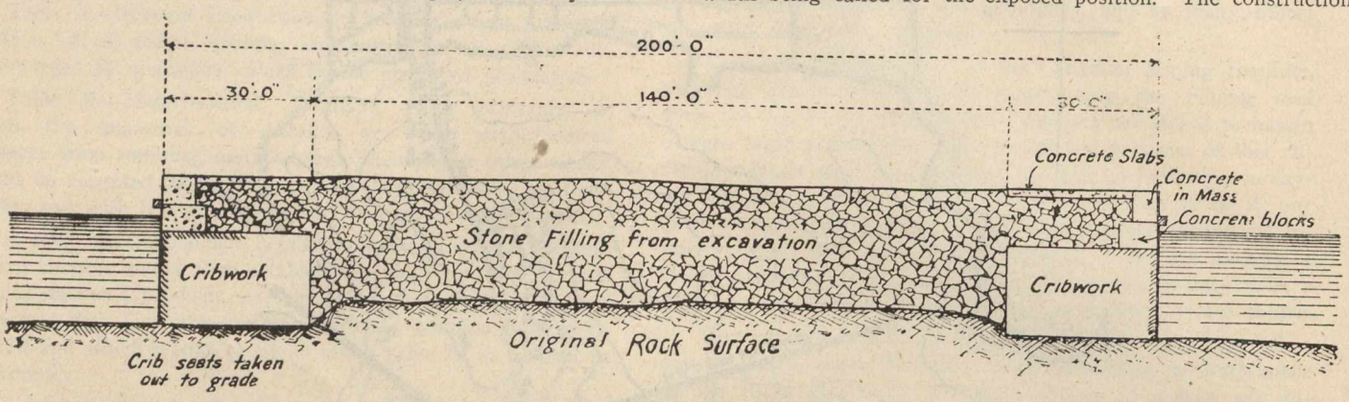
Fear of such a diversion of trade doubtless is the prime cause for the proposed large expenditure of $100,000,000 by the State of New York in deepening the Erie Canal; but even in its improved state the Erie Canal route will be inferior, both as regards depth (10 ft. as compared to 14 ft.), and distance, for the St. Lawrence route (Port Colborne to Montreal), is shorter by over 120 miles than the Buffalo to New York waterway.

*This paper was awarded the prize offered by the publishers of the Canadian Engineer for the best student's paper read before the Canadian Society of Civil Engineers in 1904.

The works comprise new docks, excavation of channels, and two large breakwaters to east and west of the port. These breakwaters, of which one, 5,000 feet long, is totally finished, while the other, 2,400 ft. long, is half completed, are under the supervision of the Department of Public Works. The rest of the works are in the Department of Railways and Canals. This paper will discuss only the latter.

The work may be divided into excavation of channels and the providing of new docks. Beginning at the breakwater, a depth of 22 ft. is to be made to the north end of the canal basin and in the vicinity of the two new docks built at the end of the old pier. All of this excavation up to the entrance of the canal basin is of solid rock, over 300,000 cubic yards in all, averaging a cut of three to four feet over its area. The limit of deepening to allow of approach to the new outside docks is shown on the plan (Fig. 1).

These new docks, which are 700 ft. by 200 ft., together with the new docking provided along the sides of the canal basin itself will give in all about one and one-half miles of concrete docks, allowing of approach by vessels up to 22-ft. draft. On one of the outside docks is to be placed an elevator for transshipment of grain.



SECTION THROUGH PIER.

Fig. 3.

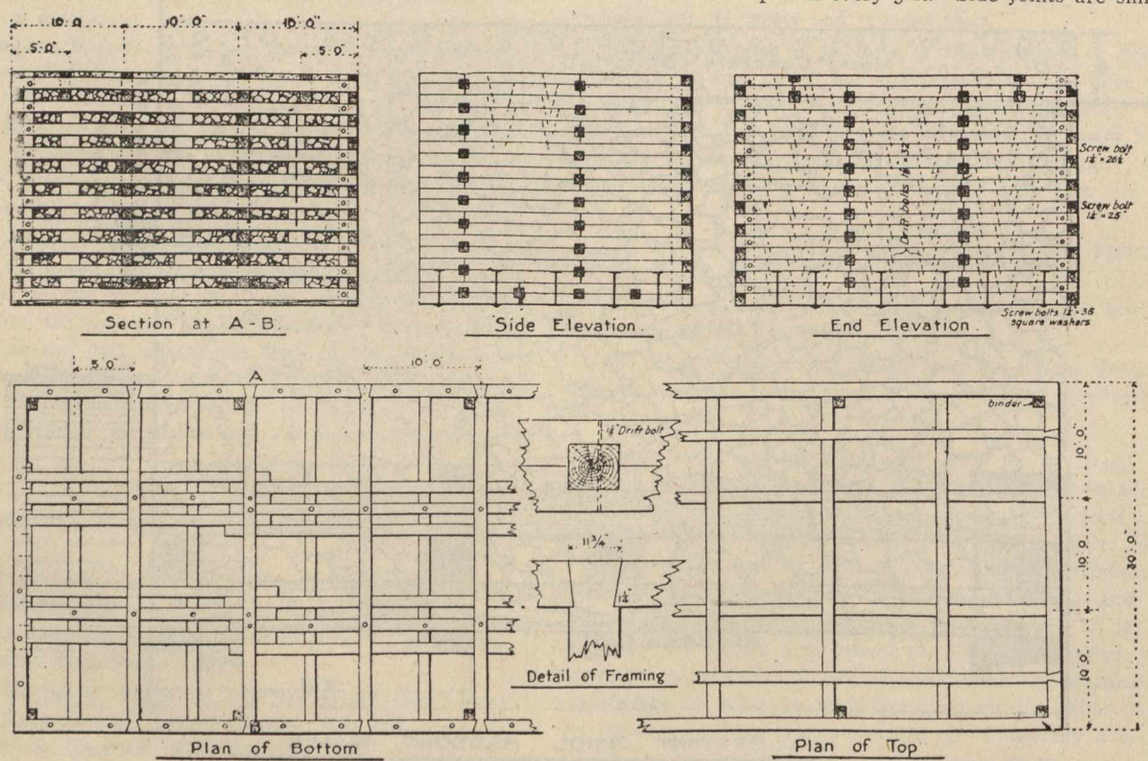
These cribs are built to within 2-ft. of an assumed water surface (14-ft. above mitre sill of lock), so that no timber is exposed to rot. The use of concrete blocks does away with the difficult operation of placing green concrete under water, and ensures a lasting job in a position where permanency is required. Crib seats were in all cases dug out to grade with dredges, but the interiors of outer docks were left as found.

Cribwork.

Plan "C" shows details of cribs. The outer harbor cribs were 30 ft. wide as against 20 ft. for inner harbor, the extra width being called for the exposed position. The construction points do not vary beyond the extra solid bulkhead in the 30-ft. crib.

The timber used, about 35,000,000 ft. B.M. in all, was all 12-in. by 12-in. square hemlock, proud edged with small quantity of wane allowed in ties or longitudinals. A small quantity of 6-in. by 12-in. is used for bottom grillage and block seat.

Ties and longitudinals are dovetailed, as per sketch. They are placed at intervals at 10-ft., except in lower course, where an extra tie is put in every 5-ft. Side joints are simply butted, ends being cut exactly square with ¼-in. allowable opening. End joints lap alternately. The longitudinals form two solid bulkheads for full length of the crib, which is a feature of great strength. This calls for short 10-ft. fillers between ties on every second course.



DETAILS - 30 x 100 CRIB.

Fig. 4.

Dock Design.

Design of inside and outside harbor docks is similar save for width of crib. Figures 2 and 3 show the design which is essentially submerged crib-work filled with stone, and surmounted by concrete blocks carrying a mass concrete wall, the whole covered for width of crib by an 18-in. slab of concrete.

Binders are placed every 20-ft. with the object of tying the face courses together vertically.

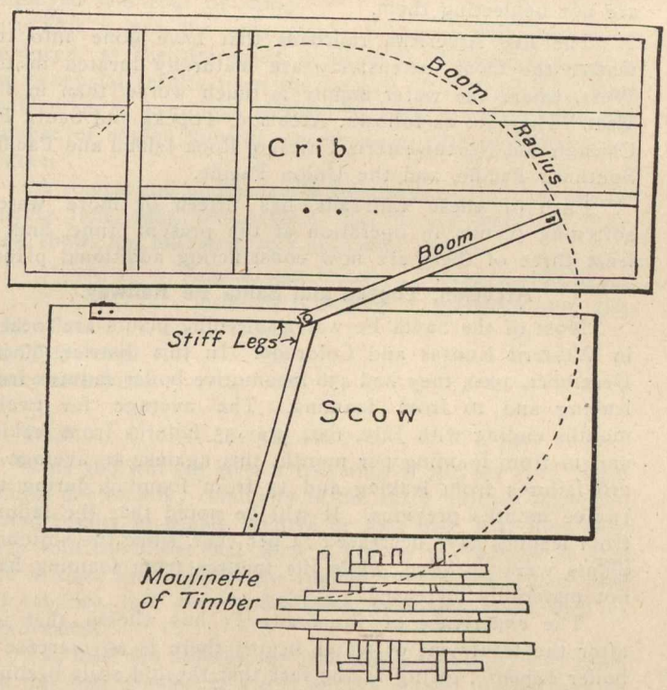
Bolting, Etc.

Binders are fastened to face timbers and ties by 1¼-in. by 26-in. screw bolts with square plate washers.

The three lower courses of crib are made specially strong to withstand stresses caused by filling, weight of wall, contact with uneven bottom, and rough usage in handling, etc. They are fastened with 1¼-in. by 36-in. screw bolts and washers passing through the whole three courses and spaced 5-ft. apart. The other courses are bolted, as shown with 1⅛-in. by 32-in. drift bolts having sheared points. These bolts pass through two entire courses and partly into a third.

The short blocks, shown in section, coming almost under the rear of concrete block, aid in preventing any deformation of tie and consequent settling of wall.

These cribs are built on ways up to 7 or 8 courses, and then launched and finished in the water. Owing to depth of water in basin being insufficient to float a finished 20 course crib, it was necessary to tow cribs into the open lake, and finish them near their sites.



METHOD OF BUILDING CRIBS BY SCOW.

Fig. 5.

Cribs were built by derricks afloat on scows. A feature was the placing of the derrick at the edge of the scow, and so arranging the stiff legs that derrick boom could have greatest possible radius of action. Only one move was required by scow to lay a whole course of timber. Hoisting engines having boom fall and swinging drums were used, so that the engineman controlled the whole movement of a stick of timber. The timber was unloaded from vessels directly into the water in piles or moulinettes; this being the most convenient method of storing the enormous quantities of timber used. As required, the moulinettes were towed alongside the crib scows and built directly into the cribs. The timber was thus placed in the crib with only one handling, as the ship was bound by contract to unload its own cargo.

Crib scow also had an air compressor plant to supply pneumatic augers used for boring, as all drift bolts were driven into holes bored ⅛-in. to 1-16-in. too small.

A gang of 20 men in all launched two crib bottoms of 7 courses and binders regularly each week, while a completed crib represented about eight days' work.

Cribs were sunk by placing on them several concrete blocks on temporary platforms at ends and middle. When properly aligned and level the filling was dumped in as rapidly as possible, and blocks later placed in their proper position. Owing to weather conditions the filling of each crib had to be completed at once, or about 2,000 cubic yards of stone filling provided. All this filling was dredged up from the excavation referred to.

(To be continued.)

SOFTENING WATER FOR RAILWAY USE.

The present attitude of American railroads toward the problem of water softening and the measures which are being taken toward its solution are outlined in a recent report of the Water Service Committee of the American Railway Engineering and Maintenance of Way Association. From this report we take the following extracts:

Your committee find that much progress is being made by American railroads towards improving the character of the water that is furnished to locomotives. Many railroads have found it advantageous to abandon wells that produced hard water and secure a supply of softer water by constructing reservoirs to collect and retain surface water. Several railroads have erected water-softening plants during the past year. The last report of your committee contained a list of twenty-seven American railroads that were known to it as having established water-softening plants. This list is now increased to about forty. Several railroads that erected a few water-softening plants, largely for experimental purposes, found the results so satisfactory that during the year they have erected additional plants. There seems to be no question, then, as to the beneficial results that can be obtained by using softened water in locomotive boilers, nor the necessity for softening hard water before using it in boilers.

The outline of committee-work suggested to the committee by the Board of Direction of the Association presents three problems, namely:

Problem I.—Water-softening Methods and Plants for various conditions.

Problem II.—Comparison of the Cost of Installing and Operating Water-softening Plants, with the benefits derived from their use.

