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CONTENTS OF THIS NUMBER :

PAGE	PAGE		
Bell Feed Water Heater and Purifier	324	Good Roads Assoc'n of Ontario... ..	319
Bottom Construction of Steel Vessels, and "Afloat" Stresses and "Ashore" Strains	312	Hamilton and Lake Erie Canal... ..	323
Brock Street Tunnel, Montreal... ..	316	Howard, Stuart, C.E.....	326
Canadian Association of Stationary Engineers	325	Industrial Notes	327
Can. Manufacturers' Association	323	Literary Notes	324
Canadian Society of Civil Engineers	327	Maze, C. D.....	318
Charcoal and its Bearing on the Utilization of our Forests.....	310	Metal Imports from Great Britain	336
Commercial and Physical Features of the Great Lakes	320	Mining Matters ..	331
Dirigo Folding Anchor	326	Patent Review	336
Down in a Belgian Coal Mine.....	309	Personal	335
Electric Flashes	334	Railway and Marine News	332
		Review of Metal Trade.....	327
		Richelleu & Ontario Nav. Co.....	319
		Samuel, Emanuel, the late	315
		St. George, P. W., C.E., City Surveyor, Montreal	317
		United Counties Railway.....	315

FOR THE CANADIAN ENGINEER.

DOWN IN A BELGIAN COAL MINE.

BY B. LIPPEMS, MONTREAL.

The subject of my sketch is a mine situate at Murchiennes, near Charleroy, Belgium, and is reputed to be one of the deepest and most extensive in Europe. The first things that engaged my attention on approaching the colliery were the large heaps of coal lying along a canal, and a railroad near which a number of men were engaged in loading railway cars and small vessels. Near the pit or shaft (of which I will speak further on) were large sheds where the coal was unloaded as it came out of the mine. It was brought there by small cars called by the miners *berlaines* or *brouettes* and running on rails of about three feet wide. They were drawn or pushed by women and children, who had also to pick out carefully the stones that were mixed with the coal which they unloaded.

The opening by which one goes into a mine is called the *shaft*: it is generally *vertical*, but sometimes also on an inclined plane. When it is straight down it is generally ten or twelve feet square. Along the shaft there is a large, massive wooden scaffolding or brick building, which supports a strong pulley of two or three feet diameter. On this pulley is rolled a cable or iron chain, by means of which men, coal and everything else are brought up or let down. The pulley is put in motion by a powerful steam engine erected near the *pit*, and is also used to pump out the water from the bottom of the mine, and, by means of a force-pump, to give a continual supply of fresh air to places where the colliers are at work. For that purpose there are tubes communicating with the bottom of the mine. In some places the chain or cable is rolled up on a roller or axle.

I tried to have a look into the shaft, and as I was

afraid of becoming giddy I told my friends to hold me by the skirt of my coat, but I saw nothing before me but darkness.

"How deep is that dark hole?" asked I.

"The lowest part, which you will visit with me," said our guide, "is three thousand feet below the surface of the ground."

"Are there ever any visitors?" asked my friend, who at the last moment durst not go down.

"Very often," was the answer, "but they are sometimes suddenly attacked by heavy cramps or headaches which force them to put off their visit to a morrow which never comes."

Then we saw coal brought up by the cable. To make up each *load* or charge there were seven or eight *wagons* full of coal. The wagons were placed in a sort of iron cage, one in each, and afterwards put on the railway tracks of which I spoke before. In some mines coal is brought up in *tubs*, called *kibbles*, which are emptied or put on *trucks* as they run on the surface. Before the invention of steam engines, horses had to draw up coal in baskets, and the colliers went down by ladders, a very fatiguing and still more dangerous method.

"Does that cable never break?" was another question of ours.

"Well, sometimes!"

"There must be a great smash-up in such a case."

"Of course there is."

It was then six o'clock in the afternoon. We heard a bell ringing, and saw a crowd of workmen who had arrived to go down for their day's work. Each miner had a lamp of a very peculiar form, of which I will say a few words while speaking of explosions of fire-damp. The same cages which are used to carry up and down the coal cars are also used to transport people. Each cage contains four persons, and they let down from thirty to forty at one descent. The workers took their places, talking and laughing; they go down every day and are not in the least impressed by it. Before starting, the cages are provided with a sort of spring, which has the effect of preventing the cages from tumbling down, in case the cable should break. They only put it on when people are going up or down. A signal system of electric bells (which is now in some mines replaced by the telephone) announced that *all was right*, the engine whistled, the pulley turned and the men disappeared. During a few minutes the cable moved on very rapidly, and then we saw the underground cages come up, also loaded with people who were going home after a day's labor. There was some difference between the color of the latter and the former, and that circumstance did not please us altogether, for we saw that if we went down we were going to be turned into blackies the next day. Formerly, colliers stayed sometimes for weeks and even for months in the mine, but now they come up every day in most places. Work goes on all the time, day and night, except on Sundays, and in those abysses there is no difference between night and day.

The next morning, at seven, we were at our post,

and decided to attempt an underground voyage. The *maitre-ponion* (or colliery foreman) showed us into a dressing-room, where we each took a complete miner's suit, clothing ourselves in a sort of heavy hemp-linen, and a very heavy, ugly leather hat, with a large rim, and stuffed with horse hair.

"Those hats are not after the Parisian fashion," said our guide, "but they protect you in case of stones or pieces of coal tumbling down."

"And against what weight can it guarantee us?"

"Well, a stone of forty pounds will not in the least injure—the hat. But sometimes, though not often, fragments of rock of half a ton fall down, and of course, in such cases, the hat is of no use."

It was now time to take our seats in the cage; our guide procured for each of us a seat in the shape of a bundle of straw. In this we were treated as distinguished visitors. The miners themselves know nothing of such luxuries. They sometimes go down sitting on the brim of a tub called in their language "a kibble." Each of us, with a safety lamp, sat down, rather close together; the bell rang, the engine whistled, and down we went. A strange sensation is felt in descending for the first time into the shaft. The light of day is cut off at once and replaced by darkness made more gloomy by the dim light of the lamps. Everything swims before our eyes, and we can hardly breathe; but little by little we get accustomed to the light of the lamps, and commence to distinguish faintly the surrounding objects. We examine the sides of the shaft; by turns we see masonry, woodwork, sometimes the bare rock, in other places iron bars screwed up, and maintaining heavy beams. Further on the walls are carefully cemented; generally water is seen leaking and dropping down, but not in large quantities. The different systems of constructing and keeping the shaft in good order depend upon the hardness of the rock, the nature of the ground, and the existence of underground water springs. Now and then we saw a large excavation, which looked like a huge "black-hole," and our guide told us that it was one of the landing places of the upper galleries.

It must be remarked that in a coal district there are different depths or *stories*. There are different layers of coal, called coal measures, say, at two hundred, three or four hundred yards deep, and so on. These layers or *strata* do not generally run quite horizontally. The thickness is generally between two and four feet, say an average of three feet; sometimes there are two layers close together, but this unfortunately is an exception to the general rule. In America, however, the layers of coal are generally much thicker, and in many places near the level of the ground. In that respect the new continent has a great advantage over the old one.

We took fourteen minutes to be lowered to a depth of 3,000 feet. There was a large excavation newly made to receive the water that was oozing in different places. Under each stratum that is worked out generally a *reservoir* is made, forming a security in case of small inundations. Then we went up again several hundred feet and landed at a colliery in full activity. At the landing place we found stables for several horses, and we felt rather surprised to find that faithful servant of man amid such surroundings. To take a horse into a mine, they tie its legs close to its body, wrap it in a leather sack made for that purpose, put it in a high cage, sitting erect, and so it goes down, keeping as stiff and stately as the president of a legislative council. There is also a place for putting tools,

babcocks, provisions and instruments, and for lighting and cleaning lamps. The landing place is the starting point of the different underground roads or galleries which lead to the working places, *shanties* or *cuttings*. These galleries run in every direction; in the interior of a coal mine there are squares, highways, small passages, and so on, in considerable numbers. Then we had to travel in a horizontal direction. A horse was harnessed to two small cars, we took our places, and had a brisk drive of about one mile through one of the main roads. The way of constructing the galleries depends, like that of the shaft, upon the nature of the stratum. Of course, all the cars run on small railway tracks, below as well as above the ground. Then we came to a *square*, and saw there arriving from different directions cars loaded with coal, which were dragged or pushed by women and boys, called in the mine "setters." Our horse was sent back with a load of six cars and returned to the landing place alone and without light, groping his way like a blind man. As we entered a new gallery, which was too low to give passage to a horse, it was replaced by two women, one pulling and one pushing our cars. The legend tells that King Sesostris had his carriage drawn by the kings he had conquered, and whose ears he had cut off as being superfluous ornaments, but that is not a bit worse than giving such work to the gentler sex. It is now, fortunately, forbidden by law.

We came at last to a place where we saw a gang of miners at work. It is a mournful, desolate spectacle. By the dim light of the lamps we saw a crowd of men handling their pickaxes, mattocks, shovels, and hammers, the noise of their tools and their sighs of fatigue being the only signs to be heard. The height varies between two and a-half and four feet, and in that narrow space they work in a painful position; some are kneeling, others are lying on their backs, or on their sides, and they work hard ten hours a day without being able to stand upright. They are covered with perspiration and coal-dust, and there they pass half their lives; it is a miserable existence indeed. Of course when the layers of coal vary from five to twenty feet in thickness, as is very often the case on the American continent, the mines are worked with far more facility, and the colliers, having their movements free, are in a much more favorable position.

(To be continued.)

CHARCOAL AND ITS BEARING ON THE UTILIZATION OF OUR FORESTS.

BY T. J. DRUMMOND, OF THE CANADA IRON FURNACE CO., MONTREAL.

(Continued from last month.)

THE MANUFACTURE OF COAL IN PITS OR MEILERS.

In Sweden the coal is very largely manufactured in pits, and this has been carried on on quite a large scale also in the United States. One advantage of the pit system is that farmers and others can do coal burning on their own lands and obtain the results of the labor, and at the same time the cost of transportation is naturally greatly lessened, as forty bushels of charcoal can be transported for considerably less than a cord of wood, of which it is an average equivalent. In general results throughout the United States, it would seem that the quantity of coal per cord obtained by pit burning has not been equal to the quantity obtained in the kilns. The general average seems to be about thirty-five bushels per cord from pit burning, as against about

forty bushels from the kilns. In my opinion, this is largely due to lack of care or knowledge on the part of the pit burner, as with the same care and attention, and with a thorough knowledge of the work, there does not seem to be any good or valid reason why the results as to quantity should not be about equal. Apart from this, however, in our own experience of pit burning, the coal produced was of a better quality than that obtained in the kilns (i.e., where the work was well done). We found the coal dense and close, and practically solid to the centre, and this class of coal develops at least 15 per cent. to 20 per cent. more gas than the ordinary coal obtained in kiln practice. It will not consume as rapidly, and gives a greater and more enduring heat, and has proved itself as economical, even where an equal quantity per cord was not obtained, as compared with kiln practice.

In manufacturing coal in pits the process of firing is practically the same as that practised in kilns, a canal being made to the centre in which to insert the fire, and a "chimney" built to the top along which light wood (or brands) is placed.

The whole is then covered with eight or ten inches of evergreen branches, leaves, and sand or earth. After the fire is thoroughly started, the top or the centre over the chimney will fall in, owing to the total consumption of the wood at that point, and a supply of hardwood is kept on hand, which is driven into this hole as soon as the covering shows a tendency to fall in. After it is thoroughly refilled, a fresh covering is put on, then vents are opened along the sides toward the base. The condition of the coal inside is ascertained by feeling with an iron rod, and as the burner finds it at any point properly "cooked," he can open it and withdraw a portion of the coal, covering the balance rapidly and carefully again in the same manner as at first. This process is kept up until he knows by the color of the smoke and by the inserting of his "try rod" that the whole is properly "cooked." It is all then carefully covered in and allowed to cool and die out.

This mode of burning coal requires very careful and constant watching, owing to the liability to fire. As I have already said, the practice in Sweden is to use wood for pit purposes in nine or ten foot lengths, and when we took up the question of getting the farmers and others in our district to make coal in this manner, we had them follow the usual Swedish process in cutting, but from various reasons, principally owing to the density of our woods, the burning of shorter lengths has proved more satisfactory, and our best results have been obtained from wood cut in four or five feet lengths, and a portion of it split, and also by using smaller pits.

The pits which we first operated contained as much as forty-seven to fifty cords, but the results were unsatisfactory, the process proving too slow and too many brands being made. The coal obtained, however, was fairly good. Our burners then resorted to smaller pits containing from 20 to 25 cords of 4-ft. wood. These burned faster and gave better coal. Where our men had had experience in the work, the coal was clean and solid, and, as pointed out, gave better results in the furnace than ordinary kiln coal.

In pit and kiln practice we have used the following woods:—Maple, birch, beech, soft maple, white birch, tamarac, hemlock, balsam, and in point of value these can be reckoned in the order named. Our principal consumption has been in maple, birch and beech, with which our district abounds. In practice in kilns

and in pits, both, we have found it possible to use 25 to 30 per cent. of soft wood, but for furnace purposes we prefer not to go above that, as the coal made from the softer woods is more friable, and will not carry a heavy burden of ore.

RETORTS.

In the United States attempts have been made to manufacture charcoal in retorts or closed vessels, in which the wood is placed, and the charring done by external heat. In a report on this system, made by a prominent expert, he mentions that one system is to erect a furnace, and supply it with a number of vertical cylindrical vessels, which are handled with a crane. The vessels are filled with wood, tightly sealed, lifted into the furnace, and connected by means of nozzles with conduits leading to condensers. After the fire has been maintained a sufficient length of time to properly char the wood, the vessel is lifted out and allowed to cool, another taking its place in the furnace. In this method the retorts serve also as cooling vessels, but they must be handled carefully, and the outlets for gases must be disconnected and closed at each change.

Another plan consists of a cylindrical retort hung from trunnions over a furnace. It is raised to a vertical position to receive the charge of wood, and reversed to discharge the charcoal into the cooling vessel, where the process is completed. The difficulty of filling these retorts and maintaining them, makes this plan undesirable.

A system largely employed in North Pennsylvania and South New York, consists of a series of cylindrical vessels set permanently in a horizontal position over furnaces. These retorts are filled with wood either thrown in, or in improved retorts, placed in a crib which has been previously loaded. When the carbonization has proceeded sufficiently, the coal is withdrawn into a cooling tank, which is hermetically sealed, until such time when the danger of the mass taking fire is greatly reduced.

Other forms have also been followed, but as far as I can ascertain, none of them has ever proved commercially successful, and the old-fashioned kiln and pit systems still seem to be for general charcoal purposes the most economical, and, in fact, the only systems by which charcoal can be successfully manufactured for general commercial purposes, or at least for the manufacture of iron.

BY-PRODUCTS.

Of late years considerable attention has been given to by-products obtainable in the manufacture of charcoal, and it has been found that with a chemical plant attached to a battery of kilns, that every cord of wood can be so handled that the exact weight that went into the kiln will practically be taken out, when everything is taken into consideration. What by-products can be drawn from a charcoal kiln would be too numerous to mention. In fact there seems to be very little that cannot be taken out of the wood in this way, but for commercial purposes the principal by-products, and those to which most of the companies using a chemical plant have given their attention, are wood, alcohol and acetate of lime, and these have been found to be, I believe, profitable, and it is very probable that within a very short time every battery of kilns will have its chemical plant adjoining, and the smoke that is now wasted will be drawn down and distilled, so that nothing will be lost. When this is done, the value to the country of a cord of wood will naturally be largely increased.

The Province of Quebec has every natural requirement for the production of charcoal pig iron, and the value of such an industry to the province and the Dominion must be fully recognized by every one. We have the iron ore, and while we have neither coal nor natural gas, we have plenty of hard and unmerchantable, or waste woods, and that fact makes it possible for the establishment of an iron industry of the greatest value, and I see no reason why such an industry should not be carried to a successful issue, as it has been in Sweden and the United States. What is wanted, however, is the assurance of an adequate supply of charcoal, both for the present and the future. To do this some steps must be taken by our Government to conserve certain woods or portions of forests, so that this industry can be established on a permanent basis. How this can be done is something that will have to be carefully thought out, but if it is done, the value to Canada will be great. If it is not, then we will have wasted a very large proportion of our forest wealth, for that is wasted which is not used to the best advantage, and I hold that more profit can be derived from our unmerchantable and waste woods by utilizing them and conserving them to the development of the charcoal iron industry, than in any other way. If this is done, the establishment of the industry is possible and certain; if it is not, then it can only be carried on in a very desultory way.

One of the principal difficulties that stand in the way of the establishment of the charcoal industry in some of the districts is the fact of large tracts of land being held by limit holders. Limit rights were originally intended to convey an area valued for its merchantable timber alone, yet the limit holders, even in cases where the merchantable timber has been removed, still retain possession and control, with the result that the hard and unmerchantable wood cannot be utilized. The only way by which these woods can be diverted is by actual settlement, and, as in a great many cases, the land may not be suitable for agricultural purposes, the wood, if these conditions are to exist, is practically inaccessible.

Another great difficulty is the lack of knowledge in regard to charcoal burning. Of course, so far as kiln practice is concerned, men can be readily obtained, or educated to good practice, but for pit burning it is necessary that a much broader system of education than could be carried on by a private enterprise should be adopted, as a knowledge of pit burning would be of the greatest value to our settlers and farmers in the wooded districts.

Now, these two questions are, I hold, provincial and national ones, and these difficulties should be considered and overcome by our Governments.