Problem III.—General Conditions under which the Installation of Water-softening Plant would produce savings.

Problem I.—Water-softening Methods and Plants for Various Conditions.

All natural waters contain certain solid matter in solution, suspension, or both. When this exceeds a certain amount, it causes trouble in boilers in one or more of three ways, namely:

(1) Depositing scale in the boiler.
(2) Corroding the boiler and its fitttings.
(3) Causing the boiler to foam.

Of these three causes of trouble from water, the first two can be corrected by treating the water with chemicals before it enters the boiler. The only complete known remedy for the third is to distil the water.

When the operation of locomotives running in a certain district has shown that the water used in the boilers is the cause of trouble and expense, or when in opening up a new line it is desired to avoid the use of poor water, chemical analyses should be made of all the available water supplies. A careful study of the results of these analyses will show the location of the poor supplies, and attention should be concentrated on these. A careful search should be made to find better supplies. It is considered good practice to spend a liberal amount of money in developing a naturally good water, rather than in improving a naturally poor one. When, however, a naturally poor water must be used, the minimum quantity that is required should be determined. This fixes the size of the softening plant.

The kind and quantity of chemicals required to soften any water can readily be determined, by anyone conversant with the subject, from the figures showing the results of an analysis of the water. If the hardness is due to carbonates of lime and magnesia, the cheapest known chemical for removing it is common lime, and the cost of softening will

be comparatively low. If the hardness is due, however, wholly or in part to sulphates of lime and magnesia, it will be necessary to use something else, and soda ash is the cheapest known chemical that can be used for that purpose. Many waters may be softened by the use of lime alone, and when such is the case, the operation is almost ideal, as nothing is added to the softened water, because the lime used for softening is precipitated along with the hardening matter that was in the water. When it is necessary, however, to use soda ash to remove the sulphates of lime and magnesia from the hard water, a by-product of sulphate of soda is left dissolved in the softened water. This sulphate of soda does not form scale in the boiler, but if allowed to concentrate in the boiler, it is liable to cause foaming. It is, therefore, desirable that it be removed from the boiler by blowing off or changing the water in the boiler at regular intervals.

The problem of water-softening is not entirely a chemical problem; it is largely a mechanical one—involving the use of machines for measuring the proper proportion of chemicals to the hard water, for mixing same, and for disposing of the solid hardening matter that is removed from the water.

In general, while the chemicals used to-day by practically all water-softening methods are the same, yet the mechanical devices differ widely. There are two general types of mechanical water-softeners, known as the Intermittent Type and the Continuous Type. The advocates of each type claim certain advantages for their type.

Your committee does not wish to exploit any particular kind of water-softener, nor does it think that this is the place to discuss the numerous claims put forth by the makers of the various water-softening machines that are on the market. It simply wishes to emphasize the fact that the chemical method of all of them is practically the same; that the chemicals in general use at the present time are common lime and soda ash; that many other chemicals have been tried and abandoned on account of costing more than lime and soda ash; that the plant best adapted to meet a certain condition can only be determined after a careful study of that condition, and that the size of the plant, cost of same, capacity, cost of operation, cost of chemicals required to soften the water, is likely to vary with each condition.

Summary of Problem I.

(1) All water used in locomotive boilers contains scale-forming matter in solution or suspension that is the cause of much trouble and expense in operating and maintaining locomotives.

(2) In locating water stations along a railroad, an investigation should be made of all the available water supplies, and care should be taken to avoid the use of poor water, or to curtail its use as much as possible.

(3) If hard water is used, the hardness should be removed before it is put into the locomotive boilers.

(4) Hard water can be softened by treating it with chemicals. The chemicals generally used are lime and soda ash.

(5) The chemical method of softening water commonly used to-day has been known for many years.

(6) The mechanical methods of modern water-softeners are new, and differ widely.

(7) Water whose hardness is due to carbonates of lime and magnesia can be softened by the use of lime alone, without adding any soluble salts to the softened water.

(8) Water whose hardness is due to sulphates of lime and magnesia can be softened by the use of soda ash, but in this case soluble sulphate of soda will be added to the softened water.

(9) A water-softening method best adapted to any condition can be determined only after a study of that condition.

Problem II.—Comparison of the Cost of Installing and Operating Water-softening Plants, with the Benefits Derived from their Use.

The cost of installing a water-softening plant varies in different localities, and, of course, depends largely upon the type and capacity of the plant. In general, it may be stated that a small plant having a capacity of, say, 40,000 to 60,000 gallons of water per twenty-four hours, may be installed for about $2,000; while a large plant having a capacity of 500,000 gallons per twenty-four hours may cost $10,000. The exact cost of plants of various types required to soften a definite amount of water in twenty-four hours can readily be ascertained from manufacturers of water-softening plants. The cost of chemicals required to soften a fixed quantity of any hard water can be figured from an analysis of the water. The cost of operating will vary according to cost of chemicals in the locality, and also upon the efficiency of the apparatus. In most forms of both types of apparatus, the cost of labor is very little, as most of the water-softening machines on the market are automatic and simple, and require so little attention that the ordinary pumper can attend to them without neglecting his other duties.

Although the softening of water by American railroads may be said to be in its infancy, as none of them have been doing it for more than a few years, yet the results obtained up to date fully warrant the expenditures that have been made for water-softening plants, and the fact that more and more plants are being built every year by American railroads indicates that they realize the possibilities for saving, and are not neglecting them.

The five American railroads that have gone into the matter the most extensively are naturally located in the West, where the water supply is much worse than in the East. They are as follows: Atchison, Topeka and Santa Fe, Chicago and Northwestern, Chicago, Rock Island and Pacific, Southern Pacific, and the Union Pacific.

Each of these railroads has fifteen or more water-softening plants in operation at the present time, and at least three of them are now constructing additional plants.

Atchison, Topeka and Santa Fe Railway.

Most of the Santa Fe water-softening plants are located in Western Kansas and Colorado. In this district, during December, 1902, they had 456 locomotive boiler failures from leaking and 16 from foaming. The average for twelve months ending with July, 1904, was 55 failures from leaking and 16 from foaming per month; this against an average of 216 failures from leaking and 15 from foaming during the twelve months previous. It will be noted that the failures from leaking have decreased 74 per cent. since the softening plants were installed, while the failures from foaming have not materially increased.

The experience of the Santa Fe has shown that just after the treatment of water begins there is an increase of boiler expense, owing to the fact that the old scale becomes cleaned off by the use of the softened water, and this cleaning off of the scale hastens the time for their admission to the shop, but when they come out with a new set of flues they make a showing that is highly satisfactory—a new set of flues lasting an average of from twelve to fourteen months, where before the water was treated they had to be renewed in from six to eight months.

A comparison of the number of new locomotive flues issued by the Store Department for a year before and after the water-softening plants were installed indicates one of the benefits of softened water. After the plants were installed the locomotives made 363,302 miles more than the year before, and the Store Department issued 109,937 linear feet less flues than the year before. From these statistics regarding flues and locomotive mileage it seems certain that a saving was made, and this saving is attributed entirely to the use of softened water.

A statement of the wages of boilermakers, apprentices and helpers employed on the district where above failures were recorded, for twelve months from August, 1903, to July 31, 1904, shows a net decrease for that time of $7,000 over the corresponding twelve months of the year before.

The average cost for chemicals and labor at the Santa Fe plants was 2.8 cents per 1,000 gallons of water softened, the cost ranging at different plants from 0.32 cents at the lowest to 10.82 cents at the highest, the next highest being 5.56 cents.

Chicago and Northwestern Railway.

The water-softening plants of the Northwestern line are located in Iowa, Minnesota and Illinois.

The main line of the Iowa Division, extending across the State of Iowa from the Mississippi river to the Missouri river, a distance of 352 miles, is equipped with seventeen water-softening plants, and, where water stations exist that are not so equipped, the water used is natural soft water. All the locomotives running on this division, therefore, are supplied with soft water. A portion of these seventeen plants have been in operation two years, and all of them at least one year. After a year's exclusive use of soft water, the master mechanic of this division reported as follows:

"I have the following figures which I desire to submit in testimony of the benefits we have derived from purified water. Our boilermaker force, for instance, has been decreased as follows: In 1902 we had at Clinton and Boone an average of 36 boilermakers, costing $10.40 an hour, and 42 boilermaker helpers, costing $7.09 an hour; while in 1903, and thus far in 1904, we have had an average of 23 boilermakers at an average cost of $7.71 an hour, and 35 boilermaker helpers at an average cost of $6.70 an hour. This means that we have decreased the cost for boilermakers 25.8 per cent., and that we have decreased our boilermakers 36.1 per cent. The increased compensation received by boilermakers makes the difference in the percentage of force employed and cost of same.

"This is not the only result, however, that has been produced, as the decreased number of boilermakers, with the beneficial results from the treated water, together, have enabled us to keep our engines in such condition that the number of engine failures has dropped off to a remarkable degree.

"A comparison of the results from August, 1902, to and including June, 1903, and August, 1903, to and including June, 1904, shows the following very gratifying results:

	August, 1902, to and including June, 1903.	August, 1903, to and including June, 1904.
Leaky flues	544	99
Leaky fireboxes	33	20
Leaky arch-tubes	6	1
Total	583	120

"This you will see gives a reduction of 79.4 per cent. in our failures due to leaky conditions in the above months. These improved results in engine failures in 1903 over 1902 have been made with conditions that show a heavier ton mileage in 1903 than in 1902, showing that the engines were worked up to their full capacity, and even under these conditions made such an improvement.

"The total ton mileage for 1902 was 2,934,130,377 ton miles, and this was handled at a cost of 28.7 pounds of coal per 100 ton miles. In 1903 we handled 3,154,484,507 ton miles at a cost of 27.5 pounds of coal. This is a saving of 1.2 pounds of coal per 100 ton miles, or 4.2 per cent. From this you will see we have handled an increase of 7.5 per cent. ton mileage during the year 1903 over the previous year, and this work has been done with an average assignment of 159 engines in 1902, as compared with an average assignment of 154 engines in 1903, a saving of 3.1 per cent. in the number of engines. In each of the years 83 per cent. of the engines assigned were in constant service.

"From the above figures it will be seen that we reduced the number of boilermakers 36 per cent.; reduced our cost for boilermakers 25 per cent.; decreased our engine failures 79 per cent.; handled an increased tonnage of 7 per cent.; decreased the number of engines in service 3 per cent., and decreased the amount of coal consumed per 100 ton miles 4 per cent.

"It is rather difficult for me to say to what extent our cost for material and labor has been affected by this item, but I feel safe in saying that a very material decrease has been effected in this direction.

"There are a number of other things that can be mentioned in connection with these as being beneficial, but which we cannot compute in dollars and cents, among which we may enumerate the benefits which we have derived: First—from the short time required for engines to go over the road, due to fewer engine failures and delays on account of leaking; second—a better tone and feeling among our men, which necessarily means better service; third—longer time at terminals, which means more time to work on our engines, consequently, our engines are in better condition; fourth—less coal consumed, other conditions being equal, because they are less hours on the road, and the destruction of the incrusting matter on the flues and firebox sheets means a higher evaporative power of the fuel consumed; fifth—less expense in the cost of delays and overtime, because of the shorter time the engines will have necessarily been on the road; sixth—we are not required to send out any relief engines to protect important passenger and mail trains, or to protect trains on stock nights."

The average cost for chemicals and labor at the Northwestern plant was 1.8 cents per 1,000 gallons of water softened—the cost ranging at different plants from 0.81 cents, at the lowest, to 3.40 cents, at the highest.

Chicago, Rock Island and Pacific Railway.

The Rock Island has 15 water-softening plants in operation on the Kansas division, only a few of which have been in operation longer than six months. Reports from their Master Mechanic show that they are having fewer engine failures and much less boiler repairs than they experienced before the installation of their plants.

Owing to traffic conditions, they are not at the present time able to state whether or not they are using fewer locomotives in this territory as a direct result of softened water. The Rock Island was the last of the five railways mentioned to install water-softening plants, hence they have not had time to collect the statistics and data that the other four have.

Southern Pacific Company.

Most of the water-softening plants of the Southern Pacific are located in California. Some have been in operation since 1896, and the fact that at the present time they have ten plants in course of construction indicates that the problem of water-softening is no longer an experiment with them. Their records and the comparisons that they have made at different times during the past eight years show that the cost of boiler repairs has been decreased 50 per cent. by the use of softened water.

The average cost for chemicals only, at the Southern Pacific plants, was 4.4 cents per 1,000 gallons of water softened, the cost ranging at different plants from 1.4 cents at the lowest, to 7 cents at the highest.