In Sweden there are national schools for charcoal burning, which have done and are doing good work in training men and spreading information throughout the country as to the most economical systems of making charcoal, especially in pits. Both the Dominion and Provincial Governments should follow this example, and disseminate useful information on the subject among the agriculturists, especially in the wooded districts and where charcoal consuming industries have been or can be established. This should be done by lectures, papers, and in every practicable manner. The practice especially of pit burning should be taught in our agricultural institutions, and certainly no mining school should be without a course in charcoal burning,

and when development comes, as it surely should come in a land of wood and iron, national schools should be established, as in Sweden. Our Governments have spent large sums in this way on dairy practice, and we all know that the results have been profitable and satisfactory, and I believe that if the same course is adopted in regard to charcoal making, which is a farmer's and practically a domestic industry, the results will be also to the national good.

Steps should also be taken to prevent the locking up by speculators or others of woods suitable for charcoal purposes, and where this evil exists, as in the cases I have referred to, it should be overcome by just changes in the present laws if necessary. I do not believe that in the case of the limits any value was considered or paid for, nor was it intended to convey to the limit holders the unmerchantable woods for which lumbermen and others purchasing these limits have no use. This is proven by the fact, I consider, that at all times the Government has reserved the right to settlers taking up any portion of the land, the only reservation in favor of the limit-holder being in regard to the merchantable wood, which he is given a certain time to remove. I therefore hold that under all circumstances, and especially where the lands are not suitable for agricultural purposes, and the unmerchantable wood cannot be realized on through the settler, the Government should have the right to divert unmerchantable wood to other purposes when and where it is deemed advisable.

When an enterprise that requires this fuel can be started in any district, it should be especially encouraged by the setting aside of wood lands to insure a continued supply, and by assistance in teaching the principles of "burning" to the inhabitants of the district, and by rebating of stumpage dues where the wood is used for charcoal purposes, and encouragement given in every practicable manner within the powers of the Dominion or Provincial Government.

The industry is, and must always be, if successful, a settler's, a farmer's, and a people's home industry, and for this reason it is especially deserving of national support and encouragement.

Our farmers should be taught and enabled to use to their own and the nation's profit everything the land has to give, and here are mighty crops wasting, burning and rotting that, properly used, might here in Canada, and especially in our own Province of Quebec, be made, as in Sweden, the mainstay of a nation.

This is a "burning" question. Let us hope it will not remain a "burning shame," but in the near future become a "burning" success.

FOR THE CANADIAN ENGINEER.

BOTTOM CONSTRUCTION OF STEEL VESSELS, AND "AFLOAT" STRESSES AND "ASHORE" STRAINS.

BY JOSEPH R. OLDHAM, N.A. AND M.E., CLEVELAND, O.

To calculate the strength of a ship, it is necessary that the stresses which it may encounter be known, as well as the strength of the material of which it is constructed. The one is a measure of the tenacity required, the other of the tenacity possessed, and the strength of the finished structure depends upon the relative proportions of the two.

The discrepancy between "afloat" and "ashore" strains experienced by ships is greater, I think, than generally understood; for instance, I have seen ocean and lake steamers with ten or twenty consecutive floors and frames broken by light grounding, and yet the

lower bottom continued keeping the ship afloat on the open sea, as if all were intact. As many are aware, when an ocean steamer constructed, say, in conformity with the "Veritas" or "Lloyds'" Register rules, is stranded under conditions which cause the bottom plating and floors to strain severely, it will usually be found that the bilge and top sides are also strained, if not fractured.

Now when you learn that this seldom or never occurs with steel lake steamers, I think it will be admitted that this diversity in results from identical causes merits investigation, and as our lake steamers are generally lighter than steel vessels of similar design and of the same dimensions and proportions trading on salt water, the problem appears still more difficult of solution. For instance, only last year I superintended the repairs of a steel lake steamer, more than 300 feet in length, which had her bottom buckled up about eighteen inches and destroyed from bilge to bilge, but her tank top was intact and floated us home; there was no straining of the sides or top-sides, and few, if any, of the bilge butts were strained. Steel lake vessels are, of course, not loaded so deeply as salt water craft, for the average lake steamer sails with from eight to ten feet of free-board amidships, but this is no reason why grounding damage should be confined to the bottom, even to the exclusion of the bilges. It is true that such vessels are not heavily loaded, but light loading will hardly account for damage being localized so.

As to the distribution of materials contributing to longitudinal strength, I may point out that the neutral plane is very low in the average lake steamer, as the axis is situated about two-thirds of the molded depth below the gunwale; this indicates a strong bottom and comparatively weak topsides, and the indication is correct so far as the longitudinal bending moment is concerned. It does not, however, elucidate the point at issue, but, when the transverse bottom strength is considered, the reason is apparent for such bottom damage being localized, as the frames and floor-plates are usually much lighter than is common in ocean steamers.

The one feature of this which appears to me to be worthy of discussion is this: If a ship's bottom is proved experimentally to be amply strong for any "afloat" stress to which it may be subject, is it necessary or advisable to increase the transverse bottom strength for the purpose of resisting rocks or uneven hard ground, which can only be resisted to a limited extent, no matter how closely the floors and frames approximate to the scantlings necessary to resist ordinary grounding strains?

It seems to me that it would be better for steamers subject to frequent groundings, to leave the lower bottom about as light as it now is, but specially designed with a view to facilitate repairs, as even the lightest, well arranged and carefully constructed bottoms have proved amply strong to withstand the most intense afloat stresses. But to make surety doubly sure, I would increase the extent, strength, efficiency and durability of the upper bottom and bilge ceiling; and, as the feature desirable in bottom plating is ductility, which should not be less than 36 per cent., with a minimum tensile strength of 58,000 pounds per square inch, I would draw particular attention to these points.

In shallow water trades, where severe bottom damage, resulting from grounding, is of frequent occurrence, the loss to ship-owners by reason of detention to make repairs, in addition to the cost of repairs, is so onerous that I believe a partial remedy or even a mitiga-

tion of this loss would be of great benefit to owners of steel vessels, hence I have for several years endeavored to design a ship, at reasonable cost, that would be a general improvement on any existing type so far as comparative immunity from bottom damage caused by grounding is concerned, and at the same time be at least as seaworthy in deep, rough waters, as the highest class of ordinary cargo vessels. In my opinion there are only about two methods of bottom construction by which these desiderata may be effected; the one, viz., sheathing the bottom with elm or oak is by no means new, and is not in any sense an original proposal of mine, but let me say a word or two about the value of wood in lending assistance to steel plates. In this connection the late Professor Rankine suggested that a fair allowance, averaging the various timbers used in shipbuilding, would be to consider wood equivalent to one-sixteenth of its sectional area of iron. In like manner, as we are now dealing with steel, I suppose we may assume that good American oak is equivalent to one-twentieth of its sectional area of good American steel. Experiments have proved that so long as the stresses put upon the metal do not surpass the limits of elasticity of the wood, it is a fact that the oak will act with the steel and lend it valuable assistance in resisting longitudinal bending; this is a most important factor where thin steel decks are laid on wide spaced beams without any longitudinal stiffeners such as fore and aft "T" or angle bars, for when such are omitted, even a good pine deck is of great value in resisting compression. Then, as regards the bottom, a five-inch oak or elm sheathing is highly valuable, for compression is the most severe stress the bottom has usually to sustain. Indeed, when an ordinary cargo steamer is in ballast trim, the bottom will generally be compressed in a longitudinal direction, as the tendency is then towards "hogging," and even when loaded the bottom is as frequently subject to compression as it is to tensional stresses.

DAMAGE REPAIRS.

Permit me to say a few words about the repairing of damaged steel hulls, as the aggregate cost of repairing the average steamer will amount to more than the first cost. In doing so I may say that perhaps there are few people who have spent more time in examining this class of work than the writer, as my field of operation has been a very large and varied one, and, since completing my apprenticeship about thirty years ago, several thousands of iron and steel steamers have been entrusted to my direction for repairs. Damage to bottoms of steel vessels is not an infrequent occurrence, and the more quickly and cheaply such injuries can be effectively repaired the better will it be for the shipowner in the long run.

I need hardly say that the approved manner of fitting the shell plating in ordinary steamers is to arrange the plates in inside and outside strakes alternately, though, in very long and shallow vessels, the naval architect or shipbuilder invariably resorts to flush or edge to edge plating—frequently in connection with doubling plates, it is true—to secure longitudinal strength.

This is a good arrangement where double separate sides are impracticable, and I would like to see one feature of this—the flush plating—extended to the bottom of the future lake steamers.

With ductile, mild steel, it will frequently be observed that, for one fractured plate in the bottom of a

vessel that has grounded, there will be found, perhaps, twenty or thirty plates not fractured, but only severely indented; what I would define as a severe indentation is, say, $1\frac{1}{2}$ inches in a diameter of 20 inches. Indentations exceeding this ratio are common without fracture, and, as I have found locally heating steel "in place," without removal for annealing, to be a very hazardous and make-shift practice, it becomes necessary generally to take out such damaged plates to be warmed, rolled and annealed. Moreover, in way of indented plates, the frame, and frequently the floor-plates, are usually either dangerously weakened or fractured, and when this latter feature of the damage is at all serious and concentrated, it is found to be as economical to remove an outside plate to get at the work, as to attempt to cut, fit and strap floors and frames in a shallow ballast tank; besides severely buckled frames and floors cannot be efficiently repaired without the removal of the shell plates.

Now what I would like to see my friends who compile our great ship-building rules, prescribe, is a strong and economical arrangement, say of bottom-plating only, whereby an indented or fractured plate may be replaced without consequential damages; for when an inside plate has to be removed, the riveting and calking of at least two outside plates must also be destroyed and renewed as a consequence.

FLUSH PLATING.

Of course I am referring to longitudinal seams. This generally entails a difficulty with regard to liners, unless the longitudinal strap be an outside one, when the remedy would equal the disease; but, with a proper upper bottom and ample transverse strength, a safe and practicable arrangement may be designed for a flush bottom, with single riveted seams joined by an inside strap; no harm need be apprehended with such a bottom in deep water.

Then as to excessive damage by grounding, let us examine the condition. When a vessel, such as an ordinary lake cargo steamer of from five to six thousand tons displacement, strikes a rock or boulder, with a velocity of some 17 feet per second, the result to the plating will be practically the same whether the plates be arranged in and out and double riveted, or flush and single riveted, provided the longitudinal straps be broad and strong, for with a kinetic energy of 50,000,000 foot pounds, the lower bottom must succumb where locally pressed till sufficient surface comes in contact with the ground to avert further fracture or indentation. If the bottom were all double riveted, such rivets in damaged plates would be either sheared or strained beyond the elastic limit. To sum up, if the arrangement I propose would save a considerable percentage of the first cost and also lessen the expense of repairing bottom plates, it is surely worthy of consideration. Let me make it clear, however, that I do not propose any diminution of the riveting of the bilge and sides, nor of the fore foot and heel. Nor do I propose any diminution of riveting or fastening about the location of the neutral axis where shearing strain is maximum.

My suggestions with regard to less elaborate riveting are limited to the longitudinal seams, and to them only when not far removed from the surface subject to minimum shearing stress. The careful designer of an ordinary ship, or of the machinery within her, will always keep in view the possibility, if not the probability, of certain portions of such fabrics requiring extensive repairs or partial renewals from time to time,

and he will accordingly arrange details (within certain simple economical limits whereby the efficiency and strength of such structures will not be impaired) so that the ship and equipment may be readily repaired without destruction or disturbance of large portions of either the hull or machinery.

But, when designing a large high speed steamer for such a trade as that of the North Atlantic, the naval architect would think but little about making bottom repairs, since economical perfection in speed and strength is yet so far from full realization, therefore the question of expense in connection with hull repairs, at least, may well be relegated to the time when necessity arises for such work to be effected.

But, on the inland seas, vastly different conditions obtain, for nearly half the average voyage of the lake steamer is in comparatively shallow water, in many parts of which narrow and tortuous rivers must be navigated. The consequence is that groundings and collisions are more frequent than generally obtains in the principal European trades, but our total, or constructive total losses of steel steamers, in proportion to numbers or tonnage, is not nearly so great as such losses in European waters. To lessen our maritime disasters many expedients have been resorted to, ballast tanks are invariably continuous from bow to stern, are well stiffened, and are connected to the side plating near the top of bilge. By this latter arrangement we sacrifice a useful, and, as I used to think, a necessary gutter waterway, but I have not seen any serious damage result from this omission.

The bottoms of several steel vessels have also been sheathed with five or six inch oak, up to, and in some cases above, the bilge; and this is, without doubt, a wise expedient against bottom damage, and I for one would like to see all the vessels so protected; but it is an expensive provision, for, in addition to the increased first cost of such protection (which may vary from \$10,000 to \$12,000), the reduction in dead-weight capacity is represented by almost the full thickness of such sheathing in the draft of water of the vessel, which in an average lake steamer means a loss of 150 tons per voyage loaded. As an alternative plan, I think that if the bottom displacement were reduced say 150 tons by increasing the rise of floor, almost equal immunity from bottom damage would be secured; or, at least, the gross loss would not be larger, since the first cost of sheathing would thereby be saved; moreover, the cost of bottom repairs would be largely reduced.

Now, though the upper bottoms of lake steamers are generally stronger than those of ocean vessels, I venture to express an opinion that such bottoms should be made still stronger, so that in an emergency a short voyage might be safely made to a home port to repair bottom damage.

DOUBLE BOTTOMS, NOT TANKS.

About thirty-three years ago, the schooner "Jane" was built at the shipyard where the writer served his apprenticeship. Templates were made in the hold of that vessel, and by these iron tanks were shaped so as to completely fill the hold up to the weather deck. Now, this was in every sense of the word a tank steamer, and I think she was about the first vessel to carry oil, in bulk, to Europe.

The ordinary "tramp" steamer is frequently designed with a light ballast tank extending over less than half the length of the hold; such structures as these are certainly tanks, the latter a ballast tank, but most of our

steamers have double bottoms, and as these frequently have to float the ship and part of her cargo home when the lower bottom becomes impaired, it appears to me that a portion of the thickness of a heavy bottom might advantageously be spared to strengthen the upper bottom.

When a large vessel suddenly rests on hard uneven ground, the bottom plating is either fractured or indented, whatever the thickness may be; I mean that whether the flat plates be ten-sixteenths of an inch or only seven-sixteenths, it makes no practical difference in the damage resulting from a weight of four or six thousand tons pressing such surfaces upon the rocks. But further, corrosion of the upper bottom goes on as actively, if not more so, than does the wear and tear of the lower bottom. Consider these as forming the upper and lower flange of a hollow girder, the latter being intact, whilst the former is pierced with manholes—does it not appear to be unscientific to make the lower flange, say, ten-sixteenths, and the upper only five-sixteenths, as is commonly the case? Moreover, the lower bottom is the only one of the four large external surfaces of a ship that is not weakened by hatchways, gangways, or scuttles.

With such dimensions as these given above, would it not improve the structure if the lower bottom were reduced by, say, two-sixteenths of an inch, and this thickness were added to the upper bottom plating, when the thicknesses would be $\frac{8}{16}$ and $\frac{7}{16}$ of an inch respectively? Of course, this implies that both the bottoms are strongly connected together transversely and longitudinally, as required by the most approved rules for steel shipbuilding.

An underwriter's surveyor would always prefer to see damage repaired as soon as it is discovered, but this cannot always be managed, and the shipowner, who pays for all in the long run, is the master of the situation, and when he requires temporary repairs and a certificate of seaworthiness, his demands must be complied with, so long as safety can be assured for the time being.

Now, when a vessel with a damaged bottom is urgently needed to make another voyage, it is a source of great comfort to know that there is a good upper bottom above the damaged one; therefore, I would say briefly, make the upper bottom still more secure.

EMANUEL SAMUEL.

The business community in Canada were startled and shocked to learn last month of the sudden death of Emanuel Samuel, one of the members of the widely known hardware firm of M. & L. Samuel, Benjamin & Co., Toronto. Mr. Samuel had gone to New York to be treated by a specialist of that city for nervous prostration, from which he had been suffering. He took up his residence with a relative, occupying a large department building. Whilst smoking after dinner he accidentally fell into an air-shaft and was precipitated on to the pavement three flights below. The fall fractured his skull, and he only lived two hours.

Mr. Samuel was born in Montreal in 1850, and at a very early age developed the remarkable aptitude for business which distinguished him and the other members of his family in after life. After coming to Toronto, 30 years ago, he founded the firm of which he had ever since been a leading member. Mr. Samuel was not only a keen-sighted and able business man, but was possessed of high social qualities, and, what was more, he was a

man who lived up to his religion. He was a member of the Board of Trade, both of Toronto and of Montreal, and was also interested in other successful business ventures besides his own firm. He was president of



LATE EMANUEL SAMUEL.

the Metallic Roofing Co. of Toronto, vice-president of the Steel Clad Bath Co. of Detroit, and a director of the Ontario Lead and Barbed Wire Co. of Toronto. He took an active interest in the manly sports, and was an expert in more than one athletic game. He was a member of the Toronto Athletic Club and of the Ontario Jockey Club. Personally he was much esteemed by those with whom he came in contact in a business way, and was very just and considerate to those in the employ of the firm. His business character was such as to gain for him the esteem of every employe. Though Mr. Samuel was only 45 years of age, he had been a widower for sixteen years, his wife having died after only a year of married life. The hardware and engineering trades of Canada, with which he was so largely connected, are distinctly the losers by the death of such a man.

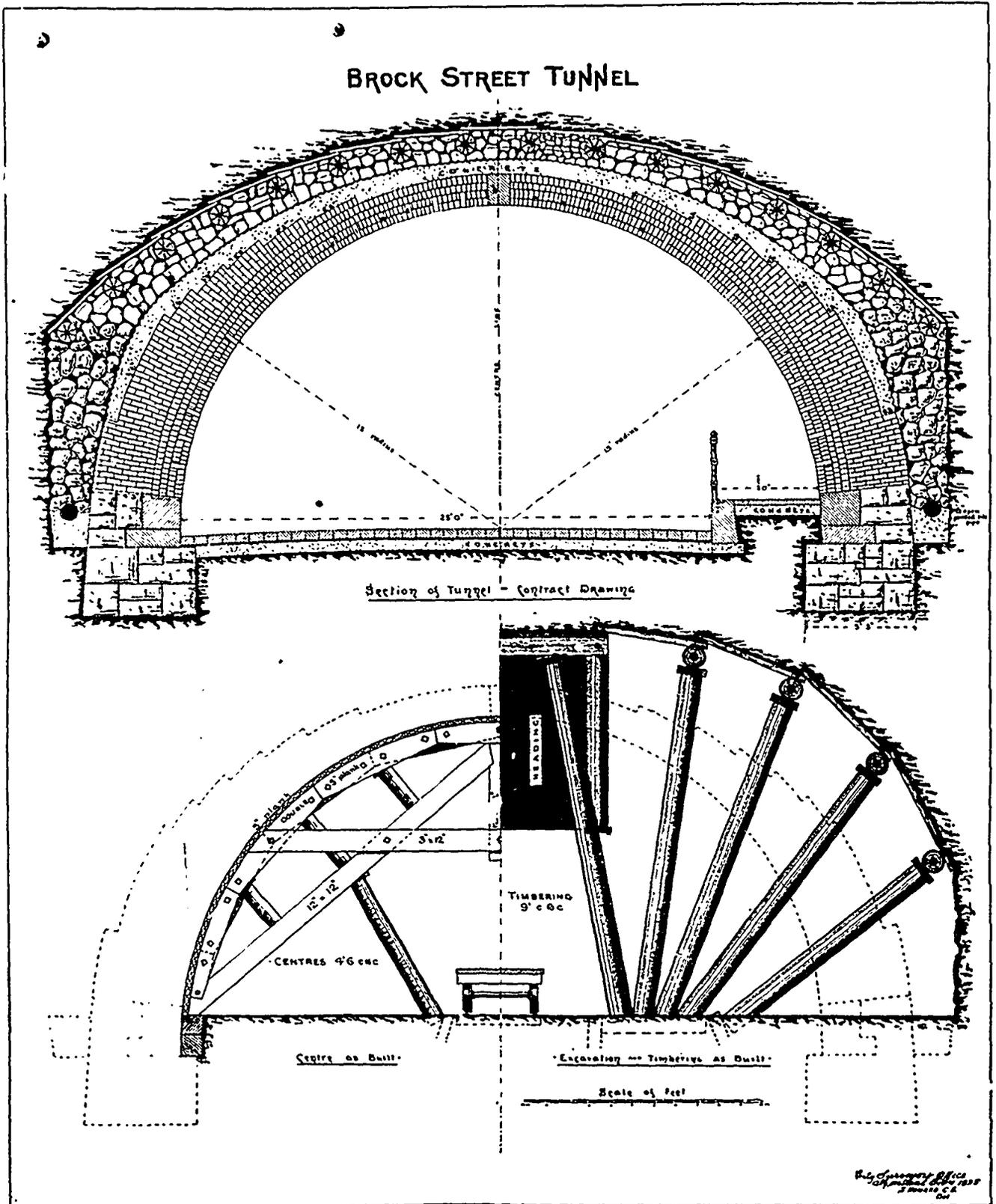
JUDGING from the remarks of the *British and South African Export Gazette* on the proposed steamship service between Canada and the Cape, they do not at the latter place appear to be particularly impressed with the great possibilities of the scheme. Canada's exports to South Africa would mainly be articles which South Africa ought to produce itself, they think. The supply of dairy produce, cattle and even timber, should not continue for ever in the hands of outside producers, and the trade is already so much catered for that Canada would not have much chance of "cutting in." As for manufactured goods, it is in a very few articles only that the Dominion can hope to compete with the flood of European and United States merchandise. The soundest policy in this instance is to leave the trade to establish itself a little, at all events, before beginning to talk about subsidizing steamers to do it. At present there is not too much evidence of the possibility of such a trade, and none at all of its existence. At least such appears to be the firm conviction of the Capetown Chamber of Commerce. We would remark that though it is true that transportation facilities are usually the result of a demand for such, yet it is also true in many cases that the presence of those facilities often creates, or at any rate increases, the utility of the same. Perhaps in this instance also there is hardly enough trade passing at present between Canada and the Cape to render a steamship service absolutely essential; yet if there were such a service, is it not possible that trade would be developed to such a degree as to render it a very paying concern, after all?

BROCK STREET TUNNEL, MONTREAL.

This tunnel has been constructed by the City of Montreal, under the jurisdiction of the Road Department of the Corporation, the object being to open up a roadway from the level of the wharves to Craig street for the transport of heavy merchandise to and from the shipping, thereby avoiding the high ridge on the sum-

mit of which Notre Dame street rises. had an inscription cut in it bearing the following words: "Brock Street Tunnel, 1895. I. O. Villeneuve, Mayor. Road Committee—R. Prefontaine, chairman; and members, T. Kennedy, P. Lyall, T. Brunet, T. A. Grothe, G. Renault, R. Turner; P. W. St. George, City Engineer; Stuart Howard, Engineer in charge; Lafontaine & Lemoine, contractors."

The total length of the tunnel and approaches is



mit of which Notre Dame street rises. On Tuesday, the 12th of February, a memorial stone, in which was deposited a leaden casket containing the archives of the City Council, the current coinage, photographs and drawings, together with the cards of the invited guests, was laid in the tunnel in the presence of the ex-Mayor, the road committee, officials and friends. The stone

905 feet, the tunnel itself being 666 feet 6 inches on a grade of 1 in 43.

The portals of the masonry are 8 feet in depth, the brickwork being built into the arch stone spaces, which at the junction with the brickwork are toothed.

The arch is semi-circular, 30 feet in diameter and 15 feet in height; the brickwork at the haunches being

4 feet 3 inches in thickness, and the masonry key 17 inches in depth.

The inside face of the arch is of firebrick 9 inches in thickness, the backing being of hard red bricks, the whole laid in cement mortar, on the top of the arch about 9 inches of concrete, and over this again galvanized corrugated iron, making the structure waterproof, any water which may percolate through the upper soil being carried to each side, and through a thickness of broken stone into an open-jointed tile pipe.

The total quantities in the tunnel itself are approximately 350,000 firebricks, 1,300,000 red bricks, 1,450 cubic yards of masonry, 1,100 cubic yards of concrete, 50,000 lbs. of iron, 3,600 cubic yards of stone filling and 15,000 cubic yards of excavation.

The approach at the north end is 200 feet in length measured from Craig street, the upper side from Notre Dame street being retained by a heavy masonry wall.



P. W. ST. GEORGE, C. E., CITY SURVEYOR, MONTREAL.

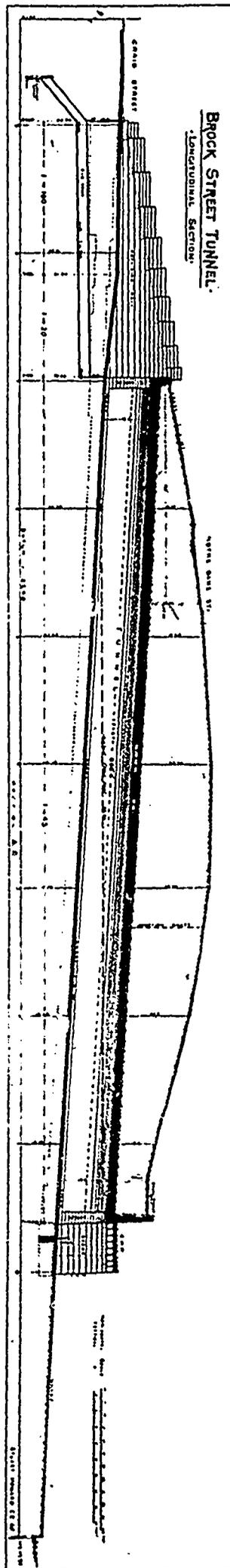
[A biographical sketch of Mr. St. George appeared in THE CANADIAN ENGINEER of May, 1894.]

At the south end bridge abutments extending to the line of the Canadian Pacific Railway cribwork on the wharf have been constructed, the railway tracks being carried upon a substantial steel deck girder bridge. On the outside of the south portal, hollow quoins have been cut in the abutments, into which lock gates will be fitted to keep out the water of the spring freshets. The difference of level between the wharf and Craig street is 21 feet, and the highest water known 13 feet 6 inches above the wharf. Besides the quantities in the tunnel proper above given, the work of construction included about 8,500 cubic yards of excavation and 1,950 cubic yards of masonry. The north approach has been already paved with scoria blocks, and the tunnel itself will be finished with porphyry blocks, with an elevated sidewalk on one side protected by an iron railing.

The total work done by Lafontaine & Lemoine amounts to \$134,732, the total cost to complete being \$180,000, which covers a sum of \$11,200 for paving, \$5,000 for drains, interior finishing and sidewalks; \$7,000; iron bridge, \$4,868, and \$17,200 for superintendence, fencing and other small items.

Percival W. St. George, C.E., the City Surveyor had as his engineer in charge, Stuart Howard, C.E., who prepared the drawings, and laid out and superintended the construction. The inspectors of masonry, brickwork, etc. were M. L. Connolly, H. W. Stanton and others.

The tunnel was commenced from both ends, the north approach, walls and portal being built at the same time as the bridge abutments for the C.P.R. bridge, the drifting of the tunnel being then proceeded



with, and when the walls met there was no variation whatever, either in the centre or level; the inscription stone was laid at the junction, the last keystones being placed in position from the street level, a shaft having been sunk at the exact locality. It is expected that the new tunnel will be open for regular traffic by the end of April.

The mode of construction of such a work as this tunnel, very little of which is known in Canada, and entirely new to most construction firms, reflects great credit upon Messrs. Lafontaine & Lemoine, contractors, who have so successfully carried out the work, without any accident whatever, and also to the letter of the specification, and the entire satisfaction of the engineer. The inspectors also, upon whose shoulders the brunt of the work falls, in having to carry out the wishes and orders of the engineer, fulfilled their duties most conscientiously.

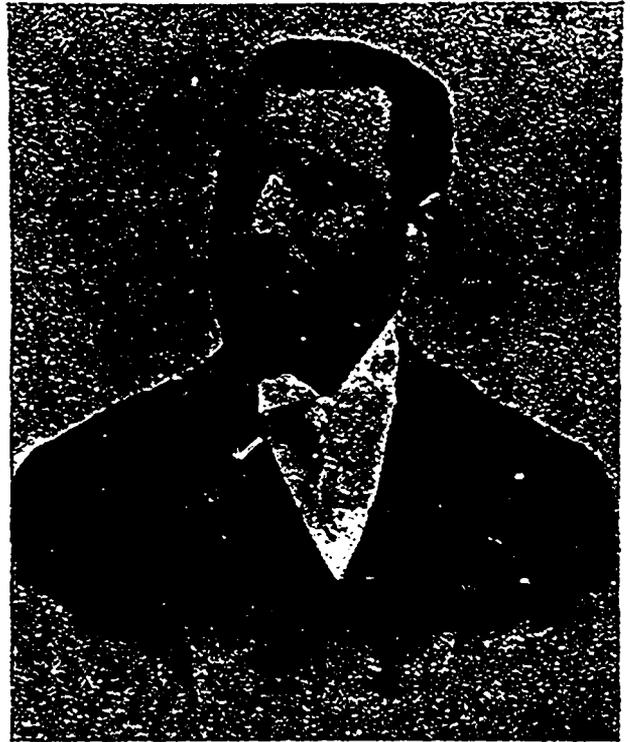


STUART HOWARD, C.E.

Stuart Howard, the engineer in charge of the Brock street tunnel, Montreal, was born in Portsmouth, England, in 1849; educated at Guilford and Queenwood College; entered the Public Works Department of the Admiralty in 1865; was employed on the construction of the dockyard extension, Portsmouth, with the Royal Engineers at Southampton, Somerset House, etc.; came to Canada in January, 1870; employed by the Northern Railway of Canada on location and the construction of their branch lines, for seven years, viz., the Muskoka Branch to Gravenhurst and the North Grey Railway. Constructed the Allanburgh branch of the Great Western. In 1879 became assistant on the Q.M.O. & O. Ry., on the construction of the Quebec Gate Barracks, and other branch lines. Was chief assistant engineer of the Canadian Pacific Railway when they took over the Government road; constructed the line from Mile End, Montreal, to Blue Bonnets, and to Point Clair; located the line into the Windsor street depot, Montreal, and had charge of the construction of the depot portion. Designed and superintended the C.P.R. elevators, and the walls and depot at Dalhousie square in same city. Superintended the construction for the city of Montreal of the St. Catherine street bridge, Ontario street subway, Berri street subway, and walls and bridges on Seigneurs street, and is now in charge of the Brock street tunnel and the Notre Dame street viaduct. He has also made surveys and estimates for many towns contemplating both waterworks and sewerage; also located and had charge of the St. Lawrence and Adirondack Railway, and many other smaller railroads.

UNITED COUNTIES RAILWAY.

The inauguration of the United Counties Railway took place on Saturday, Feb. 16th. This line, the completion of which has been eagerly looked for by the people of Sorel and the Eastern Townships, passes through one of the richest farming districts in the Province of Quebec, and is pretty certain to prove a success both in the development of the country traversed and in a commercial sense. It starts from Iberville, on the Central Vermont, and then passes through the parishes of St. Grégoire, Ste. Angèle, St. Césaire, Rougement, Caroline, St. Damase, Argenteuil, Ste. Madeleine & Grand Rouge. Connecting with the G.T.R. at St. Hyacinthe, it then goes on to St. Barnabé, St. Jude, St. Louis, St. Aimé, and then reaches Sorel, where it comes in at the old South Eastern (C.P.R.) docks, where extensive shipments are looked for. The whole length of the line is about sixty miles. In constructing no special engineering difficulties were met with, the country being very level, and the line was an easy one to build, with very easy grades and curves. There are four level crossings with other railroads, two of them being fixed with the Saxby & Farmer Interlocking system, with derails. At St. Jude there is a large, fine-looking bridge. The repairing shops are situated at St. Hyacinthe, where the company have a large yard supplied with the latest appliances necessary in all branches of repairing and manufacturing work. The inauguration train started from the Bonaventure station, Montreal, at 9 a.m., with great *eclat*, the Hon. M. Chapleau, Lieut.-Governor of Quebec, Hon. M. Nantel, Commissioner of Public Works, and many prominent citizens being among the passengers. That the first train was a very welcome sight to everyone along the line was evidenced by the holiday look of every station stopped at, delegations awaiting its arrival in each case and pre-



C. D. HAZE.

senting their congratulations amid lively tokens of joy at the fulfilment of their hopes. All went well until near St. Robert, when owing to a violent wind springing up and blowing loose snow from across the plains into the track, the train became blocked, and, in spite of heroic efforts to move her, became stuck fast half

way between St. Aimé and Sorel. This occurred about 2 o'clock in the afternoon, and it was not until some thirteen hours later, by the help of a third engine, which had been telegraphed for, that the train could be extracted and hauled back to St. Aimé. The management of the line, who of course could not be blamed for the mishap, the weather not being apt to consider either persons or occasions, did all they possibly could to make their guests comfortable during their enforced imprisonment, and with great difficulty managed to obtain a sleigh for a small party, including the Hon. Mr. Chapleau, to return to St. Aimé, where they enjoyed the hospitality of M. the Chevalier Drolet, at the Manor House. The remainder of the party reached St. Aimé, on the homeward journey, about three o'clock on Sunday morning, many of them being driven to the house of Chevalier Drolet, who received all with the most open-handed hospitality. The opening ceremony took place in the afternoon, the Lieutenant Governor laying a silver bolt opposite St. Aimé station. The party then returned home, reaching Montreal about seven o'clock in the evening. The officers of the company are as follows: President, C. D. Maze; vice-president, L. F. Morison; manager, J. W. Dawsey; chief engineers, G. H. Garden and J. M. McCarthy.

APROPOS of the Hamilton and Lake Erie power canal scheme, about which such a lively discussion has been going on in THE CANADIAN ENGINEER, we understand that a scheme is now on foot to tap the waters of the Welland River and convey them by canal to the brow of the mountain. This power could be used at Hamilton, and it is said that only 10 or 12 miles of canal excavation to a depth of 35 feet would be required to do the work. Presumably the canal would start from near the source of the river, and it is a question whether a sufficient volume could be derived.

In the January number of this journal brief reference was made in an article on "Great Things of 1895" to a new system of air compression, in which compression is effected by the natural fall of water. This is the invention of C. H. Taylor, of Montreal. Tests which have completely satisfied the company interested have been made by a high authority on air compression, and a plant is about to be erected on a commercial scale. Drawings showing the principle of this new system are now being prepared for THE CANADIAN ENGINEER and an illustrated description will appear in our next issue.