Union Pacific Railroad.

The Union Pacific water-softening plants are located in Nebraska, Wyoming and Kansas. The Wyoming division has a number of water-softening plants, and natural soft water is used to some extent.

A study of freight train statistics before and after the improved conditions in water supply shows an increase in the average monthly locomotive mileage of 27 per cent., an increase in gross ton miles per pound of coal of 7½ per cent., and a decrease in cost of repairs per locomotive mile of 34 per cent.

The increase in gross ton miles per pound of coal and decrease in locomotive repairs is directly due to better water supply, and the increase in the monthly locomotive mileage is largely due to the same thing, but cannot be entirely attributed to this one cause.

A better idea of the reduction in expense in locomotive repairs may be obtained from the following: There are assigned to this district about eight passenger and 20 freight locomotives. The average life of a set of flues in passenger locomotives before the water was softened was six months; since softening the water, the average life is 2½ years. The average life of a set of flues in freight locomotives before softening the water was from 10 to 12 months; since then it is 2½ years. Before the change in water, a great deal of trouble and expense was incurred because of tube sheets cracking between the holes, and occasionally a crown sheet was mud-burned. No troubles of this nature have occurred since using the better water.

A comparison of freight train statistics for the six months ending January 31st, 1904, with the first six months of 1902, shows an increase of 17 per cent. in average monthly mileage of freight locomotives, which is largely due to better boiler water. The locomotives spend less time in shops for repairs and in the house for washing out. The number of men at work on boiler repairs has been reduced, but it will take months and possibly years to realize fully the extent of the reduction in boiler repairs. Locomotives, which under the old conditions

would have required an entire change of flues several months ago, are still running and doing good service.

The average cost for chemicals only (their published figures do not include labor), at the Union Pacific plants, was 1.3 cents per 1,000 gallons of water softened, the cost ranging at different plants from 0.63 cents, at the lowest, to 2.55 cents at the highest.

Summary of Problem II.

(1) The cost of installing a water-softening plant varies according to the capacity of the plant, its type, cost of material and labor in its locality, and other conditions.

(2) The cost of operating a water-softening plant varies according to the efficiency of the water-softening apparatus, and cost of lime and soda ash in its locality.

(3) The cost of chemicals required to soften water varies according to the quantity of hardening matter in the water, and also its composition.

(4) If the hardening matter consists of carbonates of lime and magnesia, the cost of chemicals for softening the water will be very little, because common lime is the only chemical required.

(5) If the hardening matter consists of sulphates of lime and magnesia, the cost will be higher, because it will be necessary to use soda ash, or some expensive chemical.

(6) The average cost for chemicals and labor on the Santa Fe was 2.8 cents per 1,000 gallons; on the Northwestern it was 1.8 cents per 1,000 gallons; on the Southern Pacific the average cost for chemicals only was 4.4 cents per 1,000 gallons, and on the Union Pacific it was 1.3 cents per 1,000 gallons.

(7) The benefits derived from water-softening plants are:

Fewer boiler failures due to leaking.

Longer life of flues and firebox sheets.

Reduced cost of labor for repairing and washing boilers.

Increased locomotive mileage between shoppings.

Increased ton mileage per pound of coal consumed.

Decreased number of locomotives in service.

Shorter time required for locomotives to go over the road.

Better feeling among the men, due to fewer failures and shorter time on the road.

Less expense in cost of overtime and delayed time.

Problem III.—General Conditions Under which the Installation of a Water-softening Plant Would Produce Savings.

It is conceded by all who have any knowledge of the subject that it costs less to produce steam from soft water than from hard water. A railroad that operates its locomotives in a region where natural soft water exists, is saved much expense that a railroad that operates its locomotives in a hard water region is put to. Some railroads are so situated that part of their lines pass through a district where natural soft water can be obtained. Where such a condition exists, the difference in the cost of operating and maintaining the locomotives in the two districts is very apparent to the officers, and they realize that if soft water could be obtained generally, the cost of operation and maintenance of locomotives would be reduced, and ideal conditions, as regards water used in locomotive boilers, would exist. It has become apparent to the officers of American railroads during the past few years that the quality of water used in their locomotive boilers should be improved. The reason for this is brought home to them frequently. In connection with the accepted theory that a locomotive should haul its full capacity in order to most economically handle traffic, it has been found that within certain limits, the larger the locomotive, the greater the economy. The result has been a remarkable increase in the size of locomotives in common use to-day, compared with those of ten, or even five years ago. This applies to locomotives in passenger as well as in freight service. The larger locomotives necessitated larger boilers and fireboxes, and the use of an increased amount of water and fuel to furnish steam to operate them. The larger the amount of steam required, the more water has to be evaporated to produce it. During the generation of steam from water in a boiler, the solid impurities, such as the different salts of lime, magnesia, etc., that were dissolved in the water, remain in the boiler and form scale. The more water evaporated, therefore, in a boiler, the greater the deposit of scale. It is for this reason that the quality of the water used in locomotive boilers has become so important a question within the past few years. With the smaller boiler carrying steam at a pressure of 140 to 160 pounds and washed out at the end of each trip; with the locomotive hauling but from one-half to two-thirds of its capacity, and but six to eight hours on the road, the water had to be very bad before it gave much trouble. But with the larger boiler in common use to-day, carrying 175 to 225 pounds' pressure; with the locomotive hauling its maximum rated tonnage, and often 15 to 20 hours on the road, the trouble from bad water is much more apparent, and the necessity for doing something to relieve this trouble almost imperative.

About ten years ago a general attempt was made by railroads located in the Middle West to do something to reduce the trouble caused by using hard water in locomotive boilers. This was accomplished to a limited extent by using soda ash and other chemicals directly in the boilers, and the relief for a time was quite marked, but with the continued growth of the locomotive boilers, and increased amount of steam required from them, it was found necessary to resort to some process of treatment by which the incrusting matter could be removed from the hard water before it was allowed to enter the boilers.

In general, it may be said that if a water is corrosive, it should be treated to remove the cause of its corrosive action. If it contains over 15 grains per gallon of hardening solid matter in solution, it will pay to soften it—no matter what this hardening consists of. If a water contains less than 15 grains per gallon of hardening matter, but this hardening matter consists largely of sulphate of lime, it will pay to soften it. If a water contains 50 grains per gallon of alkali salts, and also a large quantity of sulphates of lime and magnesia, it will not pay to soften it, as the resulting softened water would undoubtedly cause foaming.

Summary of Problem III.

(1) If a railroad runs through a region where hard water is the cause of trouble and expense, it would undoubtedly benefit that railroad to install water-softening plants. The actual benefits obtained from water-softening plants by the five railroad companies referred to under Problem II. are evidence of this.

(2) If a railroad has increased the size of its locomotives and found that it has more boiler troubles due to hard water than it had with the smaller locomotives, it would be a benefit to install water-softening plants.

(3) It would be a benefit to soften any water used in locomotive boilers that contains 15 or more grains per gallon of hardening matter, or even less than 15 grains, if the hardening matter consists largely of sulphate of lime.

(4) It would not be of much benefit to soften a water that contains 50 grains per gallon of alkali salts before treatment, and also a considerable quantity of sulphate of lime, for, although the water can be softened so that it will not make scale, yet it will cause trouble from foaming.

Conclusion.

That the subject is not new is proven by the fact that European railroads have been softening water for many years. One European manufacturer of water-softening apparatus has published a list of some 2,000 users of his apparatus; another a list of about 1,200 of his plants, yet the natural water supply in Europe is no worse than that of America.

The members of the committee making this report are: G. M. Davidson, chemist and engineer of tests, C. & N. W. Railway, chairman; F. A. Delano, general manager, C., B. & Q. R. R., vice-chairman; J. A. Barnard, general manager, Peoria & Eastern Railway; Anthony McGill, assistant analyst, Inland Revenue Department, Ottawa, Canada; C. A. Morse, assistant chief engineer, A., T. & S. Fe Railway; R. S. Parsons, engineer maintenace of way, Erie Railroad; E. J. Pearson, chief engineer, Northern Pacific Railroad; J. C. Stuart, general manager, Erie Railroad.

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—The Canadian Manufacturer, for January 20th, devoted nine pages to a selected list of Canadian imports for 1904. About 250 items imported are entered under their respective classes, and each item shows the tariff, the imports from Great Britain, from the United States, and the total from all countries. Imports on the free list are also shown, and a condensed list of articles exported is given. The details given in this handy form, and the summaries that accompany the list, make it of value for reference.

THE DOCTOR STILL DOING BUSINESS

British advertisers are generally found to be "canny" when they are approached by the representatives of far distant colonial newspapers. But when a plausible humbug comes along with utterly unscrupulous misrepresentations, they are eager enough to swallow the bait he offers. Just now the manufacturers in the Birmingham district are in a flutter and meetings are being held to arrange for a united action to resist the payment of certain advertisements charged by a Canadian trade journal which has a representative who went in style and stuck at nothing to secure manufacturers' orders. The more he boasted the more he was believed, and now his victims, having compared notes, are in arms against him and his journal. This kind of thing prejudices British advertisers against respectable Canadian advertising mediums. Combined resistance to the payments of the journal's accounts has been decided on. There will probably be some litigation.—London correspondent Montreal Gazette.

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THE ELECTRIC FURNACE.

J. B. C. Kershaw, F.I.C., writing in the Engineering Supplement of the London Times, reviews the report of the Canadian Commission on Electric Smelting, recently issued. Concluding, the writer gives his own opinion of the status and prospects of the electric furnace as follows:—

In the present writer's opinion the electric furnace methods of producing pig-iron or ordinary structural steel are unlikely to make much headway, until the present centres of iron and steel production in England, Germany, and the States have exhausted their supplies of cheap fuel. The passing of the blast furnace and the substitution of the electric furnace in the iron and steel industries, may, therefore, be reserved for the next generation. But in the meantime, electric furnace methods of producing high-class steels and special alloys by a refining process are certain to develop and become of considerable industrial importance. At present these developments are occurring in centres where electric power is cheaply developed from water-power; and this development is likely to continue. There is no reason, however, why the waste gases of blast furnaces should not be utilized in large gas engines for generating the electric current required to work electric furnaces—and this method of producing the power required for working the new processes is being exploited already in Germany.

English iron-masters would therefore be wise if they gave careful consideration to these new electric furnace methods of steel production with a view to their introduction into this country, and possibly within the next five years we may see installations of this kind at work in the United Kingdom.

The up-to-date iron and steel works of the future, is, in fact, likely to be a composite installation, and the iron as it runs from the blast furnace in the molten state will flow, not into moulds for production of pig, but straight into the electric refining furnaces grouped around it. In these many special varieties of high-class tool steel will be produced at one and the same time, from the same charge of raw iron. This plan will utilize not only the wasted energy of the gases from the blast furnace, but also the heat of the molten iron, and its adoption will therefore tend to lengthen the life and usefulness of the modern blast furnace.

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—Engineering News, New York, is instituting a prize competition for essays on "The Manufacture of Concrete Blocks and their Use in Building Construction." While there is an abundance of literature available on the kindred subject of reinforced concrete, there is a great dearth of information on the concrete block, and it is to stimulate the production of articles on the subject that the competition has been inaugurated. Papers must be between 5,000 and 10,000 words in length, and must be in by May 31st. The first prize is $150, and the second $75.

A NEW MINING DISTRICT IN THE NORTH OF QUEBEC.*

Until 1900, the northern boundary of the Province of Quebec was the height of land, and the formation was mostly considered as Laurentian.

In 1900, this boundary was extended to the East Main River, and the work of the Geological Survey has shown that a considerable part of that territory is covered by the Huronian formation. The different geological explorers, such as Dr. Bell, Richardson, Low and others, without going to the detail of prospecting, had called attention to the probable value of that northern section from a mineral point of view, but the first real prospect was undertaken by Mr. Peter McKenzie, who boldly started upon such general indications to explore the region north of Lake Chibogomo, where Richardson had first pointed out the existence of serpentine, copper pyrite and magnetic iron. Thus, in 1903, Mr. McKenzie made two explorations there, starting from Lake St. John, and brought back specimens of asbestos, copper ore, magnetic iron, with information of such a nature that I decided to visit this district with him, in the fall of 1904.

I reached the Chibogomo by way of Lake St. John, the River Chamouchouan, and a succession of large lakes called Chigoubiche, Chamouchouan, Nikaubau and Obatogoman, the same route having been followed by previous explorers. After passing the Laurentian gneiss, the first Huronian rock was encountered in the form of diorite, at the end of Lake Obatogoman and followed to the north end of Chibogomo. The formation then consists mostly of diorite rock, but is sometimes chlorite schist, intrusive granite, conglomerate, talc schist and serpentine.