Those who have correspondence with firms whose native language is not English are often amused at the literal rendering of foreign idioms into English. THE CANADIAN ENGINEER has some letters with mistakes as funny as anything that ever appeared in "English as she is spoke," and a catalogue shown us the other day issued by a large Ontario iron founding firm, and translated into French for distribution among French-Canadians, contains passages equally amusing. The translation was made by a French-Canadian, but he happened to be an illiterate one, and had an idea that the more literal his rendering the better his work. The result may be imagined. Noticing such mistakes, the thought has occurred to us that we should be doing a service to many of our patrons who wish to get out circulars or catalogues in French if we put them in communication with a reliable and intelligent translator. A capable translator has undertaken to do such work,

and we shall be glad to put our readers in communication with this gentleman free of charge on our part.

THE first annual convention of the Good Roads Association of Ontario met in Toronto on the 7th and 8th ult., Andrew Pattullo, president, in the chair. Among those present on the platform were the Lieut.-Governor of Ontario and Hon. John Dryden, Minister of Agriculture. Several delegates gave their experiences as to the need for a thorough-going system of road reform, and several valuable papers were read bearing on the subject. Among these were papers by A. W. Campbell, city engineer of St. Thomas, on "Our Roads;" by W. M. Davis, C.E. of Woodstock, on "Road-building;" by J. C. Judd, of Leeds, on "Road Laws," and by A. F. Wood on "The Cost of Keeping Roads in Repair." We need not point out the value of the work which the Good Roads Association is doing, but whether much appreciable effect will be seen in the near future in the amelioration of our country roads is another matter. Already the country press has begun to take the matter in hand, and to impress upon their public the absolute necessity for passable roads at all seasons; but farming communities as a rule move slowly, and though many may see the wisdom, on general grounds, of keeping their highroads in good repair, yet for some time to come, probably, few will be found willing to hand out dollars for that purpose, even though it be their best possible investment. The association, before concluding their convention, passed resolutions recommending a reduction in the number of pathmasters and an increase in their jurisdiction. It was resolved to send out circulars to municipal corporations, boards of trade, etc., for the purpose of gaining an expression of public opinion on the question of improving the highways, and A. F. Wood, ex-M.P., and President Pattullo were appointed to wait upon the Ontario Government and ask for a grant to assist the association for the improvement of roadways. They also elected the following officers: President, A. R. Pattullo, Woodstock; first vice-president, J. F. Beam; second vice-president, A. W. Campbell, St. Thomas; and secretary-treasurer, K. W. McKay, St. Thomas.

RICHELIEU AND ONTARIO NAVIGATION CO.

The substance of the report presented at the annual meeting of the R. and O. Navigation Co., on the 19th Feb., appeared in our last issue. While the receipts increased 11.26 per cent. over 1893, the running expenses were 11.46 per cent. less than in 1893—a high tribute to the good management of Mr. Gildersleeve. The total number of passengers carried last year was 797,646. N. K. Connolly, president, presided at the meeting, and after the reports were read, Mr. Gildersleeve, as general manager, made a short but practical address, in which he expressed his assurance that the company now had the confidence of the public, and his belief that the coming season would be a prosperous one. The following board of directors was elected: L. J. Forget (president), Wm. Wainwright (vice-president), M. Connolly, Hector Mackenzie, F. C. Henshaw, and Rudolph Forget, of Montreal; N. K. Connolly and J. Lewis, Quebec; J. Swift, Kingston, and C. O. Paradis, Sorel.

A very large amount of repairing and reconstruction has been going on at the company's works, Sorel. The "Magnet" has been converted into what is practically a new steamer, and will be put on the Montreal-Hamilton route under the name of the "Hamilton." Four or five other steamers have new boilers, and a large quantity of new machinery has been put in. Plans are under consideration for two large new steamers, as large as may be accommodated by the new canal locks—250 to 260 feet—but as some nice points in navigation have to be determined where it is necessary to get the largest and best craft for combined lake, river, and canal service, no rockless haste will be made in this matter. The Lake Ontario route will open about 1st of May, the St. Lawrence the latter part of April, and the Saguenay route about the 10th May.

COMMERCE AND PHYSICAL FEATURES OF THE GREAT LAKES.*

BY MAJOR HENRY A. GRAY, C.E.

The constantly increasing importance of the Great Lakes for the purpose of commerce having recently caused considerable public attention on both sides of the Atlantic, it is thought that this paper on the commerce and physical features of these waters, prepared from notes and observations made from time to time during the past fifteen years, and from information gathered, during that period, by the writer, while filling the position of engineer in charge of the Public Works of Canada in the lake district, will be of interest. The average season of navigation on the lakes is about 220 days. In order to give an idea of the extent of the commerce on these lakes, it is shown that the annual average net tonnage for the last five years of the Suez Canal—a world's channel of com-

The sailing vessel has almost disappeared from the lakes. The square-rigged ship is no longer seen, and only a few of the great cargo-carrying schooners are left. The sailing fleet was succeeded by the "propeller," as it is known locally, with its tow of one or more consorts, and it, in turn, is giving way to the modern steamer, maintained at little more than one-half the cost, while having a carrying capacity quite as great, a speed double that of the propeller and consort, and making two or three round trips for one of the tow. Of large capacity and great power, regardless of wind or weather, the steamers of the prevailing type bear their cargoes to and from ports a thousand miles apart, with the precision of railroad trains, each of them transporting at once more than ten ordinary freight trains.

The work of this lake shipping is given approximately by the United States census report, 1890. The freight movement in 1889 on all the lakes was estimated by that report at 53,424,432 tons. The tonnage put afloat since then has increased this movement to 63,240,514 tons. Estimates only can be given, because at one point only on the lakes, Sault Ste. Marie, is there an official record made of tonnage movement. The movement through the Detroit river alone, in 1889, was estimated at 36,203,586 tons. The total entries and clearances, foreign and coastwise, for the port of London that year (1889), were 19,245,417 tons; of Liverpool, 14,175,200 tons. The estimate of the tonnage movement through the Detroit river, in 1889, was 3,000,000 tons above the combined foreign and coastwise tonnage of London and Liverpool.

The rapid growth, too, of steam transportation, and the competition of lake lines with the railways, have caused continued reductions in the cost of transportation. The cost per ton per mile of carrying freight, an average distance of eight hundred miles, was one and one-half mill in 1889. The value of all the cargoes—27,500,000 tons—carried on the lakes during that year was over \$315,000,000. Had this been carried at railway rates, the cost to the public would have been over \$433,000,000; by the lake rates it was about \$23,000,000 only; so that transportation on the lakes saved to the public about \$120,000,000 in one year. But, as to a large portion of this tonnage, any possible cost on wheels would not have permitted it to move at all. In such a case, its production at the point of origin would, of course, have been impossible. That, in turn, would have halted the pioneer emigrant this side of the richest areas of the continent.

The average distance for which freight on the lakes is carried is 566 miles. From this, the Census Bureau estimates the ton mileage for the season of 1889 to be 15,518,360,000 tons miles. The aggregate ton mileage of railways for the year ending June 30th, 1889, was 68,727,223,146, which shows the ton mileage of the lakes is nearly one-fourth of the total ton mileage of railways in the United States. In no other way could the relative importance of lake commerce be more effectively shown.

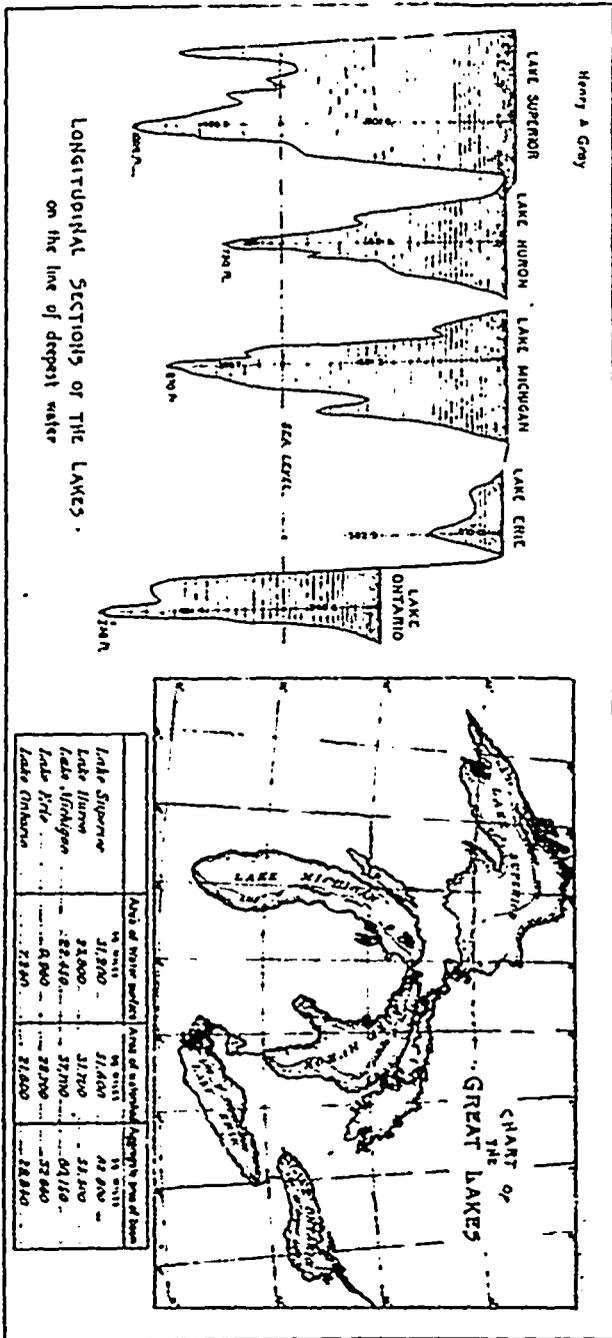
During the season of 1879, grain was shipped from Chicago to Liverpool for 17 cents per bushel, a rate but little greater than was paid for transportation by canal from Buffalo to New York, only ten years before, that is in 1869. In 1890, grain was shipped from Chicago to Liverpool for 9½ cents per bushel.

The extraordinary growth in shipbuilding and commerce on the lakes implies corresponding changes of conditions as to population and production along the thousands of miles of their shores and in the tributary country. Such equipment and use of these waters mean industrial activity and large advance in population.

	1880.	1890.
Four cities on Lake Superior had population	5,528	64,147
Four cities on Lake Huron and Lake St. Clair	181,610	304,863
Twelve cities on Lake Michigan	734,196	1,502,663
Seven cities on Lake Erie	420,685	675,310
	1,342,019	2,546,983

An increase of population in ten years of 85 per cent.

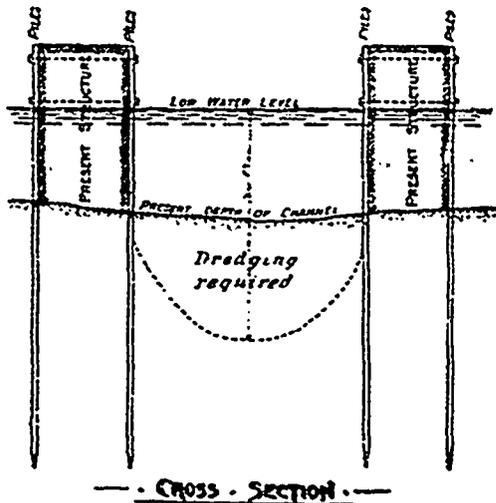
The Government of Canada has expended a large amount of money, in some instances assisted by the municipalities, on these lakes, in constructing breakwaters, piers, wharves, and in dredging out approaches to harbors and channels entering same, as well as inner basins for vessels to lie in, both for commercial purposes and refuge. Up to the time of Confederation the amount expended by the Public Works Department of Canada for the above purposes was \$390,699 25, and from that period until the 30th June, 1893, the expenditure was \$3,439,364.63, making a total of \$4,330,063.88. This does not include the construction of a dry dock at Kingston, nor the Canadian canal and locks at Sault Ste. Marie. Owing to the low stage of water in the lakes during the past two seasons of navigation, considerable demand has been made upon the Department of Public Works of Canada for dredging out



merce, and open every day in the year—was 6,983,167 tons; the annual average net tonnage of the lock and canal, at Sault Ste. Marie, for the same period—open only an average of 220 days in the year—was 6,821,062. The registered American tonnage of the lakes, June 30th, was 1,154,878 tons; 1,592 steam vessels, representing 736,751 tons, and 2,008 sail, 418,118 tons. The tonnage has more than doubled in the last five years, the increase being almost exclusively in steel steamships of 1,500 to 2,500 tons register. The number of Canadian vessels on the lakes is 647, tonnage 132,971; valuation, \$3,989,130. The total of coast and inland shipping registered in Canada is 7,153 vessels, of 1,040,481 tons register, valued at \$31,213,430.

*Presented before the Canadian Society of Civil Engineers.

channels at the entrance to many of the harbors, and also for a continuation of the dredging inside the harbors, to enable vessels to enter for the purpose of loading and unloading. Care had to be exercised in directing these operations, from the fact that when the present piers and other works were constructed at the several harbors, some years ago, these structures were considered quite safe, and as serving all purposes for which they were intended, if extended and built in from 10 to 13 feet of water, as vessels drawing these depths were the largest afloat. Recent years have developed a much larger capacity in vessels trading upon the upper lakes, and, consequently, a deeper draught. To accommodate this increased size and draught, and even to give access to those of less tonnage during the low stage of water, the dredging required was, in many cases, lower than the foundation of the structures. To obviate the difficulties and danger to the present structures—where the increased depth is required—it has become necessary to protect the piers, etc., by driving sheet-piling along the sides and ends; this method is the least expensive. The sketch below shows the method adopted:—



With respect to the low stage of water in the lakes, referred to above as having caused the Department of Public Works of Canada considerable attention and expenditure of money for dredging purposes during the past two seasons, various theories have been advanced to account for the several changes in the water level of the lake; it is, however, well established that the fluctuations are due to the variations in rainfall, as the lake levels approximate closely to those of rainfall and snow. The highest known level occurred in 1838, when Michigan and Huron rose 26 inches above ordinary high stage, and Erie and Ontario 18 inches. The lowest level was in 1819, when Erie fell 3½ feet below its usual plane. Since the highest water in 1838, there have been alternate periods of descension and ascension of the levels, either five, seven, or eight years in lengths, the seven year period being most frequent. In order to show the fluctuations of the water surface, rainfall, etc., as stated above, the accompanying chart of Lakes Huron and Michigan has been prepared, copied from information compiled from official data, obtained from the U. S. Lakes Survey, and tabulated by Mr. Chas. Crossman, U. S. Engineer at Milwaukee. The chart embraces a period from 1861 to 1894. A careful examination will show that from 1882 to 1888 the surface of Lakes Michigan and Huron was considerably above the mean level. The water, at the present time, is about the average of the period from 1882 to 1887, and judging the future by the past, it is probable that for several years to come there will be no permanent increase in depth. By this chart, the relation between the rainfall and the stage of the lake can be perceived unmistakably in the spring, autumn, and summer of 1876, the remarkable rise of water, culminating in September, 1876, corresponding with a period of heavy rainfall. This period was followed by a few months of light rainfall, during which the water fell rapidly. From this time until December, 1879, the rainfall was, as a general thing, less than the mean, and the water surface had a downward tendency. In January, 1880, began a period of heavy rainfall and a rise in the water. From June to August, 1881, the rainfall was light and the stage of water a falling one. In September there was the heaviest rainfall known for many years, accompanied by a correspondingly rapid rise in the water.

While there is every reason to believe that a winter of continually freezing weather, by retaining the snowfall until the thawing weather of April or May, will tend to raise the summer level of the lake at the expense of the winter level, it is not confirmed to any great degree. The explanation of this is not difficult. A single

week of warm weather in the winter, causing the melting of the greater part of the snow, might be preceded and followed by extremely cold weather, giving a low mean temperature for the month; so that a cold winter does not necessarily imply the impounding until spring, in the form of snow, of the winter rainfall. Vessel owners and captains state that the water in the several lakes must have decreased and fallen, as it is now found more difficult to enter the several harbors and navigate the channels. Others have remarked that the deepening of some of the channels lying between the chain of lakes has caused a drainage and lowering of the water in the lakes; others, that the wearing away of the crest of the rock at Niagara Falls has lowered the water above that point.

In making these and other assertions and statements, these persons seem to forget entirely that the vessels used now are larger, and draw from six to ten feet more water than they did some few years ago, and, consequently, require a corresponding greater depth of channel and harbor accommodation. General Poe, Lieut.-Col. of Engineers, U. S. Army, in charge of the Lake District for the American Government, writing upon this subject, states:—"There is no indication anywhere that the waters in the lakes have mysteriously fallen. The long continued series of observation, now available, show that since 1838 the water level has fluctuated within limits somewhat less than 6 feet, and that these fluctuations were due to the greater or less rain and snowfall. It may be considered, as a fact established, that the lakes are simply great pools forming part of the course of a river, and that they conform to all the laws governing the rise and fall of rivers."

In 1881, it was stated by the Toronto newspapers that the level of Lake Ontario had been lowered by work done at the Galops Rapids, in the St. Lawrence river, and that the harbor of Toronto had been damaged by it. It was proved, however, that thirty years before the deepening of the Galops channel was begun, the water was as low in Lake Ontario as it was in 1881. The best authorities on hydraulics show that no harm can result from deepening the several channels, for it is a theory of permanent motion that a change of regimen being made at any point of a river, its effect is extended up and down stream, decreasing as it goes until points are reached where it disappears entirely, and the river remains unaffected.

In the following it is endeavored to give a part of the latest and most reliable information relating to the Great Lakes. The lately completed lake surveys made by the United States have reduced to exactness much that was previously only approximate.

The water surface of the Great Lakes, with the land draining into it, presents the total drainage basin of over 270,000 square miles, assembled as follows:

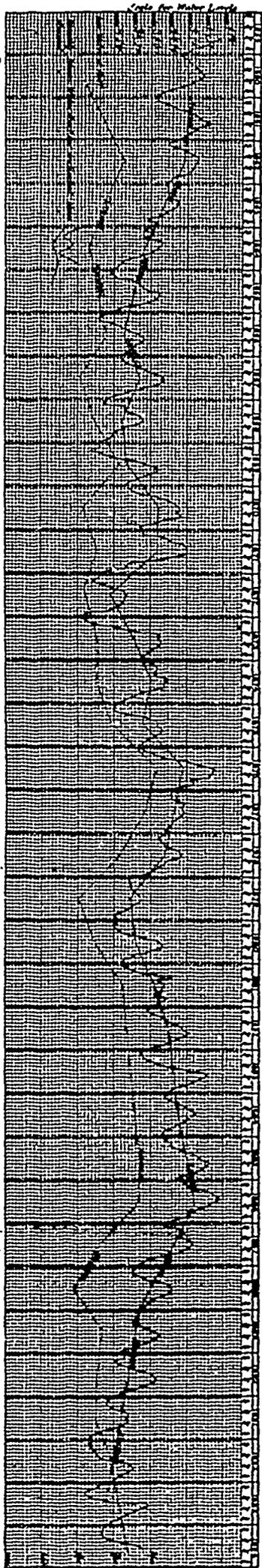
	Area of Water Surface, Square Miles.	Area of Water Shed, Square Miles.	Aggregate Area of Basin, Square Miles.
Lake Superior	31,200	51,600	82,800
St. Mary's River	150	800	950
Lake Michigan	22,450	37,700	60,150
Lake Huron and Georgian Bay.....	23,800	31,700	55,500
St. Clair River	25	3,800	3,825
Lake St. Clair.....	410	3,400	3,810
Detroit River.....	25	1,200	1,225
Lake Erie	9,960	22,700	32,660
Niagara River	15	300	315
Lake Ontario.....	7,240	21,600	28,840
	95,275	174,800	270,075

The combined areas of the lakes exceed the area of England, Wales and Scotland.

The accompanying figure is a carefully drawn chart of the lakes, and compilations showing area of water surface, water shed and aggregate areas of basin; line of greatest depth and longitudinal sections on that line, with heights and depth referred to sea level. The length of shore line of the lakes and their connecting rivers is about 5,400 miles. The elevation of the mean surface of the lakes above mean sea level is as follows:—

Lake Ontario	246½ feet.
Lake Erie.....	572½ "
Lakes Huron and Michigan.....	581½ "
Lake Superior.....	601½ "

The difference of 20½ feet between Lake Superior and Huron occurs in the rapids of St. Mary's river; the 8½ feet between Lakes Huron and Erie, mainly in Detroit river. The difference of 326 feet between Lakes Erie and Ontario occurs in the vicinity of Niagara Falls, and is principally assembled as follows:—100 feet in the five miles of rapids between Lewiston and the lower Suspension Bridge, 10 feet in the rapids between the Bridge and the Falls, 160 feet at the Falls, 50 feet in the rapids immediately above the Falls, and 6 feet in the upper Niagara river. The mean depth of



Henry A. Gray

CHART SHOWING
FLUCTUATIONS OF THE WATER SURFACE AND RAINFALL
LAKES MICHIGAN AND HURON.

Lake Superior is about 475 feet; the deepest point marks a depth of 1,008 feet, or 406 feet below the level of the sea. Lake Huron has a mean depth of 250 feet and a maximum depth of 750 feet. Lake Erie is comparatively shallow, having an average depth of less than 70 feet and a maximum of 210 feet. Lake Ontario has a mean depth of about 300 feet and a maximum of 738, or nearly 500 feet below the level of the sea. The channel of the rivers connecting the lakes seldom exceeds the depth of 50 feet. If the lakes could be drained to the level of the sea, Lake Erie would disappear, Lake Huron reduced to quite insignificant dimensions, Lake Michigan to a length of about 100 miles, with a width of 25 or 30 miles, Lakes Ontario and Superior, although with diminished areas, would still preserve the dignity of their present titles as Great Lakes.

A chemical analysis of water taken from the deepest part of Lake Superior failed, under the application of delicate tests, to indicate the presence of salt. The beds of the lakes away from the vicinity of the shore lines, and at depths exceeding 100 feet, are almost invariably covered with clay. Specimens from the deep soundings of Lake Superior were invariably soft clay, varying in color from red to yellow and blue. In the deepest parts, the drabs and bluish tints predominate. The temperature at the deepest points varies little from the mean annual temperature of the surrounding air. The temperature of Lake Superior at depths exceeding 200 feet varies but slightly from 39° F. In Lake Huron, at depths of about 300 feet, the temperatures in the months of June and August were 52° F., while, at a depth of 624 feet, the temperature was 42° F., the surface temperature being 52° F., and the air 64° F. The mean annual rain and melted snowfall of the several lake basins is as follows: Lake Superior, 29 inches; Lake Huron, 30 inches; Lake Michigan, 32 inches; Lakes Erie and Ontario, 34 inches. This is about equal to 31 inches on the entire lake basin. The following represents the average discharges at the outlets of the lakes:—

Lake Superior, at St. Mary's River.....	86,000 cubic ft per sec.		
Lakes Michigan and Huron at St. Clair River.....	225,000	"	"
Lake Erie, at Niagara	265,000	"	"
Lake Ontario, at St. Lawrence River.....	300,000	"	"

If the average discharge of the lakes passed through a river one mile wide with a mean velocity of one mile per hour, such river would have a depth of 40 feet from shore to shore.

The volume of water in the lakes is about 6,000 cubic miles, of which Lake Superior contains a little less than one-half. Perhaps a better idea of this volume may be obtained when it is said that it would sustain Niagara Falls in its present condition for about 100 years.

The principal changes in the elevation of the lake surface are those due to the wind and to rainfall.

During protracted autumn gales, waves have been observed which, through reliable means, measured from 15 to 18 feet above the normal surface. The second class of variation are those due to rainfall, as before stated. The last ten years show a tendency to irregularities which may be due to changes in rainfall and watershed, produced by the rapid destruction of the forests which, ten years ago, covered the basin of the upper lakes. Observations made by the U.S. Survey have established the existence of small tides which, at Chicago, had an amplitude of $1\frac{1}{2}$ inches for the neap tide and about 3 inches for the spring tide. There is still another class of oscillations called *seiches*, which have been already observed in the Swiss lakes, and for which a solution, in all respects satisfactory, has not been offered. Whenever the lakes are sufficiently free from the disturbing action of wind to permit observation, a quite regular series of small waves, or pulsations, can be detected, which have an interval of about ten minutes from impulse to impulse. These pulsations seem to occur almost without cessation on Lake Superior. Besides having tides in common with the ocean, the lakes have well-defined land and lake breezes, the breeze from the lakes landward commencing in summer at 8 or 10 o'clock a.m., and continuing until sunset, and the breeze from the land lakeward from 9 or 10 p.m. until sunrise.

For about one-half the distance across the continent the waters of the St. Lawrence system divide the Dominion of Canada from the United States. The boundary line, beginning on the St. Lawrence in latitude 45 degrees, passes through the middle of Lake Ontario, Erie, St. Clair, Huron, the St. Mary's River and Lake Superior, to a point on its north shore, 124 miles east of Duluth and Superior, the western end of Lake Superior. Lake Michigan is wholly within the territory of the United States. These great lakes contain more than one-half the area of all the fresh water of the globe. They make up the largest system of deep water inland navigation on the globe. No other inland water may bear upon its bosom so vast a commerce, or touches, as this does, the vital inter-

ests of so many millions of men. Lying, in general direction, east and west between the 41st and 47th parallels, they penetrate the tide water on the St. Lawrence. The western extremity of the system, the head of Lake Superior, is 1,700 miles only from the waters of the Pacific. It is 2,384 miles from Belle Isle, at the mouth of the St. Lawrence, and 4,618 miles from Liverpool.

The range of this water system, it will be observed, is entirely within the limits of the north temperate zone, on the line on which population has most freely moved westward, where final settlement is most compact, and where climatic conditions insure the largest returns to capital and labor. Lake Superior, the head of the system, alone receives the waters of 200 rivers. One hundred and fifty miles northwest of Port Arthur and Duluth are the fountains of three of the great drainage systems of the continent. Physical conditions there send flowing waters northward to the ocean through Hudson's Bay; southward, through the Mississippi Valley and the Gulf of Mexico, and eastward, through the lakes and the St. Lawrence. For commercial purposes, the northern drainage system has not yet been utilized; but flowing water will forever be a potent instrument of commerce, southward and eastward, between the interior and the Atlantic coast.

Such are the peculiar and the favoring physical conditions under which two great peoples of English tongue occupy, side by side, the North American continent from ocean to ocean, using in common this continental water-way, and by treaty stipulations interchanging with each other the use of improvements inside their respective boundary lines. From both sides, then, of this continental boundary line, inevitably and forever, will come here for transit into the world's commerce, the products of the vast plains and the mountain region of the far Northwest. On this line, also, to a large extent, will be made the commercial exchanges of the Pacific Slope; Australia, China and Japan.

HAMILTON AND LAKE ERIE CANAL.

A REPLY TO MR. GOLDING.

Editor CANADIAN ENGINEER.

In reply to my article in December, on the Hamilton and Lake Erie Power and Navigation Canal, Mr. Golding stated in your January number that I was away off with regard to the flow of water through aqueducts. I have in this article given the velocity and power that could be given off by a channel 100 feet wide, 10 feet deep, with a slope of 1.5 in 5,000 and a fall of 240 feet, the length of the channel being 40 miles, the distance from Hamilton to Lake Erie via the Grand River and Caledonia.

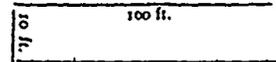
These calculations are worked out from formulae now in general use for this purpose by civil engineers of the highest standing in Europe and America. The flow of water in a rough channel, such as that referred to, would be 213 feet per minute, or nearly so.

Mr. Golding referred to the Mississippi River, one of the two largest in the world, as also to its assumed slope. No comparison can be made with a vast body of water like this river and a narrow and shallow conduit; the retarding and frictional resistances are three times as great in this as in the Mississippi River, and all hydraulic formulae recognize this. The slope in many of the English, European and Indian viaducts is nearly in the proportion given here. In the 40 miles from navigable water on Lake Erie to Hamilton 1.5 in 5,000 would give an inclination of 60 feet. This inclination, according to Rutter's formula, would give the water in the conduit a velocity of 213 feet per minute. Inasmuch as the top of the high lands or plateau above the city is 53 feet above the level of Lake Erie, the top of the water in the canal would have to be 113 feet under the level of the land. Assuming the depth to be ten feet, the bottom would be 123 feet under. This would leave a head of water of 260 feet to the level of Lake Ontario; this head could not be realized as power in practice, so I have adopted 240 feet head to calculate from.

The bed of the river at Caledonia is not less than 30 feet above the level of Lake Erie; the proposed channel, 10 feet x 100, and the slope, according to Rutter and Chegwin, 27 feet for the required velocity up the river, then 10 feet for depth of channel. The river banks are 20 feet above the present river bed; distance from top of river bank to bottom of canal, 87 feet. There is very much higher land than this between Caledonia and Hamilton.

CALCULATION OF VELOCITY AND POWER.

A channel 10 feet deep and 100 feet wide, same as proposed to be adopted from Lake Simcoe to Toronto. I have assumed that this could be more easily constructed than a deeper one in the bed of the river, and would, with the slope given, convey enough water to get all the power that could be utilized at Hamilton for many years to come.



Formula $V = C \sqrt{2 S}$ Cross Section of Channel.
When v is mean velocity in feet per minute,
 c is the velocity coefficient.

r is the mean hydraulic radius = $\frac{\text{area}}{\text{Wetted Perimeter}}$
 s line of inclination of water surface
 c is determined from Rutter's Formula

$$c = \frac{a \times \frac{l}{n} \times \frac{m}{s}}{1 + \left(a + \frac{m}{s}\right) \sqrt{\frac{n}{r}}}$$

$a = 41.65$ $l = 1.81$ $n = .00281$
 n depends on the lining of canal and roughness of surface
 s depends on slope,
 r depends on wetted perimeter, in this case $n = .03$

for channels with rough stones $s = \frac{1.5}{5000}$

slope is 1.5 in 5000 $l = \frac{1000}{120}$ when area is 1000 and wetted perimeter ≈ 120 .

$$C = 41.65 + \frac{1.811}{.03} \frac{.00281}{\frac{1.5}{5000}}$$

$$1 + \left(41.65 \times \frac{.00281}{\frac{1.5}{500}}\right) \frac{.03}{\sqrt{\frac{1000}{120}}} = 71.35$$

in Chegwin's Formula $v = c \sqrt{6s} = 71.35 \sqrt{\frac{1000 \times 1.5}{120 \times 5000}}$
 $v = 3.559$

Discharge $D = A V = 1000 \times 35559 = 3556$ cubic feet per second.

$D =$ Discharge in feet per second,
 $V = 3.5559$ feet per second,
 $A =$ Area of cross section,
 $D = 3556$ cubic feet per second,
 $V =$ Mean velocity in feet per second.

$$3556 \times \frac{60}{1000} = 213 \text{ feet velocity per minute.}$$

$3556 \times 62 \times 60 \times \frac{240}{33000} = 90,933$ theoretical H.P. Allowing for loss in transmission, loss of head friction of machinery, resistance of dynamos, etc., not more than 60,000 H.P. can be realized in electric potential; there is a loss en route from leakage, evaporation, etc., that cannot be estimated. I have gone fully into this to justify myself in my previous statement of head required, and to show that Mr. Golding is away off in this, as much as he was in his statement that Lake Erie water would flow up to Caledonia against an incline of more than 30 feet. I still assert that in a channel such as is described, to get a velocity of 240 feet per minute, 2 feet to the mile of a slope would be required. I would like Mr. Golding to show me if I am wrong in the calculation given in this article.

I do not wish for a mere general assertion, but mathematical proof of the position he assumes on this matter proved from formulae that can be relied upon. I have had no alternative but to give this explanation to justify myself, as Mr. Golding's letter to you criticizing my statement has been published and copied into other papers; he there denies my correctness without giving the slightest proof, mathematical or otherwise, bearing on the question of the channel referred to. I am sorry I have had to occupy so much of your valuable space in defending myself on this matter. It is a wet question that may be considered dry by the majority of your readers.

Hamilton, 21st Feb., 1895.

J. H. KILLEY.

CANADIAN MANUFACTURERS' ASSOCIATION.

The twentieth annual meeting of the Canadian Manufacturers' Association was held in the association's rooms, Toronto, on the 27th February, W. H. Law, president, in the chair. Resolutions were adopted putting on record its opposition to any change in the fiscal system of the country, congratulating Sir Mackenzie Bowell upon his elevation to the Premiership, and promising him its support, declaring in favor of the creation of a railway commission to prevent discrimination in freight rates, and favoring the idea of Imperial Federation. The following officers were elected: President, A. E. Kemp; first vice-president, Jas. P. Murray; second vice-president, James Kendry; treasurer, George Booth; secretary, J. J. Cassidy; chairman executive committee, R. W. Elliot; chairman tariff committee, W. K. McNaught; representatives to the Toronto Industrial Exhibition Association, George Booth, R. W. Elliot, W. K. McNaught, Samuel May, and J. J. Cassidy.

LITERARY NOTES.

Electric Power, now in its seventh year, last month appeared in an entirely new form and dress. It is now a magazine both as to size and character—a change which the readers of electrical science will greatly appreciate. The first number of the new form is handsomely printed and contains many excellent illustrations. The reading matter is less technical in its nature and is interesting to those who wish to know something of what is going on in electricity and yet do not care to make a study of the science. *Electric Power* is well worth the subscription price of \$2 a year. It is published at 30 Cortlandt street, New York.

"Practical Application of the Indicator," by Lewis M. Ellison, C.E., Chicago, is a handsomely bound and printed book on the subject indicated. Besides a mass of other valuable information, diagrams, &c., the book contains complete instructions for attaching and manipulating the indicator, working up the diagrams with and without the planimeter, &c., illustrations of Corliss, sliding, cut-off and single-valve automatics, with directions for adjusting with the indicator, variation in cushion with and without condenser attached, indicator applied to steam and water cylinder of boiler-feed pumps and ammonia-compressors, tables of useful information, etc., etc. Price \$2, postage paid to any address.

J. A. Marion, the well-known civil engineer and patent expert, of Montreal, has issued a very instructive pamphlet on the subject of Patents, Trade-Marks, Copyrights, etc. It gives much useful information on Canadian and foreign patents, how to obtain and sell them. The book, we understand, is free to seekers after knowledge in this line.

The Packard Electric Company (Ltd.) have issued a very artistic little catalogue, showing illustrations and setting forth some of the points of superiority of the well and widely known Packard lamps. Since 1890, when the Packard was first put on the market, this lamp has created a high reputation, and this has been constantly increasing ever since. This little catalogue also gives particulars of all sorts of electric light appliances, such as reflectors, shades, transformers, etc., in the manufacture of all of which articles the Packard Company have a reputation equal to that of their lamps.

One of the best catalogues recently issued is that of E. Leonard & Sons. This firm are very well known as manufacturers of the Leonard Ball Automatic and all sorts of engines and boilers. Their machine shop, devoted to the manufacture of steam engines of all kinds, is one of the finest and best equipped in the Dominion. The catalogue contains large illustrations of the chief engines, etc., made by them, and those interested will be greatly pleased by a perusal of it.