On a large island between the two discharges of Lake Chibogomo, I found the following minerals:—

1. An extensive outcrop of quartz showing a distinct vein of the same, running about E.W. for 2,000 feet, with a vertical dip. The south wall was well exposed and I measured 30 feet across without finding the other wall, the quartz being then covered by earth and trees. This quartz shows visible gold in small particles in several places as well as in the loose boulders; it also contains bunches of copper and iron pyrites in which analyses have shown gold in commercial quantities. By panning out in the vicinity of the vein, and even at some distance from it, fine colors of gold were found in nearly every pan. Several hand pieces of quartz were tested, giving from traces to $10 per ton, two specimens of pyrite giving respectively $9 and $64 to the ton. About 8 ounces of concentrate resulting from the rough hammer crushing followed by panning of about 100 lbs. of quartz from that vein, gave 9 ounces of gold to the ton, numerous colors of gold being visible in that concentrate.

2. An outcrop of chalcopyrite yielding 23 per cent. of copper with some gold and silver to the amount of $2 to the ton. The ore is contained in what is apparently a vein running N.S. from the shore of the lake, of about 2 feet of mixed ore and quartz, some bornite being also met in the vein. In the surrounding diorite rock small pockets of ore are also in sight for a distance of more than fifty feet along the shore. By panning out in the crevices of that vein, which is about one-fourth of a mile from the auriferous quartz vein, I found colors of gold.

3. A belt of the diorite contains a large amount of magnetic iron disseminated through the rock for about 50 feet in width, and a distance of one-fourth of a mile towards a hill called Paint Mountain, about 300 feet high.

4. On this Paint Mountain there is a good deal of rusty rock, and at one point I found colors of gold. In several places are small quartz veins, some of them with a little copper pyrites, and at a few points, red oxide of iron or ochre, being undoubtedly due to the decomposition of iron pyrites. By digging out at one place a kind of porous quartz was encountered, and a few feet deep, it became impregnated

*A paper read by J. Obalski, M.E., Quebec, Que., before the Canadian Mining Institute, Montreal Meeting, March, 1905.

with iron pyrites to the extent of 50 per cent. in the quartz, such pyrites containing 44 per cent. of sulphur, but no copper nor precious metals. I consider that deposit to be a large one.

About five miles in a northerly direction, after passing through some narrows where diorite and conglomerate are visible on both shores, a large exposure of serpentine rock is met with. That serpentine was mentioned by Richardson on a small hill which we called Magnetic Cone, but the exploration of the shore and of the Rapids River shows that this formation extends in an easterly direction for more than 8 miles, and, in fact, I did not see the end of it.

On a large island close to the shore, Mr. McKenzie discovered asbestos on his first trip, and in the following ones he made some prospects which disclosed fibres of good length, and, in my opinion, in commercial quantities. The quality is comparable with that of our Eastern Townships, the serpentine resembling also that of the same region. I saw fibres 2½ inches, and at one place there was an agglomeration of veins forming a total width of about 6 inches. The rock presents itself in various forms, being sometimes compact, broken or shaly. When in the compact serpentine, the fibre is very abundant, but the veins do not extend far; in the shaly rock, a variety of apparently fibrous horneblende, resembling Italian asbestos, is quite abundant. The prospects show the existence of asbestos for a distance of about 800 feet.

Magnetic iron appears to be widely distributed throughout this section. On the Magnetic Cone, and in its vicinity, the needle shows a remarkable variation which, in a certain zone, is really 180 degrees turning completely from north to south.

There is a vein of magnesite containing 7½ per cent. of iron which is magnetic and the surrounding serpentine is strongly magnetic, and contains visible grains of magnetite. On the Asbestos Island there is a black serpentine with a semi-metallic streak due to magnetic iron in an earthy form. In all that district north of Lake Chibogomo, the dip-needle is strongly affected over an extent of several miles, the needle remaining vertical in many places. The facts are remarkable, and justify the expectation of finding this magnetic iron somewhere in a more condensed form..

I recall the fact that the report for 1872-73 of the Geological survey mentions a variety of strongly magnetic serpentine found on an island in Lake Abitibi, by Mr. W. McOuatt, which would seem to resemble that found at Chibogomo.

Besides the above indications, magnetic iron in massive form was found by Mr. P. McKenzie south of the Sorcerer's Mountain in veinlets of about one inch, specimens of which possess the property of loadstone.

On looking over the geological map of the basin of the Nottaway River, by Dr. R. Bell, we see a considerable development of Huronian rocks, having, in the western part of Northern Quebec, a width of about 140 miles from north to south, and I am of opinion, with the members of the Geological Survey who have explored it, that there are great possibilities of finding commercial minerals there. That belt will be crossed by the proposed transcontinental railway, and I think that a large field will then be offered to prospectors.

That district is well wooded with good, but small sized timber, offers numerous water powers, and fairly extensive tracts of cultivable land, the climate being that of our northern counties. The country is undulated, with here and there low hills, and the average altitude is from 1,000 to 12,000 feet above sea level.

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—The Comstock Lode, a large part of which has been flooded for twenty years to the 1,600-foot level, is about to be pumped out.

—The Royal Canadian Automobile Show, which was to have been held in Toronto February 27th to March 4th, had to be cancelled, owing to the failure of the authorities to secure a suitable building.

INDUSTRIAL NOTES.

A new public clock is being installed in the tower of the post-office at Sydney, C.B.

The Brantford Screw Company are considering plans for the erection of a large new factory.

Another new industry has been added to Berlin's list by the establishment of the Berlin Aluminum Works.

The Hamilton Brass Manufacturing Company are arranging to secure larger quarters for their Montreal branch.

Taggart Bros., Winnipeg, have purchased land in that city on which to erect a factory, where they will manufacture all kinds of ornamental iron work.

The new steel bridge across the Souris River at Melita, Man., has been completed and opened for traffic. It is of steel on concrete pillars, and cost nearly $75,000.

The W. R. Perrin & Co., manufacturers of hydraulic presses and machinery for factories, have purchased land in Toronto on which they will erect a factory costing about $12,000, and employing about 50 hands.

Fire took place at Coal Creek mines near Fernie, recently, destroying both tipples, a stable and one power-house. The estimated loss is $200,000. It will take three to six months to make repairs.

The A. C. Thompson Company, Limited, will establish a nail factory at Sydney, N.S., the capacity to be 75,000 or 100,000 kegs per year. The raw material will be purchased from the Dominion Iron and Steel Company.

The tender of A. E. and Roy Barrett Company, of Seattle, has been accepted for the erection of a tourist hotel at Victoria, for the Canadian Pacific Railway Company. The contract price is just under $500,000.

The Magnesia Asbestos Supply Company, of San Francisco, Portland and Seattle, has opened an office in Vancouver, and proposes to establish a branch factory there to manufacture asbestos covering for steam pipes for the British Columbia market.

The Canadian Drawn Steel Co., a branch of the Union Drawn Steel Co., of Beaver Falls, Pa., have secured a charter capital $150,000, and will locate in Hamilton. They will build a plant in the annex, and manufacture polished steel shaftings, forgings, castings, etc. About 50 hands will be employed.

The contract for the rebuilding of Red Bank bridge, over the Northwest Miramichi River, Northumberland County, N.B., has been given to contractor D. J. McLaughlin, of Mill Cove, Queen's County. The new bridge is to be a seven span covered bridge, each span being 140 feet long. The contract price is $15,000.

The St. Mary's Falls Paper Company, with a capital of $100,000, has been organized at the Michigan Soo. A mammoth mill, employing a large number of men, will be built early this coming summer. The mill will handle all the pulp from the Canadian Soo pulp mill, which has an almost limitless supply of raw material in the forests in this part of the country.

An industry for the manufacture of sand and lime brick is to be in running operation at Toronto by June. The capital is placed at $50,000. About sixteen to twenty hands will be employed, and the daily output is estimated at 30,000 bricks. W. C. Irwin, W. A. Skeans, and T. J. Smith, are among those interested. There is only one other similar industry in Canada.

The Quebec Railway, Light and Power Company will construct what will be one of the highest dams ever built in Canada. This dam will be 90 feet in height, 12 feet wide at the top, and 65 feet wide at the bottom. It is to be built at the foot of the Natural Steps on the Montmorency River, and rushed to completion as rapidly as possible. The construction of this dam will not only have the effect of doubling the power of the company, but will also give them an enormous storage reservoir, containing over fifty million cubic feet of water to draw from in period of drought.

At Gananoque, a by-law to grant a loan of $15,000 and exemption from taxes to the Sampson Bolt Co., was carried recently.

The purchase of four hundred acres of peat land near Newtonville, Ont., is being negotiated with a view to establishing large peat works.

Wm. J. Allison, New York, is at the head of a strong company which is about to locate a large steel and tin plate works in Morrisburg, Ont.

Rhodes, Curry & Co., Amherst and Sydney, N.S., have the contract for the supplying of the material for the building of seven Marconi wireless telegraph stations.

The Wilkinson Plow Co. has purchased the West Lorne Wagon Works, and will run it in connection with their plant at Toronto Junction. The company will manufacture all kinds of heavy wagons.

Charles May has secured the contract for the erection of the power-house for the Edmonton Street Railway Company. The work will be begun during the spring and pushed to completion with as little delay as possible.

A firm from Easton, Pa., has secured land in Hamilton and will erect a factory for the manufacture of shovels and tools. Messrs. Skelton, McCarthy, William Holton and Phil. Dwyer are connected with the enterprise.

At Hamilton a number of men have formed a local company to erect an apartment building, on account of the scarcity of houses. The plans call for 252 complete suites with modern conveniences, 63 of which are to be ready by August 1st.

The directors of the Traders Bank, Toronto, will erect a substantial new office building, work on which will begin in a few weeks. It is understood that the building will be of seven or eight storeys, and will occupy a ground space of one hundred feet square.

At Hickey, No. 4., Leamington, Ont., oil has been struck at a depth of 1,080 feet. When the tools were pulled out oil shot 75 feet above the derrick. This well is now flowing at the rate of one barrel per minute, and makes an oil refinery at Leamington a certainty.

The Munro Wire Works, Ltd., have purchased a site in Winnipeg, and expect to have the factory running this month. The class of goods the company will make include wire, iron and steel fencing, spiral railway fencing, elevator grill work, and all wire works of the heavier kinds.

B. R. Payne, resident manager of the Ontario Power Co., Niagara, expects to turn the first wheel in May, and have 30,000 horsepower on the market by July 1st. Two turbines and two generators have been placed in the power-house and the foundation is being built for the transformers.

There is a prospect of a Portland cement industry being established at St. Peters, C.B., where suitable clay and limestone abound. Experts place the cost of cement manufactured there at from 80 to 90 cents per barrel. A company incorporated under the name of the Eastern Portland Cement Company has the proposition in hand.

The John Bertram & Sons Co., Limited, Dundas, Ont., have recently supplied Dodge Manufacturing Co., of Toronto, with one of their new patent head high speed turret manufacturing lathes, for the rapid production of duplicate work. This latest production of the Bertram shops is attracting the attention of manufacturers.

The ratepayers of Brockville passed two money by-laws, one to authorize the council to lend $30,000 to the Canada Carriage Company to assist in rebuilding the works destroyed by fire a few months ago; and the other to raise $1,000 with which to buy land for a site for the D. H. Burrell Company, of Little Falls, N.Y., which proposes erecting a factory for the manufacture of dairy supplies.

The Locomotive & Machine Co., of Montreal, Limited, have recently closed contracts for a large amount of structural material, having been awarded the contract for the Royal Victoria Museum at Ottawa, as well as the Royal Mint at the same city; they have also been awarded the contract for all the steel work for the new post-office at Winnipeg, as well as having received orders for a large amount of bridge work for the Canadian Pacific.

Arrangements have been completed for the building of a large plant at Sydney, C.B., for making cement from slag, one of the by-products of the Dominion Iron and Steel Company. The plant is to cost about a quarter of a million dollars, and will be the only one of the kind in Canada. The site has been selected close to the steel works. The company, called the Sydney Cement Company, is capitalized at $500,000, and the capital is largely English. Its capacity will probably be 500 barrels a day, and a cooperage with a capacity of 50,000 barrels a year is also proposed to be built. The plant is to be of steel, and will probably be finished in July. The city council of Sydney has granted the company a bonus of $10,000, exemption from taxes for twenty years, and low water rates, providing the company manufacture not less than 25,000 barrels of cement a year. Construction work has been begun, the contract having been awarded to C. J. Curtis. of New York.

MARINE NEWS.