We are in receipt of the third Report of the Bureau of Mines for 1893, printed by order of the Ontario Government. This book contains statistics and full particulars of what development has taken place in the gold, copper, mica and nickel mining industries, as well as information about rocks and building stone, vitrified brick for street pavements, moss litter, etc. There are also the reports on the visits of the mining inspector to the various mines of the Province of Ontario.

Alex. Rankine has issued his first catalogue since becoming proprietor of the St. John, N.B., Bolt and Nut Works. This factory manufactures all kinds of screws, bolt ends, railway track bolts, spikes, iron and steel rivets, nuts, etc., and all these articles are first-class in every respect. It is the new owner's desire not only to keep up to the former standard, but to continually improve on the quality and finish of the goods turned out.

The *Canadian Magazine* is making good headway, and the February number is very creditable. The "Royal Military College," its aims, relations, etc., is ably dealt with in an illustrated article by Col Cotton and others. Barlow Cumberland writes a most interesting illustrated article entitled "Manitoba Revista." An article sure to attract the attention of members of fraternal societies especially, is Dr. Ferguson's on "False Insurance Methods." "A Forgotten Chapter of the War of 1812," the events which occurred in North Simcoe during that war, is contributed by A. F. Hunter, M.A. Hampden Burnham writes a charming notice of Mrs. Trill, the famous Canadian author, now 93 years of age. Keppelle Strange, Elgin Meyers, Q.C., Prof. Gwillim and Mrs. Carzon supply an agreeable variety in the way of fiction, and Seranus furnishes a strong poem entitled "Friends on the Astrakan Ranche." The *Magazine* is published by the Ontario Publishing Co., Ltd., Toronto.

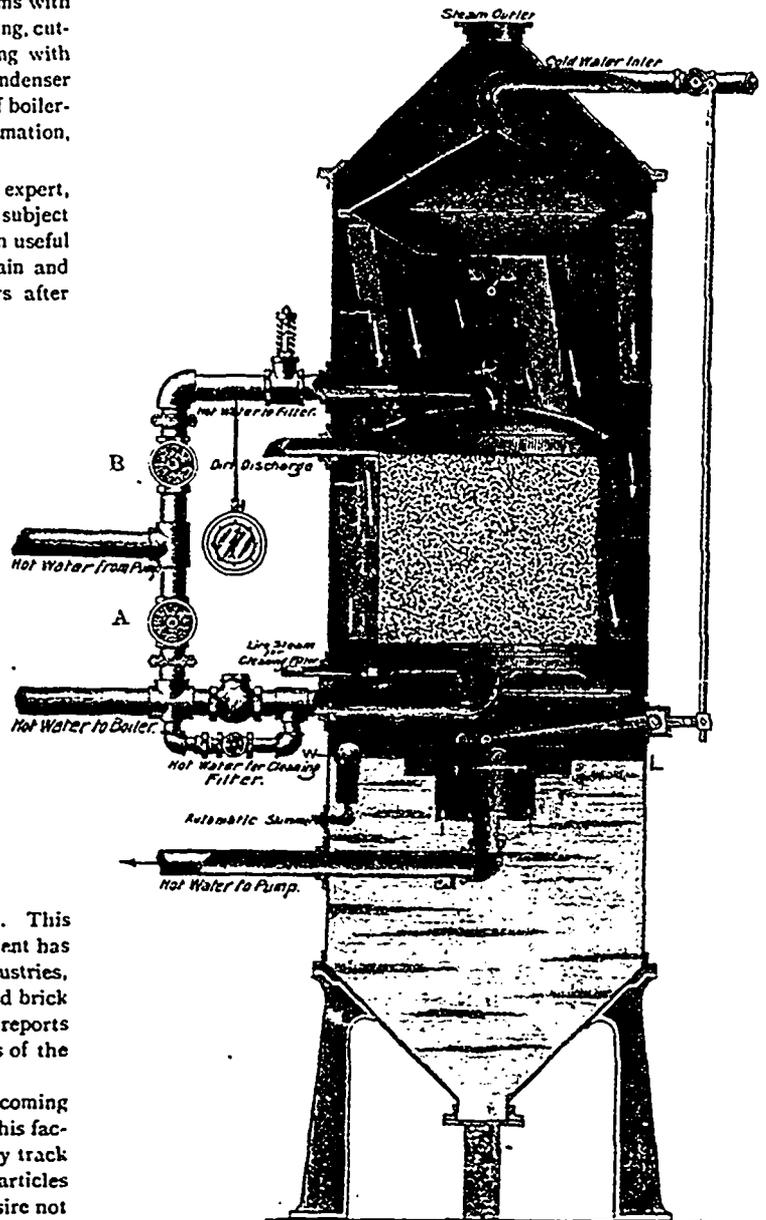
THE BELL FEED WATER HEATER AND PURIFIER.

The accompanying cuts illustrate the principle of the Bell Feed Water Heater and Purifier, for which the Caledonia Iron Works (John McDougall, proprietor), Montreal, are sole manufacturers in Canada.

These heaters do not depend solely on plates or trays for the collection of impurities contained in the water, nor are they simply heaters having tubes or coils which in time become so thickly coated with scale as to render them useless.

It is claimed for the Bell that it always gives a supply of absolutely pure hot water, and it can be cleaned out at any time, even when it is in operation. These features add much to its effectiveness.

The Bell Heater and Purifier is thus described by the well-known firm who have undertaken its manufacture in Canada.



SECTIONAL VIEW.

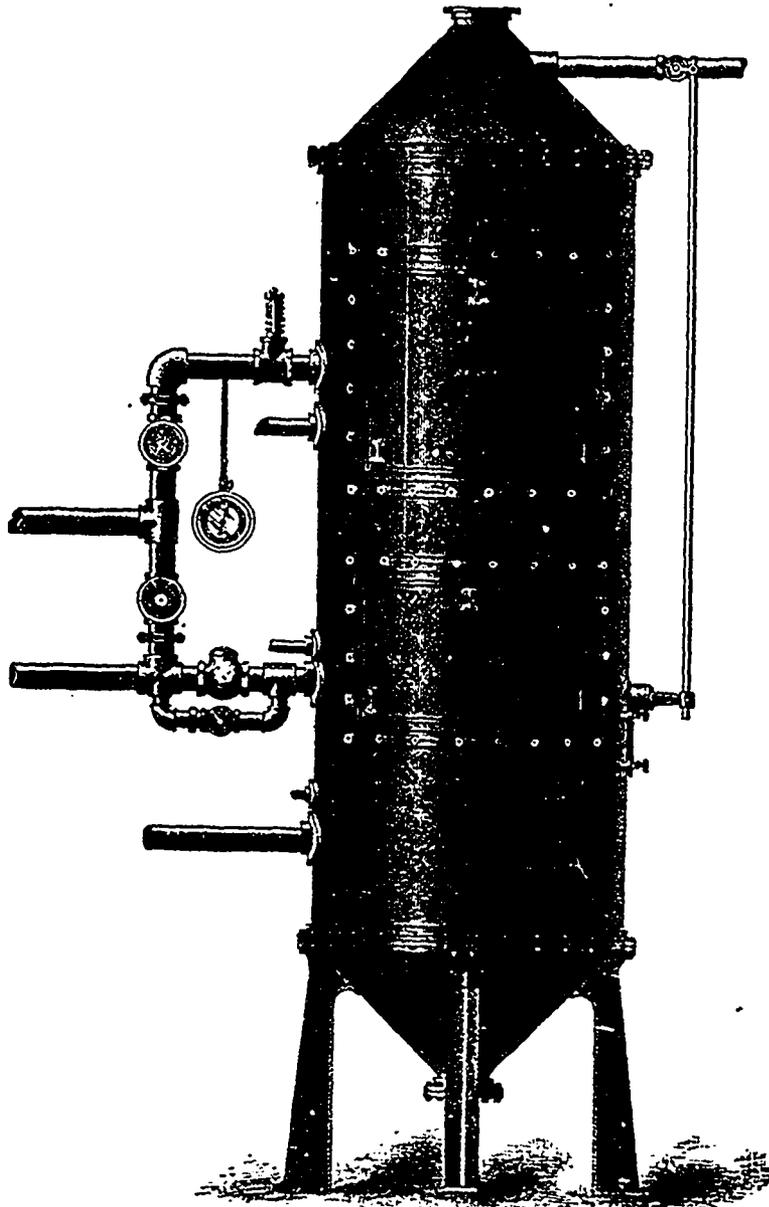
The exhaust steam from the engine is utilized in this heater for heating the water. The steam in entering into it comes in direct contact with the cold water as it descends from the hood or distributor, and passes over the surfaces of the spiral plates that are set almost vertically in the steam space. The water is, thereby, made to boil almost as soon as it enters the heater, so that the carbonic acid gas is driven off, setting free the carbonates of lime and magnesia that were held in solution in water. These, again, are drawn off with the water by the pump and sent through the filter (the filter being placed in the steam space) and caught and held there, so that only hot water is sent to the boiler in an absolutely pure condition. The boiler is, therefore, always clean and free from scale.

The filtering material in the filter can be cleaned at any time without interfering with the action of the heater when in operation, or of stopping the flow of water to the boiler. It is cleaned

out by opening valve A and by closing valve B; the valve on the dirt discharge pipe is then opened, after which the live steam is turned on through the pipe that is placed at the bottom of the filter, so as to blow all the dirt up and out by the dirt discharge pipe, but, if desirable, hot water can be used instead of steam for cleaning the filtering material by opening the valve on the bye-pass pipe instead of turning on the live steam.

The engine is relieved from back-pressure when the Bell heater is used, as the exhaust steam is, to a large extent, condensed by coming in contact with the cold water on entering the heater. It can be used to advantage in connection with condensing and non-condensing land or marine engines, the steam from any of their auxiliaries being sufficient to raise the temperature of the water to the boiling point.

The importance of having a system whereby water can be relieved of its impurities, including lime, is well understood by steam users, yet they do not seem to realize the evil effects of scale in boilers, and that scale is a poor conductor of heat, being only



EXTERNAL VIEW.

as about 1 to 37 compared with iron. The effect of that rate of comparison on the fuel bill, as well as on the life of the boiler, is very serious. For instance, an incrustation of one-sixteenth of an inch of scale in a boiler will take about 15 per cent. more fuel than what would be necessary if the boiler were clean, and the ratio increases as the scale grows thicker. For example, to keep the steam pressure in a boiler at 90 lbs. to the square inch, the heat on its fire surface would require to be kept at about 325 degrees Fah., but it would be necessary to raise the heat up to 700 degrees Fah. to be able to sustain a like pressure if the boiler had an incrustation of half an inch in thickness; this would mean an actual increase in the fuel needed of about 150 per cent. Such results from such conditions raise the question of economy at once, and the only way to obtain that end to the best advantage is to put in the very best heater and purifier that money can buy, and great care should be exercised in making the selection.

CANADIAN ASSOCIATION OF STATIONARY ENGINEERS.

Editor CANADIAN ENGINEER:

SIR,—It gives me much pleasure to send you this report of the C.A.S.E. of this town. We have 21 members, all in good standing, and expect to have at least four more added to our number in the near future. This, I think, considering the examination they have to pass before they can become members, speaks well for the engineers of Brockville. I have no doubt about our prosperity here as long as our members take such interest in attending our meetings as they are doing at present, and under the management of our energetic president, W. F. Chapman, we cannot fail to be successful. We meet twice a week, which we think is none too often. The blackboard has the heaviest burden to bear. Its face is always pale with the load of questions and answers it has to support. In my own humble opinion our association, although still in its infancy, is going to make engineers who will deserve the name of their profession in every respect. And I would consider it very ungrateful to our employers who place in our care the most expensive part of their property, as well as loss to ourselves, if we did not avail ourselves of this splendid opportunity to get better educated for the performance of our very responsible employment. By attending our meetings we learn from one another what we could not learn otherwise, the safest management of boilers, which means the preservation of life and property, and the most economical plans of everything pertaining to an extensive steam plant. Our motto is safety, reliability, economy and intelligence. On the 17th of the month we were favored with a call from Brother A. M. Wickens, of Toronto, who, on one of his official visits, dropped in and gave us a very interesting lecture on "Heat." A vote of thanks was tendered him by all present. He then accompanied us to Stollicker's saloon, where an oyster supper was prepared for us. We hope soon to be favored with another call from Bro. Wickens. On behalf of the members of this branch of C.A.S.E., I return thanks for the New Year's greeting kindly sent to me for distribution among our members by Bro. John J. York, executive president, through Bro. James Devlin, executive secretary C.A.S.E.

JAMES ATKINS, Recording Secretary,
Brockville Branch, No 15, C.A.S.E.

February 6th, 1895.

Hamilton, No. 2, is still alive. Although not making as many new members as we would like of late, we are still on the progressive side. We continue our open meetings, and we find them quite a benefit. At our last open meeting we had a very interesting time. After a good discussion on some points of interest, Bro. Brice, of the Brice Electric Works, and a member of this branch, gave the members quite a treat in the shape of a talk on "Electricity." Bro. Brice being a practical electrician, was able to handle the subject in a manner that made the talk instructive as well as interesting, striking on the very points that an engineer needs most in the handling of an electric plant. It will be as well to note that Hamilton, No. 2, is about to make arrangements for their annual supper. We intend to make it the usual success.

W. NORRIS, Cor. Sec.

A meeting of Peterborough Branch, No. 14, was held on the 13th ult. in the Sons of England Hall. An interesting paper on "Steam Heating" was read by President S. Potter, and another by T. Duncan, on "Energy."

At the meeting of Montreal No. 1, C.A.S.E., on the 21st ult., two new members were elected. The principal other business was the revision of the by-laws. One amendment was adopted raising the entrance fee from \$2 to \$3. And another amendment was passed dealing more stringently with delinquents. It was also decided to impose a fine upon committees who failed to bring in a report within the time specified. The amount of these fines is left to the general meeting, and will vary from 25 cents to \$1 upon each member of the delinquent committee.

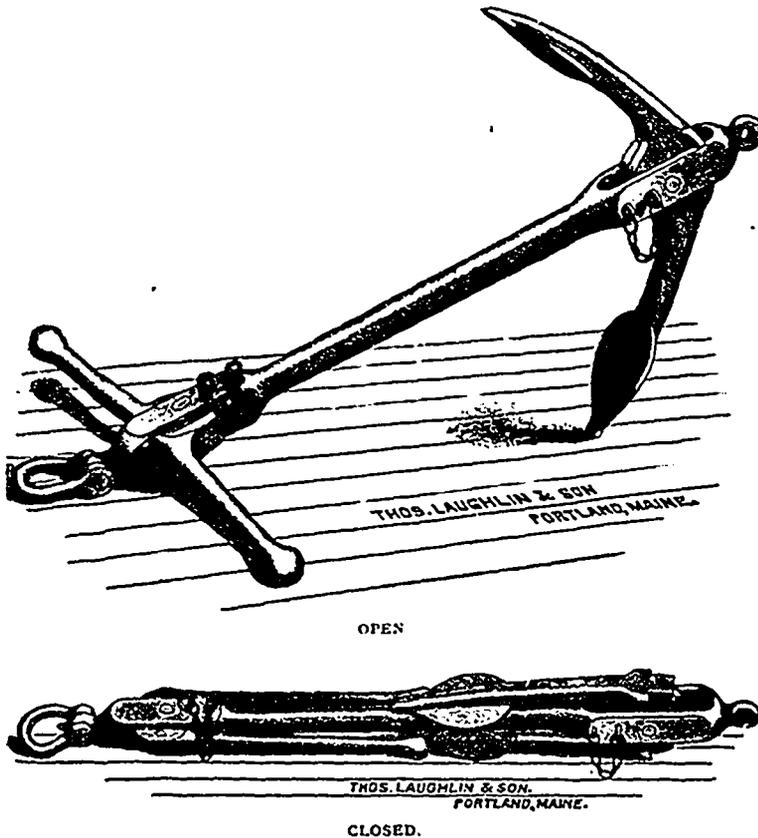
The "Société Mutuelle d'Ingenieurs Mecaniques de la Province de Quebec," recently formed in Montreal, is making better progress than was expected when the association was first organized. R. Drouin, the president, is very active in the interests of the association and is energetic in obtaining new members.

Winnipeg Association No. 11, C.A.S.E., have installed the following officers for the current year. President, G. M. Hazlett; vice-president, John McKechnie; recording secretary, W. J. Edwards; financial secretary, Thos. Gray; treasurer, J. Stuart; conductor, W. F. Brown; doorkeeper, Robt. Sutherland; trustees, Bros. Harper, Douglas and Whyte. This branch are arranging now for a meeting room of their own, and the members are showing increased activity.

The fifth annual dinner of Montreal No. 1 was held in their own hall on Feb. 2nd. President John J. York in the chair. On his right sat A. E. Edkins, district deputy for Ontario, the representatives of the locomotive engineers, Past President T. Ryan and P. Cowper. On the left were Past President Hunt, I. Marchand, president St. Lawrence No. 2, J. Joly, secretary No. 2, and others. After the many good things on the *menu* had been carefully attended to, cigars were lit and the toast list began. P. Cowper, the friend and benefactor of No. 1, replied to "Steam Engineering," giving the members much valuable advice. He, however, brought down the house when he alluded to our venerable Past President Ryan as "the man with the silver mounted face." The somewhat lengthy toast list was interspersed with songs and recitations by Bros Joly, Nuttal, O'Neil, Edkins, Weaver and Nadin, Bro. Driscoll presiding at the piano. A novel toast on the list was "Our tormentors, the oil and supply men," and although creating much fun brought out good replies from J. Sclater and J. Lamontagne. O. E. Granberg on "License Law and Inspection" was a treat not to be missed. Wm. Green and T. Fisher on "Manufacturing Interests," Mr. Spence for the "Locomotive Engineers," Mr. Edkins for "Sister Associations," proved themselves to be able speakers and well posted on the subjects before them. Midnight was soon reached, and it being Saturday night, the chairman brought down the gavel as a signal, and all present joined in singing "God Save the Queen" and "Auld Lang Syne," everybody going home satisfied with the evening's enjoyment.