The repairs made by the Victoria Machinery Depot to the British ship "Haddon Hall," involving about $8,000, have been completed.

J. W. Aston, of Collingwood, last year engineer of the steamer "Newmount," has been appointed chief engineer of the Toronto Ferry Company's fleet.

The G.T.P. will make St. John or Halifax, or possibly both, their Atlantic port.

Victor Robinson, of Chatham, bought the hull of the tug "Aldridge," which had been sunk at Sarnia last year, and has put in an engine and fitted her out for tugging this year.

The Allan Line has been awarded the contract by the Dominion Government for a fortnightly service between Canada and France. The service will begin with the opening of St. Lawrence navigation.

The R. & O. Navigation Co., are asking a bonus of $2,000 from Montreal for a summer ferry service to St. Helen's Island, or the company will sell its ferry boats for $33,000 if the city wishes to take over the service.

The Niagara Navigation Co. will build a twin screw passenger steamer with quadruple expansion engines for the Lewiston-Toronto route. She will be 317 ft. long with beam of 54 ft. and have a speed of 24½ miles per hour. The contract has been awarded to The Canadian Shipbuilding Co., and she is to be finished by May, 1906.

The work of the ice-breaker "Montcalm" on the St. Lawrence at Cap Rouge this winter has proved satisfactory. It is the intention to send this boat, as soon as she has cleared the ice blockade away at Cap Rouge, down as far as Belle Isle, to help any incoming steamers that may be embarrassed by the ice in the early spring.

The Dominion Government's new snag boat "Samson," built to replace the old "Samson," now working on the Fraser River, is at the Victoria Machinery Depot having the machinery installed. The boat is a much better one than that already in use, and is the strongest craft of the kind built in British Columbia.

The Victorian and Virginian, the two new turbine boats just completed for the Allan Line, sail from Liverpool for St. John on March 23rd and April 6th respectively. These steamers are fitted with the new long distance receivers for wireless telegraphy, the same as those in use on the Cunard boats. They will be capable of receiving messages at a distance of 2,000 miles.

The "Minnie M." and "Ossifrage," of the Algoma Central Steamship Co., will run this season between Sault Ste. Marie and Collingwood, calling at intermediate ports. The "King Edward," of the same line, will run between the Sault and Toledo. The company's four freight boats are

being fitted out, and will go in the ore-carrying trade as soon as navigation opens.

Capt. Pouliot who for years was in charge of the steamer "Admiral," on the Dalhousie Gaspe line, will be in command of the "Lady Eileen," a new steamer to be put on the route in April. The steamer will have a speed of about fifteen knots per hour, and will be fitted with triple expansion engines. She will have accommodation for 100 first-class passengers and 100 second-class, and will be fitted up with all modern improvements.

The Hamburg-American line is fitting out the steamer Vulcan at its works at Stettin, with an invention of Otto Shiek, an engineer of Hamburg, which it is expected will reduce the rolling of vessels at sea to a minimum. This consists in a massive balance wheel so mounted as to counteract the shifting of the ship's centre of gravity. The steamship officials are so convinced of its utility that they are advancing money and loaning a vessel for a trial which will take place in June or July.

The Richelieu and Ontario Navigation Company have decided to change the names of some eight of their vessels in order that there may be more uniformity. It has been decided to adopt the titles of Canadian centres, and drop such titles as Algerian, Bohemian, etc. The steamers with their new names are as follows: Algerian to Cornwall; Bohemian to Prescott; Canada to St. Irenee; Cultivateur to Varennes; Corsican to Picton; Saugenay to Chicoutimi; Virginia to Tadousac; Spartan to Belleville.

The Richelieu & Ontario Navigation Co. announce that the new steamer Montreal will make its first trip on May 23rd, and on the following day will go into service on the Montreal and Quebec route. The steamer, which is being entirely constructed at the company's works at Sorel, will be the first large steamer built in the province of Quebec. The plans of the steamer are almost identical with those followed by the John Bertram Co., of Toronto, in the construction of the ill-fated steamer Montreal.

Captain Crawford, who was master of the steamer Turbinia last year, has been engaged to superintend the bringing to Toronto from Nova Scotia of the Dominion Coal Company's shipments, which, it is said, will amount to about 100,000 tons. Captain Crawford will be succeeded on the Turbinia by Captain Bongard, who was formerly in charge of the steamers of the Lake Ontario and Bay of Quinte fleet. Some of the other officers appointed on the steamer are: First officer, J. Mann; chief engineer, J. White, and purser, C. Arthurs. Just as soon as the bays in Toronto and Hamilton are free of ice the steamer Turbinia will go into commission.

The Dominion Coal Company during the coming season will employ the following chartered boats in the coal trade from Sydney: Catalone, Mystic, Dominion, Torduenjold, Tancred, Britannic, Harrod, Ovidia, Symra, and the James Ross, besides the company's own steamers, namely, the Cobban, Louisburg, Cape Breton, Bonavista and Cacouna. They will also have a steamer, the Turpin, chartered for the coast trade alone. The James Ross is a new steamer, now in course of construction at Middlesboro, England. She is being built specially for the coal trade and will carry seven thousand tons. The steamer will be launched in a few weeks.

A deputation from the Marine Engineers' Association having waited on the Minister of Marine urging that licenses to run tug boats and small steamers, except pleasure steamers, be granted only to qualified engineers. A bill was introduced by Leighton G. McCarthy, and referred to a special. By a compromise reached in committee, it was agreed that steam boats and tug boats having single engines under 11 nominal horse-power, or compound engines of under 21 horse-power, also small pleasure yachts, privately owned and not run for hire, should be exempt. It was also provided that fourth-class engineers might act as chief engineers on tugs or assistant engineers on passenger steamboats under 100 nominal horse-power, and that any engineer now in charge of a tug boat engine may receive a permanent engineer's certificate on furnishing testimony as to character and proof of 24 months' service as engineer on a tug boat. It was agreed that the act should not come into force till January, 1906, in order to leave the present season's traffic unaffected, and these provisions seemed likely to be accepted when strong opposition to the bill suddenly developed from the Maritime Province members, who asked that the present permit system should be maintained to meet the varied conditions for navigating inland waters in the east. E. Adams, chairman of the Board of Steamboat Inspection, supported the opponents of the bill.

MINING MATTERS.

A giant ore crusher is being installed at the Granby Mine at Grand Forks, B.C.

Nickel has been discovered at the Yankee Girl Mine, near Ymir, B.C. The assay showed that nickel constituted 5.1 per cent. of the ore.

The Northern Light Mine Co., has recently completed a stamp mill on its Baden Powell property, Eagle River, Ont. Air compressor drills have also been installed, which will be kept constantly running.

Tenders will be received up to 30th of April for the purchase of the Mikado Gold Mines, Rat Portage, Ontario. Work was suspended on this property some time ago, owing to lack of working capital.

The property of the Cape Breton Copper Co., at Beechmont, was sold at public auction to J. A. Gillies, of Sydney, for $30,000. Mr. Gillies is the representative of a new company which intends to take hold of the property and develop it.

The contract for opening up the property of the Honor Bright Co., near Eagle River, Ont., was completed recently. So far 54 feet has been sunk, with 15 feet of cross cutting. It is said that a likely 4-ft. vein was struck 11 feet from the shaft.

Word as been received of the discovery of two additional and apparently rich deposits of cobalt silver ores along the line of the Temiskaming Railway. One of these is 25 miles north of Haileybury, right on the railway, and the other still further north and a little to the west of the line.

The property of the Canada Coal and Railway Co., near Amherst, N.S., was recently sold to Stuart Jenks, of the firm of Rogers, Jenks and Purdy, for $50,500. It is said that this property is one of the most valuable in the country and embraces the line of railway from Maccan to Joggins, and the large coal mines in splendid working condition at the latter place.

On the Pioneer Mining Co.'s property on Pioneer Island, Ont., the shaft has been sunk 55 feet on a large contact vein with an iron cap, the ore changing rapidly from iron to good quartz, carrying much visible gold. This appears to be the only vein in the region lying between slate and granite, and its future development will be watched with interest.

It is said that the Shakespeare Mine, on the Webbwood gold mining property near Sault Ste. Marie, is the greatest gold mine on the continent. The total depth of the shaft is 140 feet. The cross cuts and drifts all show pay ore which goes to the ore bin without sorting. Four stamps are running and a new five stamp mill is soon to be installed. The company has just refused an offer of $1,000,000 for the property made by an English syndicate.

The Beaver Hat Gold Mining Co. has been incorporated in Guysboro County, N.S., Hiram Donkin, chief engineer of the Dominion Coal Co., being one of the directors. The mine this company will work is said to be the richest find in the history of Nova Scotia gold mining. Already over a hundred tons of gold-bearing quartz are ready for the crusher, and with the opening of spring development work will be rushed forward.

LIGHT, HEAT, POWER, ETC.

A by-law is to be submitted to the ratepayers of Duncans, B.C., to empower a company to install an electric-light system during the coming summer.

At the annual meeting of the Hamilton Gas Company, held recently, the directors were re-elected and a dividend of 8 per cent. declared.

All the locks of the Lachine Canal are to be operated this year by electricity. It is expected about $400,000 will be spent on the canals near Montreal in improvements.

The Ontario Electrical Development Co., which has just let contracts of a new $500,000 power-house at Niagara Falls, has decided on a scheme by which power from the Falls will be distributed to the towns and cities of Western Ontario.

The council for the city of Quebec has appointed a commission to enquire into the lighting situation in the city and endeavor to induce both the gas and electric companies to reduce rates, failing which, action will be recommended looking to municipal ownership.

The Vancouver Gas Company, recently taken over by the British Columbia Electric Railway Company is receiving tenders for a 150,000-foot gas holder. The entire works are being remodeled, fourteen miles of main are being laid and the output will be increased considerably.

A meeting was held at the Engineers' Club, Toronto, on March 23rd, at which K. L. Aitken, consulting engineer, presented a paper entitled, "The Relation Between High Tension Lines and Other Lines." A large number of members were present, and the paper was followed by an interesting discussion.

The Montreal Light, Heat & Power Co. has offered to supply gas to the citizens at ninety cents a thousand feet for cooking, and one dollar a thousand feet for lighting, if the city council will give them an extension of fifteen years on their present franchise.

The Edison Sault Electric Co. will put up a large power plant on St. Mary's Rapid, near the locks, expending $120,000 during the present summer. The first section is to have a capacity of nearly 3,000 horse-power, and it is the intention ultimately to use all the power in the St. Mary's River, amounting to about half a million horse-power.

A project is on foot to develop the water-power of Grand Falls, N.B. The Electro-Manganese Co. has been formed, and their plans include the manufacture of ferro manganese at the falls, the development of electric energy for the operation of mills and railways, also for use in lighting and manufacturing as far as St. John. The project will involve from $3,000,000 to $4,000,000.

The Niagara Falls Electrical Transmission Co. has been incorporated at Niagara Falls, N.Y., with a capital stock of $100,000. The object of the company is to manufacture and supply gas for lighting purposes, and to purchase natural gas for domestic and manufacturing use. Among the incorporators are F. Nicholls, E. R. Wood, and R. E. Thompson, Toronto.

Canadian and American capitalists have organized the Rio de Janeiro Tramway Light, and Power Co., with a capital of $25,000,000, and an authorized bond issue of $25,000,000. The enterprise promises to be the largest electrical undertaking in the world outside of the United States. Among the organizers are W. Mackenzie, R. R. Wood, and Z. A. Lash, of Toronto.

The West Kootenay Power & Light Co., B.C., has commenced an elaborate scheme of development of the upper falls of the Kootenay River at Bonnington, by which it is intended to harness the water power at that point to an extent never before contemplated in Western Canada. This company now generate over 4,000-horse-power in electrical energy, but it is expected that the new plant will have a capacity of from 12,000 to 16,000 horse-power. The work will be rushed.

During the last year over 1,909 permits were issued for electric power in Winnipeg, covering the installation of 85 arc lamps, 1,808 horse-power for motors, and wiring for 28,316 incandescent lamps. For street illuminations a number of 50-candlepower series incandescent lamps on 7½-ampere current were installed last year, being used on the same circuit with the arc lamps. These have been so satisfactory that an additional supply will be purchased and installed during the coming summer. About 100 additional arc lamps will also be purchased and installed, this being made necessary by the rapid growth of the city. The installation of 10 additional fire-alarm boxes will also be made this spring.

* * *

PERSONAL.

F. Percy Smith has been appointed secretary of the Richelieu & Ontario Navigation Co., of Montreal.

W. T. Robson, formerly president of the Canadian Club in New York, has been appointed advertising agent for the Canadian Pacific Railway.

K. L. Aitken, consulting engineer, of Toronto, has recently returned from Sarnia, where he made a complete inspection of the electrical equipment of the Imperial Oil Co.

H. P. Douglas, general manager of the Canadian Otis Elevator Company, has relinquished his present responsible position for a more prominent and lucrative one under the American Otis Company, of New York.

Archibald McNaughton, Kingston, has been appointed secretary-treasurer of the Kingston and Pembroke Railway Company in succession to John Whitehead. He has recently been auditor, and for years previous he was local passenger agent.

The C.P.R. has appointed J. W. Leonard, of Toronto, as manager of construction between Sudbury and Toronto. This is a new office. Mr. Leonard will have full control of the construction work on the new line. His offices for the present will be at Toronto.

Prof. L. A. Herdt, master of electrical engineering of McGill University, Montreal, has received from the Government of France the honorary title of Officier d'Academie, a distinction granted for services rendered in the field of art, science, and literature.

Ed. Whittaker, for nearly eighteen years in the service of the Toronto Railway Company, and for the last ten years roadmaster on the down-town lines, has been appointed assistant superintendent of the London Street Railway Company. He will enter upon his new duties on April 15th.

G. R. Willis, formerly with the Colborne Machine Tool Co., Franklin, Pa., and Brown & Sharpe, has been for the past year representing the interests of Biggar-Samuel, Limited, in Great Britain, and now goes to the Cincinnati Milling Machine Co. Mr. Willis is a Quebec boy who has made his mark in his chosen line.

Charles Cameron, one of the pioneer residents of Collingwood died recently in that town. Mr. Cameron was a native of Aberdeenshire, Scotland, and settled in Collingwood about 1854. He founded the Northern Navigation Co., and for many years was its chief stockholder and general manager. He was also a director of the Collingwood Shipbuilding Co.

The death is announced at Montreal, of Adolph Davis, one of the best-known railway engineers in Canada. Mr. Davis was born in Montreal in 1839, and educated as an engineer. In 1867 he was appointed by the Government of Canada a commissioner to the World's Fair at Vienna. In 1880 he was appointed manager of the old North Shore Railway, now the C.P.R., between Montreal and Quebec. In 1892 Mr. Davis was appointed superintendent of the Montreal waterworks, and held the position for a number of years. While Mr. Blair was Minister of Railways, Mr. Davis was employed as consulting engineer to the department.

TELEPHONE AND TELEGRAPH

The Pacific Wireless Telegraph Co. has opened its local office for business at Victoria, B.C.

The Bell Telephone Co. are now offering the farmers of Waterloo County instruments at $15.

A telephone company is being organized in the Temiskaming district with a capital stock of $25,000.

The officials of the De Forest Wireless Telegraphy Co. announce that by the middle of May, Montreal will have a regularly established wireless telegraphy system.

It is said that over two and a half million dollars were spent last year in Canada in long distance conversations over the telephone lines.

The Board of Works, St. John, N.B., will ask permission from the Legislature to establish a municipal telephone system in opposition to the Bell system now used there.

An American company has purchased the local telephone plant at Moose Jaw, N.W.T., and will immediately begin to enlarge the plant. Connections will be made with the surrounding district.

The G.T.R. have discharged twenty telegraph operators on the middle division, and fifteen on the eastern division of its line, and will use the telephone instead of the telegraph for dispatching messages.

At the annual meeting of the Bell Telephone Co., the financial statement submitted showed receipts $2,933,653, and expenses $2,231,748, leaving a net revenue of $701,905. During the year 8,988 subscribers were added, making a total of 66,160 sets instruments earning rental.

The Orillia town council has notified the Bell Telephone Co. that the town will subscribe for the usual number of telephones at the regular price, but will not make a contract for more than one year, as it is making investigations with a view to installing a municipal system.

The Restigouche Telephone Company, N.B., will, it is said, sell out to the New Brunswick Telephone Company, and the latter will complete the line from Campbellton to Newcastle, including the town of Dalhousie, and will extend the line to the settlements of Balmoral and Dundee, Restigouche County.

Tests will be made with the telautograph at the Union Station, Pittsburg. One transmitter and three receivers have been put in place for the experiments. The transmitter is in the office of the train dispatcher, and receivers have been connected at the tower at the outer end of the train shed, at the office of the assistant station master, and at the office of the assistant trainmaster. Only two telautographs are known to be in use at railroad terminals in the United States. One is at the Union Station, St. Louis, where it has proved quite satisfactory. The other terminal is the Grand Central Station in New York. The result of the test will be watched with interest.

NEW INCORPORATIONS.

Dominion.—Montreal and Lake Erie Steamship Co., Toronto, $180,000; J. Carruthers, C. A. Jaques, Montreal; J. H. Hall, Ottawa; W. D. Matthews, F. D. Benjamin, S. Samuel, C. W. Rand, and G. Summerville, Toronto.

Northern Development Co., Montreal, $40,000; C. H. Archer, J. L. Perron, L. Beauchamp, J. E. Perrault, and N. E. Brais, Montreal; to mine, smelt, and deal in gold, silver, copper, etc.

Western Development Co., Toronto, $1,000,000; J. W. Mitchell, R. Armstrong, A. L. Malone, H. M. Asling, and C. W. Fleming, Toronto.

E. W. Moyer Co., Toronto, $150,000; E. N. Moyer, S. Moyer, W. P. Bull, Toronto; H. R. A. Moyer, Halifax; and J. W. Softly, Winnipeg. To manufacture store, school, church and office furniture, and to build and equip stores, offices, etc.

St. Lawrence Waggon Co., Montreal, $75,000; J. Meldrum, W. Meldrum, R. A. Gentles, W. A. Harper, Montreal, and C. A. Duclos, of Westmount, Que.

The Martel Stewart Co., Montreal, $45,000; S. H. Martel, F. S. Martel, L. W. Smith, L. L. Martel, and W. Martel, Montreal. To manufacture or acquire electric power for lighting, etc.

Lewis Bros., Ltd., Montreal, $1,000,000; F. O. Lewis, J. G. Lewis, W. Lewis, C. M. Strange, C. F. Smallpiece, Montreal. To manufacture and deal in electric motors, dynamos, etc.

The Canadian Fairbanks Co., Montreal, $500,000; H. J. Fuller, C. M. Rudel, Westmount; S. A. Pownall, and C. A. Duclos, Montreal. To take over the business carried on in Canada and Newfoundland by the Fairbanks Co., and to manufacture all kinds of scales, machinery tools, etc.

W. J. McGuire & Co., Montreal, $50,000; W. J. McGuire, R. J. McCauley, W. L. Horn, and H. C. Stone, Montreal. Contractors for drainage, plumbing, heating, lighting, etc.

Ontario.—Dominion De Forest Wireless Telegraph Co., Ottawa, $1,200,000; L. J. Lemieux, F. J. Humphrey, J. Cardinal, A. Brassard, and E. Brassard, Quebec.

Ontario and Quebec Navigation Co., Picton, $50,000; B. R. Hepburn, J. De C. Hepburn, R. G. K. Hepburn, C. D. Wilson, M. E. Tyner, Picton.

Detroit and Leamington Oil Co., of Arizona, has been granted an Ontario charter with $40,000 authorized capital; A. R. Bartlet, Windsor, attorney.

The Ayton Cordage Co., has been empowered to produce and supply electricity for light, heat and power, and to act as electricians and mechanical engineers, etc.

The People's Telegraph and Telephone Co., Maynooth, $40,000; W. J. Sergeant, S. Harryett, Bancroft; W. J. Fitzgerald, S. P. Netterville, and D. Smith, Maynooth, and others.

McPhee Automatic Signalling Co., Toronto, $100,000; J. C. Kelly, H. W. Bickell, H. G. Bickell, M. H. Kelly, Toronto, and T. McVeity, Ottawa.

Collingwood Shipbuilding Co., Collingwood, $1,000,000; T. Long, H. S. Osler, W. B. Raymond, D. L. McCarthy, B. Osler, F. Ford, G. C. Loveys, and J. M. Ewing, Toronto.

Pittsburg Gold Dredging Co., Peterborough, $300,000; W. Hamilton, M. Smith, W. H. Munro, Peterborough.

The Dymond Gas and Engine Co., Toronto, $1,000,000; J. Dymond, A. L. Wighton, C. J. Gibson, R. J. Goudy, Toronto; V. E. Taplin, Novar, Ont.

Detroit and Dominion Oil Co., incorporated in Arizona, U.S., has been granted a charter to operate in Ontario with $1,000,000 capital.

McKeough and Trotter, Ltd., Chatham, $100,000; S. Trotter, J. F. McKeough, R. Gray, N. H. Stevens, M. Campbell, S. M. Glenn, and T. R. Holmes, Chatham. To manufacture machinery, dredges, engines, electrical goods, etc.

Nanor Automobile Co., Toronto, $200,000; A. G. Ronan, G. A. Ronan, W. Bullock, E. Ronan, and E. Armstrong, Toronto.

Union Drawn Steel Co., Hamilton, $150,000; F. N. Beegle, E. C. Rebeske, J. A. McMahon, Beaver Falls, Pa.; F. Dawson, Pittsburg, Pa.; and G. Davison, New Brighton, Pa.

Walter Nicholls Motor Boat Co., Toronto, $25,000; W. N. Nicholls, F. Nicholls, A. Angstrom, H. G. Nicholls, and H. H. McRae, Toronto.

Brampton Pressed Brick Co., Brampton, $50,000; W. J. Packham, J. McHoover, C. R. J. Packham, and R. E. Heggie, Brampton.

Leamington Light and Heat Co., Leamington, $40,000; W. Stares, E. Stares, W. Snider, Leamington; J. M. Reid, Mersea Township; and J. W. Wright, Chatham. To manufacture and supply gas and electricity for lighting, heating, power, etc.

Clark-Demill Co., Hespler, $100,000; G. D. Forbes, Z. A. Hall, W. H. Weaver, A. Ochs, J. R. Phim, and C. M. Shultz, Hespeler. To manufacture and sell machinery, tools, engines, boilers, etc.

MUNICIPAL WORKS, ETC.

Fort Frances will raise $20,000 for fire apparatus and municipal buildings.

The by-law to raise $7,000 to defray the additional cost of waterworks at Burk's Falls, Ont., was carried.

The New Liskeard Council has taken up the question of establishing a waterworks system in that town.

The recent flood in Montreal, caused by the breaking of a 24-in. main on Commissioners St., cost the city $2,500.

Sydney, C.B., is borrowing the sum of $60,000 for the purpose of erecting and equipping a civic-owned and civic-operated electric light plant.

The municipalities of Richmond and Sweetsburg, Que., are considering the advisability of installing acetylene plants to light their streets.

The town of Glace Bay, N.S., a year or two ago installed a civic-owned plant and last year the corporation realized the sum of $5,000 on it net profit.

Belfast, Ireland, obtained possession of its horse-car system from the operating company at New Year's. The corporation is now installing a trolley system and electric light plant.

It has been resolved by the municipal council of the Township of McNab to erect a steel bridge with stone and concrete sub-structure, across the Madawaska at Clay Bank, three miles from Arnprior.

At the present time Winnipeg owns its own waterworks plant, its street lighting system, stone quarry and asphalt plant. It enjoys the distinction of being the first city in America to own its asphalt plant.

Bracebridge, Ont., contemplates duplicating its present machinery equipment at the municipal electric light plant, at an early date. Alex. C. Salman is secretary and treasurer of the council.

The services of Arthur L. Adams, a water works engineer, have been engaged by the Mayor of Victoria, B.C., to conduct an investigation into the requirements of that city for the improvement of its waterworks.

The employees of the Canada Foundry Company, Toronto, and the London Machine Tool Company, who have been working for some time past upon the installation of the new hydraulic pumps at the waterworks at London, have completed their work, and the pumps are now in perfect condition.

The town of Milton, Ont., has retained K. L. Aitken, Toronto, as Consulting Engineer in connection with the rebuilding of their electric light plant. A new power-house will be built, and machinery consisting of boilers, engine, generator, and switchboard, installed. In all probability, the system of distribution will be materially changed.

The City Engineer of Toronto has reported to the Board of Control that the estimated cost of installing a municipal electric lighting plant, with an alternating current, sufficient to keep up 1,500 arc lights, would be $638,000, which includes buildings, but not land. If power were obtained from Niagara Falls, the cost of lighting to the city would be $475,000.

The Fire Committee of the Westmount, Que., town council has drawn up a report to be presented at the current meeting of council, on the establishment of a municipal lighting and power plant. It is understood that the council are in favor of going on with the project, although the Montreal Light, Heat and Power Co.'s agents are canvassing the town offering a discount of over 33 per cent. to citizens who will sign a three years' contract.