THE DIRIGO FOLDING ANCHOR.

The Thomas Laughlin Co., the well-known manufacturers of ship specialties in ship supplies, Portland, Maine, whose new steering gears were described in last number, are the makers of a very ingenious and withal most serviceable folding anchor. In this anchor, of which illustrations are here given, both stock and flukes



fold up, and the same pin keeps them open or closed as desired. They are made in galvanized iron in the small sizes. It is claimed for these anchors that while they can be made so compact for stowage, they have all the good qualities of the old-fashioned anchor. This invention, like the steering gear made by the Thos. Laughlin Co., was awarded the highest honors at the World's Fair, Chicago.

ERRATUM.—In the biographical notice of Herr Fried Krupp, in our December issue, the number of employes in that great establishment was put down by a typographical error as 2,700. The number should have been 27,000.

THE HAMILTON AND LAKE ERIE POWER CANAL.

NEW ORLEANS, LA, February 21st, 1895.

Editor CANADIAN ENGINEER:

SIR,—Replying to your correspondents, Messrs Killey and Holgate, who have criticised my scheme for bringing water from Lake Erie to Hamilton, I desire to say. Every scheme must have a beginning, some one must make the first suggestion, which, if the matter be of interest to the public, will be in order for persons who have in their possession facts relating to the subject, to present the same for consideration, while to discourage well-digested schemes by simply pointing out great difficulties, can serve no useful purpose. The original suggestion need not recite more than a general outline of the scheme, to be entitled to respect, while those who criticise are expected to supply the facts upon which they found their criticism.

There is nothing in either of the letters to induce me to add to or take from my previous statements. Mr Holgate asserts that the bed of Grand River at Caledonia is about 38 feet above the surface of Lake Erie, but he does not claim to have acquired knowledge from his own or any other survey.

Mr. Killey asserts that the bed of Grand River at Caledonia is 25 feet 6 inches above the surface of Lake Erie, and furnishes a profile of the *surface* of the river to establish the elevation of the *bed*, and in aggregating he errors in including the height of the uppermost dam of 5 feet. Thus corrected, we have the bed of Grand River at Caledonia, as given by Mr. Killey, 20½ feet above the surface of Lake Erie, and, as given by Mr. Holgate, 38 feet.

Now, the fact is, the cut from Hamilton to Caledonia is not affected by the height of the bed of Grand River at all, as the scheme contemplates a channel fifteen feet deep, with a fall of two feet to the mile all the way from Lake Erie to Hamilton. The height of the bed of Grand River concerns only the cubic contents to be excavated for the channel.

I have mentioned Caledonia as the turning point for the cut to Hamilton, yet the turn may be made lower down. My idea of beginning the work would be to complete the cut to Hamilton, including the tail races, then turn in the flow from Grand River and proceed to business. Thus the bed of Grand River would be drained for dry work if found best.

Now if the bed of Grand River at Caledonia be 38 feet above the lake surface, the power to be obtained at this point would be of no small consideration, and could be utilized to advantage in operating the machinery required in excavating the bed of the lower river.

I hope Mr. Holgate will not cut down the 38 foot mark. I also hope that Mr. Killey will stick to that profile, as it will be so handy in keeping the water from Lake Erie out of the river bed during the picnic.

Regarding the impending disaster referred to by Mr. Killey in relegating to the scrap heap all the engines and boilers, and also in requiring the shops engaged in manufacturing same to seek new business, I give as my opinion that, figuratively speaking, all the engines and boilers within a radius of 50 miles of Hamilton are in the scrap heap now, and the manufacturing shops that produce them will, unless they find new business, discover the sheriff's banner on the walls. Electricity, the greatest power transmittent yet discovered, has come to do the work, and it will not be long before the people of Hamilton and vicinity will realize that to hold the title of champion manufacturing centre, it will be necessary to instal the electric motor.

The anxiety of Messrs. Killey, Holgate and others lest some one should invest in the scheme, is aptly illustrated by an incident that occurred during the late American War. "During the march of the regiment to the front, every heart full of hope and patriotism, word was sent to the commander saying, 'Halt the regiment, there is a man hurt.' It is needless to state that the regiment did not halt, but reached the field in time to take part in achieving a glorious victory."

It has been related that "Rome was saved by the hissing of geese." Let it not be recorded that "Hamilton was lost by the braying of asses."

I may say I have crossed Caledonia bridge many times, and recollect the bridge as being about 20 feet above the water. On leaving the bridge towards Hamilton there was a perceptible rise in the land in plain view of about 20 feet, and judging from the size of the boats I saw in the stream, the water must have been at least five feet deep. This would take 45 feet from the 53 foot mark; and since all the drainage from the top of the mountain runs to Lake

Erie, several feet more would be taken off, so that I am apt to be near the mark in stating that the bed of Grand River at Caledonia is very little, if any, above the surface of Lake Erie.

It is characteristic of rivers to consist of a series of basins, each emptying or overflowing into the other, so as to retain some water in the event that the supply should fail.

The entire work, as I have shown, is quite simple, and with modern appliances and honest administration \$3,000,000 will be ample. You see the work will all be above water, and if necessary under canvas in bad weather. Everything will be done by machinery—there will be no skilled labor required. All the material and supplies will be furnished from Hamilton. As soon as the cut from Grand River to Hamilton is completed—including the tail races—the revenues will pay the working expenses. I have all confidence in the scheme if honestly and intelligently administered.

Yours respectfully,

WM. GOLDING.

CANADIAN SOCIETY OF CIVIL ENGINEERS.

An ordinary meeting of the society was held on Thursday, February 14th, the new president, Thomas Monto, in the chair.

After minutes of the preceding meeting had been read and received, the discussion on Mr. Orray's papers on "The Commerce of the Great Lakes" was opened. H. K. Wicksteed, of Cobourg, stated that vessels with 18 feet draft were now able to move grain from $1\frac{1}{2}$ to 1 mill per ton mile. He next referred to the approaching withdrawal of 30,000 cubic feet per second through the Chicago drainage canal, or $\frac{1}{3}$ of the discharge of Lake Huron.

President Monto remarked that the Chief of Engineers' report to United States Government showed that the deepening of the Gallops Rapids Channel would not affect the depth of the river more than 4 or 5 miles up the river. The president then commented on the immense tonnage of our great lakes, which is 30,000,000 tons through the Sault Canal and 22,000,000 through St. Clair River per year, showing the greatest increase of any waterway in the world.

The paper was further discussed by Mr. Sproule and others.

The discussion of Prof. Bovey's paper, read at the last ordinary meeting at McGill College, was deferred until later, owing to the important nature of the results given.

A paper on "Cement Testing" (see elsewhere), by Cecil B. Smith, was then read by the author.

After a few remarks and the vote of thanks, the discussion was postponed until next meeting.

REVIEW OF THE METAL TRADE.

MONTREAL, March 1st, 1895.

It is almost discouraging to write anything about the iron and steel trade. The atmosphere surrounding this business for the past year has been very cloudy, and there do not appear any signs of sunshine in the near future. In fact it is a subject of serious consideration to the merchants in this line, that it is just about as well for them to direct their efforts and capital to some other branch of trade, as the close connections that are being formed between producers and consumers are injuring the prospects of the middlemen seriously. The very low prices at which Americans are willing to sell at in this market is a factor that the merchants must take into consideration. This competition from the United States does not come from merchants there, but from the producers themselves, who will sell to any consumer here, even to taking very small individual orders. This is the competition that is closing the merchants more than anything else. Canada is a long stretch of country, and goods can come in all along the line at very cheap freights, while if a manufacturer in the eastern portion of Canada desires to sell his goods in western Canada, he has to freight them a much longer distance, and therefore is not as favorably situated to compete. This, of course, is true of all importations from across the water. We believe raw material is as cheap or cheaper in the United States than any country in the world, but, while labor is no doubt dearer, this is nevertheless offset by their close proximity to this country lessening carriage charges. The financial question and the general depression may be the cause of the American market being the cheapest for Canadians at present, and we think it is hardly safe to venture an opinion as to the future, but the trade will not be surprised if this state of affairs continues, and nearly all iron and steel material heretofore purchased in England and on the continent comes from the United States. This year we hear that some large Canadian orders for wire rods have been placed in the latter market, and we think this is the first time in many

years, all supplies of this kind having been purchased in Sweden and Germany, and doubtless the latter countries will try to meet this competition, but meantime the American market is the cheapest to buy in. There is now a movement on foot to introduce American bar iron to British consumers, but the scheme does not look practicable. There is not any change in prices of any material in this market. They are certainly low enough. Rolling mill stock, scrap iron, etc., has opened at just about the same values as last season, but an advance of \$1 per ton in the duty, which took place on January 1st, makes the material considerably dearer to the mills. It is pretty evident, however, that they will continue to use this material instead of puddling bars, as was anticipated last year. The impending elections and a probable change in the tariff will not help to revive business much, and we must patiently wait, as all other countries are doing, for the outcome of this universal depression.

Industrial Notes.

THE new system of waterworks at Beamsville, Ont., is being laid.

MIDLAND, Ont., town council will build a new fire hall and council chamber.

W. HAMILTON is about to put up a sawmill and a shingle mill at Sand Point, Ont.

THE iron bridge over the Nation River at Casselman, Ont., is to be rebuilt at once.

WINNIPEG is to have a Masonic Temple. The work of building will be commenced in a few weeks.

THE by-law to authorize the raising of \$5,100 in Dundas, Ont., for the building of bridges, has been carried.

THE Canadian Wire Mattress Company's works in Toronto, recently burned down, will be rebuilt at once.

THE Mowat Mfg. Co., manufacturers of agricultural implements at Whitby, Ont., have assigned. Liabilities \$10,000.

THE Kingston Chemical Fire Engine Company have decided to start the manufacture of fire engines and firemen's supplies.

H. C. REESE will rebuild his stove mill at South Woodslee, Ont., putting in the most modern and improved machinery.

L. J. BADAUR, of Oso, Ont., has purchased the Laurie saw and grist mills, with water power, from Peter McLaren, for \$3,700.

THE British Columbia Paper Manufacturing Co.'s mills at Alberni have been closed down, owing to the foreclosure of a mortgage.

HAMILTON fire and water committee recommend the purchase of fifty new hydrants to be placed not more than 300 feet apart.

REEVE EVANS, of Etobicoke, recently called a mass meeting to discuss the advisability of establishing a waterworks system between Mimico and New Toronto.

THE Independent Order of Foresters have decided to erect a palatial building, for head offices, in Toronto. The cost is estimated at from \$150,000 to \$200,000.

THE Kingston, Ont., Foundry and Machinery Co. (Ltd) have leased their premises and plant to Rauey, Reid & Selby, who will carry on the business in all branches.

ROBERT THOMPSON & Co., of Hamilton, have purchased 146½ square miles of timber limits on the Upper Ottawa, known as the Lauzon limits, the price being \$115,000.

FOR the past month about a dozen men have been at work on the new Malleable Iron Works buildings, Oshawa, Ont., and the factory will soon be in a position to run again.

HARVEY MORRIS, manufacturer of cooperage stock, Wallaceburg, Ont., has assigned. Liabilities \$40,000, the chief creditor being the Bank of Montreal. The assets are nearly \$30,000.

THE Toronto Hoop and Veneer Company, capital stock \$50,000, are applying for incorporation. They will manufacture hoops, staves, veneers, etc., and the factory will be at Eugenia, Ont.

THE bridge commissioners of Middlesex county council, Ontario, have awarded the contract for building three bridges to L. S. Pearson, of London, Ont. The price is \$1,200 for the three.

AN immense new chimney is to be built at the Ogilvie Mill in Winnipeg. The height is to be 125 feet, and the inside diameter 7 feet; and 15 to 20 feet in diameter outside at the base. Four new boilers also are to be put in.

F. W. MOYER has started a broom factory in Thorold, Ont.

T. CUSACK is building a lager beer brewery in Buckingham, Quebec.

WORK will start shortly on the new sewerage system at Guelph, Ont.

THE Government will shortly spend \$25,000 in repairs to the Brantford asylum.

FRANK ROGERS & Co. have opened an iron foundry at Richard's Landing, Algoma, Ont.

THE council of Westville, N.S., have voted the \$60,000 required for the new water works.

CARLETON PLACE, Ont., council is calling for tenders for the erection of a new town and fire hall.

THE Stratford Mill Building Co. (Ltd.) is applying for incorporation with a capital of \$30,000.

THE Burlington Pressed Brick & Terra Cotta Co. has sold out its plant, and is retiring from business.

ESTIMATES have been submitted to the village council of Granby, Que., for a new sewerage system.

THE British Columbia Auer Light Co. (Ltd.), Vancouver, capital stock \$30,000, has been incorporated.

MARVIN & TILTON, wholesale hardware and metal merchants, Victoria, B.C., are retiring from the business.

THE gaol and court house committee of Hamilton are asking for an appropriation of \$20,000 for a new gaol.

THOS. ALLISON and D. Graham, of Montreal, are thinking of establishing a new pulp mill at Chatham, N.B.

HUGHES & STEPHENSON, steamfitters, Montreal, have dissolved and the business will be continued by J. W. Hughes.

A PROPOSITION is on foot at Lindsay, Ont., for the town to buy out the local company's waterworks plant for \$60,000.

CHATER & ROUSE, of Guelph and Galt, are establishing in Brantford, Ont., a factory for making laundry machinery.

KNIGHT & LOWE are rebuilding their saw-mill at the Fourth Chute on the Bonnechère, which was burned down last November.

CONTRACTOR BROWN, who is at work building a bridge over the long pond, Toronto Island, says he will complete the work by April 1st.

THOS. SHAW, formerly superintendent of the Albion Iron Works, Victoria, B.C., has opened a boiler shop on his own account in that city.

THE W. G. T. Labelling Machine Manufacturing Co. (Ltd.), Vancouver, B.C., has been incorporated. Capital, \$25,000. W. G. Tretheway is trustee.

JAMES WOOD, owner of the Osgoodby building, recently burned down in Toronto, has taken out a permit to rebuild. The estimated cost is \$35,000.

THE by-law at Springer, Ont., granting a bonus of \$7,000 towards the erection of a pulp and paper mill at Sturgeon Falls, was passed by a large majority.

THE Ottawa Saw Company, who recently established a factory for the manufacture of saws, etc., in Ottawa, have started operations with a force of thirty-five hands.

THE Hamilton city council have again extended the time allowed for the completion of the smelting works, the present extension being from the 1st of July to October 1st, this year.

C. A. KENT & Co., coffin and casket manufacturers, and McLeod Bros., wire mattress makers, Truro, N.S., contemplate amalgamating their business and forming a joint stock company.

ALEX. MCKAY has started in Montreal as a boiler maker and sheet iron worker, land and marine boiler repairing being a specialty. Mr. McKay is a thoroughly practical man, and is sure to succeed.

ST. HENRI Catholic school commissioners are asking the Council of Public Instruction of the Quebec Government for permission to borrow money to build a new school house to cost about \$18,000.

THE Brunette Saw Mills Co., Westminster, B.C., have elected as officers the following. President, J. Wilson; secretary-treasurer, H. L. DeBeck; directors, J. B. Kennedy, H. Macdonald and L. A. Lewis.

THE Diehl Manufacturing Co., Toronto, are applying for incorporation. Capital stock, \$50,000. They will make mantels, furniture, piano keys and other wooden and ivory articles, and also tiles and grates.

A RESERVOIR is to be built at Niagara, Ont., to cost nearly \$50,000.

THE Coquitlam bridge at Westminster, B.C., will probably be rebuilt shortly.

THE Montreal Roofing Co. is to be incorporated, with a capital stock of \$150,000.

WILLIS CHIPMAN, C.E., Toronto, has completed plans for a system of sewerage in Galt, Ont.

THE Hall Mowing Machine Co. of Canada, Sherbrooke, Que., has been incorporated. Capital stock \$100,000.

LEWIS' peg factory at Truro, N.S., which has been shut down for some weeks past, has now started up again.

THE Marion Steel Shovel Co., of Marion, O., are considering the establishment of branch works in Canada.

THE large new grist mill at Moulinette, Ont., is now running. It is fitted with a fine plant of modern machinery.

A NEW steel superstructure is to be added to the Osborne street bridge, Winnipeg. The cost is estimated at \$9,500.

PORT HOPE, Ont., town council invites tenders up till the 15th inst., for the construction of a system of water works.

ROBERTSON & HACKETT are erecting a new saw mill on False Creek, Vancouver, B.C., with a capacity of 35,000 feet per day.

BRACKMAN & KER, oatmeal millers of Victoria and New Westminster, B.C., propose erecting an elevator in Edmonton, N.W.T.

A COMPANY will shortly apply for incorporation for the purpose of building and operating a large summer hotel in Port Dover, Ont.

E. A. EVERETT, hardware merchant, St. John, N.B., has assigned. Liabilities between \$25,000 and \$30,000; assets considerably less.