The city council of Leeds, England, is undertaking a waterworks engineering scheme which will involve the expenditure of about twelve million dollars in the aggregate. The city has always had a good water supply, but the new move is being made with a view to providing a sufficient future supply for the rapidly increasing population. Four reservoirs are to be constructed on streams tributary to the Ure River. The city is appointing an engineer to look after the work. Notwithstanding the appeals of an army of unemployed that the corporation should do the work, the construction of the reservoirs is to be done by contract, which method is considered the more economical.

The legal department of Toronto has issued a writ against the Toronto Electric Light Company to recover the land on the Esplanade upon which the company's works now stand, and to block the arbitration which the company has instituted to secure a renewal of the lease for twenty-one years from the city. If the court upholds the city's claim the whole property of the company, including plant, buildings, etc., can be taken over to become part of the projected civic plant.

Superintendent Janin, of the Montreal Water Department, reports a scheme for enlarging the water supply to a capacity of fifty million gallons a day at a cost of $2,000,000. By this scheme the intake would be extended further into the river where the water would be purer, and the water would be taken to the pumps through a conduit instead of by open aqueduct as at present. The estimate of cost is as follows: Lateral conduit with a discharge of fifty million gallons daily, $660,000; excavations, stop gates, etc., $817,000; wheelhouse, new pumping machinery, etc., $300,000; extending the conduit out into the St. Lawrence by means of two pipes, $75,000; widening and deepening the tailrace, $45,000; suction wells for pumps, $20,000; purchase of land, $20,000; extra cost for steam power during the construction of new works, $95,000; yearly interest charge, $85,280; making a grand total of $2,217,280. The present consumption of water for the city is 27,000,000 a day. The supply has frequently been condemned as impure, except in mid-winter.

The Bell Telephone franchise at Orillia, Ont., expired on January 1st, and the council refused the company's application for a five years' renewal at the present rates of $25 and $30. The company thereupon offered to furnish long distance telephones, with metallic circuits, and to reduce the rates to $20 for residence and $25 for business connections; also to pay the town $125 per annum in lieu of the present free telephones. These terms were not considered low enough, and the monopoly was offered $20 for business, and $15 for residence connections, or $30 for business and residence phones combined; the company to give the town five free telephones, or pay $100 per annum. This offer has not been accepted, and at the last meeting of the Board of Trade the telephone question was discussed at length; resolutions in favor of Government ownership or control of the long distance lines, the establishment of a municipal telephone system, and approving of the council's action in refusing to give the "Bell" a monopoly, were carried unanimously. A committee was appointed consisting of A. B. Thompson, Thomas Haywood, C. H. Hale, M. B. Tudhope, F. G. Evans, and S. H. Black. At the first meeting the committee decided to advertise for tenders for a municipal system.

MINING IN BRITISH COLUMBIA.

While the year just closed has been, in a sense, the most uneventful one in the history of the mining industry of the Province, it has, nevertheless, represented a period of substantial growth and important industrial development, and this is but partly indicated by a considerable increase in respect to both tonnage and value of coal and mineral output. About seven years ago an epidemic of speculative fever spread through British Columbia, wild-catting raged supreme, and while the excitement lasted hundreds of worthless companies were floated by unscrupulous promoters, who were quick to take advantage of the rampant insanity of the time. The inevitable crash followed in due course, and was accentuated by labor troubles, by the closing of the American market to our silver-lead ores, and by the numerous difficulties necessarily associated with the initial establishment of a young industry. The reaction was decisive and uncompromising. It became at once almost impossible to secure much-needed capital, previously so willing to invest, even for the most meritorious undertakings; the whole

country felt the influence of a dismal depression, and for a period the outlook was as gloomy as it possibly could be. This state of affairs continued for some time, and, although there were occasional signs of improvement, it was really not until eighteen months or so ago that it became apparent that the industrial horizon was clearing.—H. Mortimer Lamb, in March Mines and Minerals, Scranton, Pa.

MOTOR BOATS.

Editor Canadian Engineer:—

We note in your February issue that you allude to the Canada Launch & Engine Works, as being the only builders of motor boats in Canada. We wish to correct you in this, as we have been making a specialty of this class of work. We expect this year to turn out a number of these launches, as the work which we did along this line last year was eminently satisfactory. So far as we know, we have built the fastest gasolene launch ever turned out by a Canadian factory.

Yours very truly,
Hamilton Motor Works, Limited.

Hamilton, March 8th, 1905.

PRODUCTION OF PIG IRON IN CANADA IN 1904.

The American and Steel Association has published the statistics of the production of all kinds of pig iron in Canada in the calendar year 1904. They show an increase of 5,524 gross tons, or a little over 2 per cent. as compared with 1903, but a decrease of 48,615 tons as compared with 1902.

The total production in 1904 amounted to 270,942 gross tons, against 265,418 tons in 1903, 319,557 tons in 1902, 244,976 tons in 1901, and 86,090 tons in 1900. In the first half of 1904 the production was 120,643 tons, and in the second half it was 150,299 tons, an increase of 29,671 tons. Of the total production in 1904, 251,671 tons were made with coke and 19,271 tons with charcoal. About one-fourth of the total production was basic pig iron, namely, 70,133 tons. The production of Bessemer pig iron, all made in the last half of the year, was 26,016 tons. Spiegeleisen and ferromanganese have not been made since 1899.

The unsold stocks of pig iron in Canada on December 31, 1904, amounted to 35,119 tons.

On December 31, 1904, Canada had fifteen completed blast furnaces, of which eight were in blast and seven were idle. Of this total ten were equipped to use coke for fuel and five to use charcoal. In addition, three coke furnaces were partly erected on December 31st, but work on the furnaces had been suspended some time ago.

APPLICATIONS TO LEGISLATURE.

The following notices of private bills have been received by the Clerk of the Ontario Legislature:

To incorporate the Algoma Copper Range Railway Company, which desires to build and operate a line from Bachawana Bay, Algoma East, to the Superior Copper Mines; thence east to the main line of the C.P.R. between Cartier and Biscotasing.

To incorporate a company to build and operate an electric railway to run from Stratford to Grand Bend, on Lake Huron, with branches to New Hamburg and Tavistock.

The Windsor and Tecumseh Electric Railway wants to extend its lines in the county of Essex, in Walkerton and Windsor, and to legalize agreements with the Ontario Traction Company.

An Act is asked to validate agreements between Chatham and Wallaceburg and surrounding townships and the Chatham, Wallaceburg and Lake Erie Railway, relating to exemption from taxation.

An extension of time is desired for the completion of the Aylmer and North Shore Electric Railway.

To validate by-laws of the town of Whitby granting bonuses to the Farmers' Co-operative Harvesting Machine Company, Limited, and the Keystone Sugar Company, Limited.

To authorize the granting of a bonus by the city of St. Catharines to the Avery Stamping Company, of Cleveland, Ohio, and the Jenckes Machine Company, Limited, of Sherbrooke, Que., to induce them to erect works in that city.

To extend the time for the commencement and completion of the Toronto and York Radial Railway Company's lines, to construct an extension to Bowmanville and Cobourg, to acquire land for markets and to confirm agreements made by the company with the town of Whitby and the townships of Scarboro', Pickering and Whitby respectively.

MARINE ENGINEERS.

The following are the appointments of captains and engineers on Canadian steamers, so far reported for the season of 1905:

Deseronto Navigation Co., Deseronto, Ont.: Steamers—Resolute, Capt. John Cowan, Engineer John Hainson; Reliance, Capt. James Dougherty, Engineer John Topping; Ella Ross, Capt. D. B. Christie, Engineer M. J. McFaul; Deseronto, Capt. M. Palmateer, Engineer Stanley La Rue; Rescue, Capt. P. J. Lynch, Engineer Owen Flood; Armenia, Capt. Albert Bamhart, Engineer Michael Topping; Ranges, Capt. Howard Burmip, Engineer Wm. Stanhope; Arctic, Capt. W. J. Daly, Engineer Thomas Lynch.

Canadian Pacific Railway Co., Owen Sound, Ont.: Steamers—Manitoba, Capt. E. B. Anderson, Engineer Wm. Lewis; Athabasca, Capt. George McDougall, Engineer Wm. Lockerbie; Alberta, Capt. L. Pyette, Engineer A. Cameron.

Montreal Trans. Co., James A. Cuttle, managing director, Montreal, Que., Steamers—Westmount, Capt. Alexander Milligan, Engineer Kemp Richardson; Fairmount, Capt. P. C. Telfer, Engineer Wm. Newbold; Rosemount, Capt. John Wood, Engineer Richard Taylor; Bothnia, Capt. John Doyle, Engineer Wm. Spencer; Advance, Engineer George Hazlett. Tugs—Emerson, Capt. James Murray, Engineer George Henderson; D. G. Thomson, Capt. Joseph Murray, Engineer George Boyd; H. F. Bronson; Capt. Charles Martin, Engineer R. Hepburn.

Richelieu and Ontario Navigation Co.: Kingston—Capt. Henry Esford, Chief Engineer Alex. Milne; Toronto, Captain Booth, Chief Engineer W. Black; Spartan, Captain John McGrath, Engineer William S. Parker; Corsican, Captain Dan Mills, Chief Engineer Alexander De Martianey; Hamilton, Captain James Stevenson, Chief Engineer James Connell.

Hamilton Steamboat Co.—Modjeska, Captain Patrick Walsh, Chief Engineer William Noonan, Assistant Engineer Alfred Tompkins; Macassa, Captain Robert Cooney, Chief Engineer Oscar Flummerfelt.

The Merchants' Line of Montreal—City of Montreal, Capt. A. Lefevre, Chief Engineer F. Hamelon; Cuba, Capt. R. Monpetit, Chief Engineer E. Hamelon; Melbourne, Captain H. Vaughan; Persia, Captain J. H. Scott, Chief Engineer J. Payne.

Canadian Lake and Ocean Navigation Co.—A. E. Ames, Captain E. L. Stephen, Chief Engineer S. Gillespie; J. H. Plummer, Captain George Mackay, Chief Engineer Robert Chalmers; Henry M. Pellatt, Captain G. A. Bugan; Chief Engineer W. Byres; Turret Court, Captain James Black, Chief Engineer C. J. McSorley; Turret Chief, Captain M. McPhee, Chief Engineer, Robert Dugid; Turret Cape, Captain E. McIntyre, Chief Engineer W. H. Durham; Scottish Hero, Capt. A. W. Muir, Chief Engineer Robert Joell.

Canadian North-West Steamship Company, Limited, Toronto—Neebing, Captain John Ewart, Engineer A. F. Foote.

Niagara River Line—Chippewa, Commodore McGiffin, Chief Engineer George Arnold; Corona, Captain Harvey Solmes, Chief Engineer James Woodward; Chicora, Captain Robert Clapp, Chief Engineer Harry Parker.

Reid, James, Sarnia, Ont.—Manistique, Capt. John Cooper, Engineer Wm. King; James Reid, Capt. James T. Reid, Engineer Wm. Oakes; Ottawa, Captain George H. Phelps, Engineer Walter Thorne; Winslow, Capt. A. Harris, Engineer S. Radcliff; Salvor, Capt. Charles Hill, Engineer John Kinsley; Sarnia, Capt. James Ryney, Engineer John Taylor; J. M. Diver, Capt.

H. B. Reid, Engineer Frank Moore; Tempest, Capt. L. McFarland, Engineer L. Cuthbertson.

St. Lawrence and Chicago Steam Navigation Company, Toronto—W. D. Matthews, Captain James Ewart, Engineer E. J. O'Dell; Iroquois, Captain James McNaugh, Engineer Wm. Harwood; Algonquin, Captain Wm. H. Wright, Engineer John W. Taylor; Rosedale, Captain P. J. Shaw, Engineer James Findlay.

R. O. and A. B. McKay Company, Hamilton—Strathcona, Captain John Irving, Engineer Wm. Harman; Donnacona, Capt. J. W. Mawdesley, Engineer John S. Duguid; Neepawah, Capt. Oliver Patenaude, Engineer James Smeaton; Wahcondah, Capt. Harry Zealand, Engineer John Waller; Lake Michigan, Capt. J. H. Fitzgerald.

J. B. Fairgrieve & Company, Hamilton—Arabian, Captain J. V. Trowell, Engineer W. H. Cunningham.

Central Canada Coal Company, Limited, Brockville—Samuel Marshall, Captain John Bouchard, Engineer Henry Cerow.

Midland Navigation Company, Midland—Captain W. H. Featherstonhaugh, Engineer Edward Abbey.

Midland Towing and Wrecking Company, Limited, Midland—Traveller, Captain James Tyndal, Engineer Frank Goodwin; Reliance, Captain Roy Burke, Engineer James McGregor; Magnolia, Captain Joseph Clark, Engineer John Doran; Metamora, Captain Edward Burke, Engineer Fred. Chester; Minitaga, Captain George Kinnel, engineer, John Kinnel; Menodora, Captain Charles Gould, Engineer Henry Chester.

Calvin Company, Garden Island—Simla, Captain A. H. Malone, Engineer R. H. Veech; India, Captain Charles Coons, Engineer T. C. Smith; D. D. Calvin, Captain H. N. Smith, Engineer John Kennedy.

Northern Navigation Company of Ontario, Limited, Sarnia—Huronic, Captain R. D. Foote, Engineer Samuel Brisbin; Monarch, Captain E. Robertson, Engineer A. Morton; United Empire, Captain A. L. Campbell, Engineer H. Myler; Majestic, Captain George H. Playter, Engineer Wm. Phipps; City of Collingwood, Captain A. M. Wright, Engineer C. Robertson; Germanic, Captain W. G. Cox, Engineer Joseph Asten; City of Midland, Captain F. G. Moles, Engineer Steve Burgess; City of Toronto, Captain Paul Dusome Pentang, Engineer B. F. Osborne; Britannic, Captain M. McLean, Engineer Isaac Boyd.

Niagara, St. Catharines and Toronto Navigation Company—Lakeside, Captain Wigle; Garden City, Captain Enright.

The Charlottetown Steam Navigation Company, Charlottetown, P. E. Island—Northumberland, Chief Engineer J. A. Rowe, Second Engineer, J. K. Sutherland; Princess, Chief Engineer Charles Cuming, Second Engineer James Godfrey.

Pere Marquette Steamship Co. (Lake Erie and Detroit River Railway), Ludington, Mich.—"P. M. 15," Engineer Jas. Meyers, First Assistant James B. Conrad, Second Assistant Charles F. Brown; "P. M. 16," Chief Engineer George I. Van Brunt, First Assistant, W. H. Houghtboy; "P. M. 17," Chief Engineer, A. W. Ackerman, First Assistant August Oliva, Second Assistant L. Brezinsky; "P. M. 18," Chief Engineer Charles Sylvester, First Assistant I. McMahon, Second Assistant, F. Brizenske; "P. M. 19," Chief Engineer, J. C. Watson, First Assistant, A. Ward, Second Assistant A. Oertling; "P. M. 20," Chief Engineer Robert McLaren, First Assistant E. O. Brown, Second Assistant F. Beebe.

Lake Ontario and Bay of Quinte Steamboat Co., Kingston—North King, Chief Engineer (not appointed), Second Engineer Robert Vince, Kingston; Caspian, Chief Engineer O. J. Hickey, Second Engineer R. Bajus; Aletha, Engineer D. McSorley; Company's Supt. Engineer, O. J. Hickey.

THE LARGEST EVER BUILT.

The Shawinigan Water and Power Co. have recently installed in their sub-station at Maisonneuve, Montreal, the largest frequency changer ever built. The machine changes the current on the Shawinigan Falls transmission line from a frequency of 30 cycles to one of 60 cycles for use in the city for lighting and other purposes. It was built by the Bullock Electric Co., of Cincinnati, and consists of a synchronous motor directly connected to a generator, and a starting motor, all on the same base. The starter is an induction motor, specially designed to give a heavy starting torque. The rheostats have been placed in a separate room and are operated by a separate motor, and controlled from switch-board. The exciter set consists of a 200 K.W. 120 volt, direct current generator, which supplies direct current to the field of the frequency changer, directly connected to a 300-horse-power induction motor of 400 revolutions, the latter built by Allis-Chalmers-Bullock, Limited, Montreal.

The total length of the frequency changer is 30 feet, and the motor and the generator are each 15 feet high. The total weight is 250 tons. The motor rotor weighs 72,560 lbs., and the generator rotor 76,700 tons.

The work of erecting the machine was in charge of Thomas J. Mullen, superintendent of construction, of Allis-Chalmers-Bullock, Limited. As the crane in the station was only 15 tons' capacity, the heavier parts were all raised and lowered by jack screws. Part of the end of the building was taken down, and a runway was built from the railway to the foundation beds, and the machinery was brought in on rollers. The whole work was accomplished without mishap in 31 days.

The set approximates 14,600-h.p., and the change from electrical energy to mechanical and back again is effected with a loss of less than ten per cent. As there were already in this station five smaller 1,000-K.W. frequency changers, the capacity of the station is now doubled.

MINERAL PRODUCTION IN QUEBEC.

The following is a statement of the mineral production of Quebec for 1904, as compiled under the supervision of J. Obalski, M.E., Provincial Inspector of Mines:

		Valued at.
Titanic iron, tons	100	$ 300
Hematite, tons	200	800
Bog ore, tons	16,152	54,084
Ochre, tons	1,590	18,825
Chrome ore in lumps, tons	1,924	19,213
Chrome ore in concentrate, tons	4,504	52,286
	6,428	
Copper ore, tons	20,000	80,000
Asbestos, crude, tons	4,353	525,000
Asbestos fibre, tons	31,126	697,000
	35,479	
Mica thumb, trimmed and split, tons	150	85,000
Graphite, tons	25	2,300
Phosphate, tons	730	4,590
Gold, oz.	20	370
Slates, squares	5,277	23,247
Flag stones, sq. yards	3,000	2,550
Cement, barrels	33,500	50,250
Total		1,615,815
Building material (lime, bricks, stone, as per last year's report)		1,355,000
Total		2,970,815
Charcoal pig iron produced = 11,120 tons		256,376

—To us in this country it is inexplicable why the anti-Chinese agitation should have broken out with renewed virulence in England at this particular juncture. As far as the facts within our knowledge guide us, the Chinese laborers on the Rand are fulfilling admirably the objects for which they were desired. They are good workmen, and their presence has given the required stimulus to the gold mining industry. On the whole, they appear to be contented with the conditions to which they have been introduced—conditions which it is a grotesque misuse of language to describe as "slavery," as the Liberals persist in describing it for electoral purposes. If the result of the employment of the Chinese were to oust the white man from the position appropriate to him on the mines, the Chinese importation policy might call for reconsideration, but its certain tendency is to increase the opportunities for the white man.—Natal Mercury, Durban, January 20, 1905.

RAILWAY NOTES.

The I. C. R. will in the near future erect a round-house at Newcastle, N.S., costing $25,000.

The C.P.R. will at the conclusion of the coming summer have its own connection with Spokane, Wash.

The Grand Trunk Pacific will commence to build in the early spring from Thunder Bay west to the Pacific Coast.

A Montreal firm has been awarded the contract for building the Edmonton Electric Railway, which will be ready in September.

The G.T.R. will spend about $2,000,000 between Cote St. Paul and Montreal this summer on extensions and improvements.

It is expected that the work of strengthening the bridges on the I.C.R. between Chaudiere and St. Hyacinthe, Que., will be done this year.

It is announced that the C.P.R. will build a line from London through Petrolea to Sarnia for the purpose of securing the local business of that territory.

Maisonneuve, Que., has granted the Montreal Street Railway Co. a thirty years' franchise in the municipality for running passenger, mail and freight cars.

H. C. Cleveland, head engineer of the Orford Mountain Railway died suddenly while talking to a friend at Sherbrooke station. Mr. Cleveland was 64 years of age, and unmarried.

Tenders are being asked for the extensions to the Grand Trunk shops at Stratford, Ont. The new building will be of steel and cement, and will give room for the handling of 16 additional engines.

A return made to the House of Commons a few days ago shows that 322 railway accidents were reported in Canada in ten months ending December last. The Board of Railway Commissioners has investigated thirteen of these accidents.

Dewart, Young & Maw, of Hamilton, solicitors for the Hamilton, Galt & Berlin Railway Company, have given notice that they will apply to the Parliament of Canada for power to construct branch lines and extensions to the city of Guelph and the town of Hespeler, Ont.

An electric railway will be built from New Westminster to Chilliwack, by the Chilliwack Light and Power Company. The estimated cost of the road is $1,500 per mile and the power plant and transmission lines for its operation are estimated to cost $125,000. It is planned to commence construction at once.

The Niagara, St. Catharines & Toronto Railway Company has obtained a franchise from Stamford Township for the extension of the Falls View division of their system southward from Niagara Falls. The extension proposed will give this road a junction with the new Toronto & Hamilton Railway.

The Canadian Northern Railway are building five very extensive bridges of steel and masonry at the different crossings of the Saskatchewan River, in the two new provinces of Alberta and Saskatchewan. It is estimated that the total cost will be close to $1,500,000, and that they will rank with the best railway bridges in the country.

There is every probability of Barrie having a street car service before the close of next year. About ten years ago a charter was secured and plans prepared for a street railway from Kemppenfeldt Hill to Minett's Point, but the project fell through. It is now proposed to take this matter up again, giving, in addition to the town service, regular connections with the C.P.R. at Colwell. The line would handle both freight and passengers.

The Canadian Northern Railway has several important bits of work to do in the Province of Quebec during the coming season. There will be built the extension from Shawinigan to the city of Quebec, a distance of some eighty miles, several bridges, and probably the building of a dock at Longue Point, to accommodate the Canadian Northern business there.

M. P. McGrath, Easton, Pa., has been awarded the contract for building the Ottawa River railroad, which is to be a combined electric and steam line, to extend from Montreal to Ottawa.

In a head-on collision on the C.P.R. line, between West St. John and Fairville, N.B., two men were killed, two injured, and the engines were badly damaged. The accident is said to have been owing to a mistake or omission in the orders to the yard foreman.

The city of St. Thomas, Ont., has arrived at an agreement with the Southwestern Traction Company, whereby the traction company's cars will use the street railway lines in St. Thomas en route from London to Port Stanley and return. The Southwestern Traction Company is to have a fifty-year franchise to run over its connecting terminals with the city street car lines. A twenty-five year agreement for the use of the city lines on the basis of a scale of payments, divided into terms of five years each. It is hoped to have cars running to Port Stanley by July 1st, and to St. Thomas some time before that date.

The Grand Trunk Railway is erecting a large round-house at New Toronto, which will have a capacity of thirty-seven stalls. The building costing $50,000 is to be made of reinforced concrete. In connection with the round-house will be a machine and repair shop. This building is 157 x 50 feet, and, as a "back shop," it affords accommodation for two engines at a time. Modern coal chutes will be erected and an up-to-date ash handling system will be installed, and sanding and watering facilities will be provided. The freight yards will contain about 25 miles of track and with the buildings necessary in freight handling will all form the nucleus of a prosperous railroad village which the company will expand by building houses for its employees.

The 47th annual report of the Grand Trunk Railway Literary and Scientific Institute shows a total registration of 777 members, 159 of whom were brought in during the year. Evening classes were conducted for instruction in mechanical drawing, air brake, triple valve, engineers' valve, defects and remedies, and pumps, governors, link motion and locomotive boilers. The attendance at the evening classes during the season was 3,358. Members are entitled to the following privileges: The use of reading-room, books, (over 7,500 catalogued), magazines and papers (87 on file), astronomical telescope, microscope, maps, globes, air-brake section, compound locomotive, link and valve motion, and inspirator models, reference library, and free admission to lectures and classes, etc. The fee for membership is ten cents per month, or one dollar per year.

In three years it will be possible to make a railway journey from New York or San Francisco to Guatemala city. At a recent meeting of the permanent committee of the Pan-American Railway, of which Henry G. Davis is chairman, reports were presented which showed that progress is being made in the construction of the links which will ultimately connect North and South America by rail. The line from Tehuantepec to the Guatemalan border is being carried on under a concession granted by the Mexican Government. In Central America several enterprises are being carried out looking to the completion of a line north and south. Argentine is extending its system into Bolivia, and the latter country has set aside for railway construction the $10,000,000 which it received as indemnity from Brazil. Bolivia has also entered into a treaty with Chile by which that country advances capital for railway construction. In Chile itself the railway tunnel through the Andes is progressing under the contract awarded to a New York firm, and within a few years Valparaiso and Buenos Ayres will be joined. In Peru the conditions are reported to be unusually favorable. The Government has completed its surveys for the main links which it is proposed to build from Lake Titicaca north and from the existing system of railways south. A special railway fund was created by the Peruvian Congress. Several private enterprises also are under way in Peru, and a large amount of American capital is invested in them. In Ecuador work on the railway from Guayaquil to Quito is proceeding in accordance with the terms of Government concession.