ARCHIBALD F. M. RATTENBURG, Victoria, B.C., has completed plans for a new stone court house for Nanaimo. It will cost about \$35,000.

THE pulp mill and match factory at Moss Glen, N.B., are closed down owing to a strike of the operatives on the ground of non-payment of wages.

WARD's timber limits on the Rouge River, Ottawa district, comprising 550 square miles, have been sold to E. J. Swan, of New York, for \$100,000.

ROBT. BLOW's carriage factory and W. Bailey's tinning factory, at South Mountain, Ont., have been burned down. Loss, about \$15,000; not insured.

TRINITY SCHOOL, for boys, at Port Hope, Ont., has been burned to the ground. Loss, \$80,000. Insurance, \$61,000. The institution will be rebuilt.

W. L. HIBBARD's sawmill, at Farnham, Que., has been destroyed by fire. Loss, including the electric light plant, which was also destroyed, \$6,000.

THE Wm. Hamilton Manufacturing Co., Peterborough, Ont., are putting in at André, Cushing & Co.'s sawmill a new Prescott band mill and other machinery.

LINDSAY, Ont., town council have decided to set aside a sum of money for the building of a bridge over Connell's Creek, on the township line, between Eldon and Thorah.

ROBT. WEDDEL has submitted a proposition to Trenton, Ont., council to construct waterworks and electric light systems and a central fire station in that town, at a cost of \$80,000.

THE St. Anthony Lumber Co.'s mill, at Long Lake, on the O. A. and P. S. Railway, is now having machinery put in. It will be in operation about June, and will employ about 500 men.

THE Consolidated Plate Glass Co. of Canada (Ltd.) have elected the following officers: President, Frank J. Phillips, Toronto; vice-president, W. R. Hobbs, London, Ont., and A. Ramsay, Montreal.

E. A. GREATHED and W. McCullough, of Winnipeg, are applying to the Manitoba Legislature for power to form a company to develop the Assiniboine water power, in accordance with the by-law recently passed.

THE tenders of Heney & Smith, Ottawa, for the rock asphalt paving of Spark street, have been recommended for acceptance. The amount was \$28,860, or more than \$7,000 less than the city engineer's estimate.

SMALL & FISHER and the Union Foundry Co., of Woodstock, N.B., have given notice that they will apply to Legislature for incorporation as a joint stock company, with a capital of \$60,000. They will carry on a general manufacturing business in agricultural implements, machinery and the supply of electric light.

THE Canada Screw Co.'s works, Hamilton, which have been closed down for some time, are now running again with the usual staff.

THE Cunningham Hardware Co., Westminister, B.C., have gone into liquidation. The business will be sold and probably carried on as usual.

GIBB, FRANCHOT, McLAREN & Co.'s chlorate of potash works at Bassin du L'Évêque, Que., have been totally destroyed by fire. Loss \$50,000; not insured.

A BY-LAW is to be introduced in North Bay town council providing for a waterworks system for that town. Councillor McRae has the matter in hand.

CONTRACTS will shortly be given out for the erection of various N.W.T. Government buildings at Regina. R. B. Gordon, Regina, has charge of the matter.

THE Kemp Mfg. Co., Toronto, are asking for exemption from taxation on new buildings which they propose erecting for the manufacture of granite ware.

OTTAWA city council has passed a by-law providing for the issue of \$50,000 debentures for the construction of a main sewer for the drainage of Dalhousie ward.

THE Belleville, Ont., Gas Company have elected the following officers: President, John Bell; vice-president, J. W. Johnson, and secretary-treasurer, J. L. Biggar.

THE Woods Company has been organized under the title of the Woodstock, N.B., Novelty Co. (Ltd.), for the purpose of manufacturing Cobalt's patent dish washer.

THE Currie Iron Works machinery and stock, Westminister, B.C., have been sold to John Wilson. The assessed value was \$19,000, and the price fetched, \$5,000.

THE London, Ont., Hardware Co. (Ltd.) are applying for incorporation. Capital stock, \$50,000. The applicants are W. A. Brock and Gillelan McLean, of London, and others.

THE Maritime Pressed Brick & Terra Cotta Co., Moncton, N.B., will shortly apply for incorporation, with a capital of \$20,000. They will manufacture building bricks by the dry process.

THE Sherbrooke, Que., by-law granting a bonus and other advantages to the Jenckes Machine Co., as outlined in a recent issue, was passed. Work on the new buildings is to be commenced at once.

THE work of construction has been commenced on an iron bridge for vehicles at Ste. Anne de la Parade, to replace the one swept away by the floods last spring. The cost is estimated at \$30,000.

THE hardware stock of Bowman & Moore, Hamilton, who, as stated in last issue, were in financial difficulties, has been sold to Peter Bertram at 40 cents on the dollar. The stock was valued at \$50,000.

THOS. PELLIS, contractor, has tenders in for a new opera house in Toronto, to be located on King street east, corner of Frederick. The building will cost \$35,000, and with fittings complete the cost will be \$60,000.

COOPER & SONS' cork factory at Collingwood, Ont., has been destroyed by fire. Loss \$3,000. No insurance. The fire is supposed to have been caused by an incendiary. It is not probable that the factory will be re-built.

THE firm of Costigan, Pratt & Co., Montreal, has been dissolved and a new partnership formed by Thomas, Francis and Edward Pratt, under the style of the Pratt Manufacturing Co., as manufacturers of dies, tools, etc.

SMYTHE BROS. have purchased from D. L. Shannon the engine and machinery now in his mill at Prince Albert East, Sask., and will move it to Steep Creek, where they will carry on business as lumber and shingle manufacturers.

JAS. CRAWFORD offers to build and equip a large sawmill on Baker's Brook, Madawaska County, N.B., provided the council will grant exemption from taxation for ten years. The council agrees to do this for a term of eight years.

MESSRS. MONRO, COSTE AND ANDERSON, the three Government engineers who were appointed to examine into the plans and scope of the Montreal harbor works, have concluded their investigation for the present, and will now prepare their report.

It is stated that the whole of the plant which was set up recently in India for the manufacture of cordite will be removed to Halifax, N.S., and factories established there. This is owing to the climate of India having been found unsuited to the manufacture of this explosive.

DAME MARY HELLER will carry on the foundry business in Montreal of her husband, Wm. R. Cuthbert, under the style of W. R. Cuthbert & Co.

J. W. KELLER & Co., manufacturers of sewer pipes, plaster ornaments, cement, etc., Victoria, B.C., are adding the manufacture of floor and hearth tiles.

THE Laughlin Hough Mfg. Co., Guelph, Ont., has been incorporated, with a capital stock of \$55,000, for the purpose of manufacturing architects' and school supplies.

SCOTT BROS. have lately thoroughly overhauled all the machinery in their sawmills near Galt, Ont., and added some entirely new, thus greatly increasing their capacity.

CORNWALL, Ont., county council is petitioning the Dominion and Provincial Governments for grants of \$3,000 each towards the construction of drainage works at Hoople Creek.

OTTAWA waterworks committee have prepared their estimates for the year, and they total up to \$155,000. Of this \$12,180 is for street service, and \$15,010 for pipe castings and extensions.

LAW BROS. & Co. have purchased the Caledonia Foundry and Machine Shops in Ottawa, formerly operated by P. J. Powers & Co., and will carry on operations on a more extensive scale.

WINNIPEG Industrial Association will probably hold an exposition this summer. The directors will ask the city for a grant of \$5,000 and a similar amount from the Provincial Government.

LAW BROS. & Co., of Ottawa, have purchased J. Powers & Co.'s boiler shops in Ottawa, and will operate them in connection with their foundry and machine shops on a more extensive scale.

THE St. John, N.B., Iron and Hardware Association have elected the following officers: President, W. H. Thorne; vice-president, S. Hayward; and secretary-treasurer, John J. Barry.

THE Record Foundry and Machine Company, Moncton, N.B., are rushed with orders as usual. About 110 men are employed at present. The company have recently added nickel and silver plating.

CATARAQUI bridge, connecting Kingston, Ont., with Pittsburg township, will probably, before long, be rebuilt. Most likely it will be of iron or steel and so constructed as to allow of the passage of electric cars.

THE McClary Mfg. Co., London, Ont., intend going into the manufacture of steel and cast iron enamelled or granite ware, and will shortly commence extending their factory by the erection of a new building.

OTTAWA city council are about to call for tenders for the construction of a new bridge to replace the one across the Rideau, known as Hurdman's. The girders will be of iron, but the superstructure probably of wood.

HORACE THORNE, Alfred D. Benjamin, Frank D. Benjamin, John Foy, Herbert C. Hammond, Nicol Kingsmill, Henry C. Michell, all of Toronto, have been incorporated as the "Mica Boiler Covering Company, Limited."

WORK on the new Verdun, Que., dyke will be commenced in May. Plans have been prepared, and the area covered will consist of 903,000 feet, of which about 770,000 feet have been already offered by the proprietors in question.

CASSIDY, BONNER & Co., who are rapidly increasing their high reputation as manufacturers of the best glass leather belting, mill supplies, etc., received the contract recently for making all the belting required in the Montreal Steam Laundry.

EDWARD BRENTON, an employé in McMullen & Winn's sawmill at Truro, N. S., got his coat entangled in the machinery, which caused him to be thrown across a circular saw. His limbs were terribly mangled, and he only lived half an hour.

QUEEN'S avenue Methodist Church, London, was, last month, burned to the ground. Some valuable musical instruments, including a \$15,000 pipe organ, were destroyed. Loss, \$80,000. Insurance, \$30,000. The church will be rebuilt at once.

CONTRACTOR JAMIESON, who has in hand the work of building a large elevator at Prescott, Ont., is rushing things there, and hopes to have the elevator completed by next June. The town of Prescott has granted a bonus of \$6,000 and exemption from taxation for twenty years.

THE manufacturers of pressed ware, comprising the McClary Mfg. Co., London, Thos. Davidson & Co., Montreal, E. T. Wright & Co., Hamilton, and the Kemp Mfg. Co., Toronto, have formed an association for the purpose of keeping their goods at a fixed price. They have already reduced the price of pressed ware, and values are now expected to rule steadier.

THE Montreal Rolling Mills Co. have elected the following officers: President, Andrew Allan; vice-president, Hugh Maclean; directors, G. A. Drummond, E. S. Clouston, H. Montagu Allan, H. Archibald, and (managing director), Wm. McMaster.

FOLLOWING the example of Fredericton, the people of Moncton, N.B., have decided to erect a hospital if the Provincial Government gives the subsidy asked for. The *Eastern Chronicle*, New Glasgow, N.S., urges a similar institution for that progressive town.

HAMILTON city engineer recommends that the sewers committee should be granted \$30,000 this year, in order to enable it to complete the sewers on Robinson and Wood streets, and to construct a main sewer on Sanford avenue, works which are urgently required.

THOS. ALLISON has been in Chatham, N.B., lately, looking for a site for a proposed new pulp mill. He has behind him capitalists who are ready, he states, to form a company with a capital of \$200,000 for the purpose of building a mill capable of producing 30 tons of chemical pulp per day.

TORONTO Board of Works recommend the council to submit a by-law to the citizens for improvements in the waterworks supply, having especially in view fire protection for the crowded parts of the city. The improvements in question, as estimated by the city engineer, would cost about \$226,000.

MONTREAL city attorney has entered an action against the Water and Power Co. to recover \$72,000 due on water furnished by the Waterworks to the company for the supply of Coteau St. Louis and Maisonneuve. The company is alleged to have collected the water rates, but did not pay the city's bill.

A COMPANY is about to start the manufacture of gas in St. Louis du Mile End, Montreal, supplying it at a very cheap rate. It is understood that the new company has a subscribed capital of \$100,000, and that it will start operations in May, should the municipality grant exemption from taxation for 25 years.

THE Contractors and Builders' Association, Ottawa, have appointed the following officers: President, John E. Askworth; first vice-president, John McKinley; second vice president, Joseph Gravelle; recording secretary, James Bennett; assistant recording secretary, H. Burgess; treasurer, E. B. Butterworth.

FREDERICK TOMS, contractor for the Dominion Government buildings at Victoria, B.C., died of pneumonia in that city on Feb. 25th. His condition had become so serious recently that he abandoned the contract, which was taken over by Elford & Smith of that city. Mr. Toms was a native of Newfoundland.

HAMILTON Bridge Works were sold last month by the local master in Chancery to J. H. Tilden, of the Gurney-Tilden Company, for \$49,900. A new company is now being organized to carry on the business, although there is a possibility of the works being removed from Hamilton. The works originally cost \$135,000.

NEARLY all the proprietors on Melinda street, Toronto, which was practically ruined by the recent fires, have decided to rebuild. The Osgoodby Building will cost about \$40,000 to reconstruct. To repair the McKinnon block it is estimated the cost will be \$60,000. It has not so far been decided whether to rebuild the *Globe* building or not.

THE celebrated trial of Boyd and Somerville, agricultural implement makers, Huntingdon, Que., has at last ended. A verdict of guilty was returned against both parties on a charge of having obtained money under false pretences from the Eastern Townships Bank. Notice of appeal to the Court of Queen's Bench, Montreal, was entered.

THE Wm. Hamilton Manufacturing Co., of Peterboro, have received an order from the C.P.R. for the steam plant for the new elevator at Prescott, Ont. The plant will consist of a 16 x 20 in. Payne-Corliss engine and two steel boilers, with a Worthington condenser. The latter will be manufactured by the Caledonia Iron Works, Montreal.

THE *Toronto World* is agitating for an increased protective duty on bicycles, which, it claims, would have the effect of keeping all the trade in these articles within Canada. It states that the output of Toronto factories alone this year will aggregate 18,400 wheels, the number of employes being 524, and the weekly amount paid out in wages being \$4,780.

THE Samuel Rogers Oil Co., of Ottawa, is to be incorporated as a joint stock company, as the "Rogers & Morris, Ltd." The applicants for incorporation are Samuel Rogers, A. S. Rogers and J. P. Rogers, Toronto, and W. D. Morris and Mary Ann Rogers, of Ottawa. Capital stock, \$70,000. The business will still remain a branch of the Queen City Oil Co.

L. THOMAS, Melbourne, Que.; W. E. Jones, Richmond, Que.; J. M. Nunns and H. A. Allen, Melbourne; and K.A. Cummings and F. N. Nunns, Coaticook, Que., are seeking incorporation as the Richmond Industrial Co., with a capital of \$100,000. They will acquire the real estate, plant and franchise of the Richmond Water Power and Manufacturing Co.

JAS. HARDMAN, who for some years past has acted as the Western Ontario representative of Robin, Sadler & Howarth, leather belting manufacturers, Montreal, has severed his connection with that firm and accepted a similar position with Goodhue & Co., leather belting manufacturers, Danville, Que. Mr. Hardman's address in Toronto is 90 Bay street.

THE Ottawa Investment Co. are applying for incorporation, with a capital stock of \$425,000, for the purpose of purchasing large manufacturing and business properties, and selling them to outside speculators. They hope by this means to establish several new industries in Ottawa. J. W. McRae and Thos. Ahearn are among the provisional directors of the company.

ARCHIBALD FORD's action against the Citizens' Gas Control Co., Montreal, claiming \$10,000 damages on the ground of an alleged infringement of certain patents belonging to the plaintiff, has been dismissed, as the plaintiff refused to furnish the security ordered by the court for costs to be incurred by defendants on the proceedings taken and taxable against the plaintiff.

A. C. LESLIE & Co., Montreal, manufacturers' agents for iron and steel, also cutlery, American fencing wire, etc., who have had an office in Toronto for the past eight years, last month determined to close the latter. They do not intend, however, to give up their large connection with merchants and manufacturers throughout the West. For the present W. S. Leslie, who has been in charge of the Toronto office, will cover the ground, and arrangements are now being made for a thoroughly good representation of the firm in western Ontario.

ON the evening of the 25th ult. a terrific explosion occurred in John M. McLaughlin's mineral water factory, Sherbourne street, Toronto. A large portion of the walls of the two-storey brick building were blown down and neighboring houses more or less damaged. When the firemen came to clear away the debris it was found that it had been caused by the bursting of the boiler, the cause of which has not been ascertained up to the time of writing. The loss is about \$10,000, and as Mr. McLaughlin is not insured against boiler explosions, there is no insurance to cover the loss. Mr. McLaughlin was in California when the accident took place.

A. G. SINCLAIR, late president of the New York Emery Co., having been forced out of the combination by its so-called friendly action, has decided to stay on the outside, yet remain in the same line of business. He has, therefore, connected himself with the Tanite Co., of Stroudsburg, Pa., and solicits for that company the trade which in former times he controlled as salesman for the Ashland Mills, and later for the New York Emery Co. and the American Emery Mills. As Mr. Sinclair is one of the oldest salesmen in the emery trade, and also a practical manufacturer of emery, he knows something as to the intrinsic quality of that article, and also as to the needs of the trade. Having learned what Tanite Mills Emery is by several years' competition with it, he now offers it with confidence, and asks equal confidence from old customers and friends.

WHILE the grindstone still remains, and possibly always will remain a popular and useful tool in the manufacture of iron and steel goods, the mechanical public were quick to see the value of an artificial wheel whose emery grains were harder and sharper than those of natural and sometimes rounded sand. Hence the solid emery wheel soon made its way into public favor. It seems strange that a similar material and process was not at the same time successfully applied to the production of hone stones, oil stones and whetstones. Early attempts were made to introduce such articles, but, for various reasons, failed. The peculiar properties of Tanite, which fit it for a base in emery wheel manufacture, have been applied by the Tanite Co., of Stroudsburg, Pa., U.S.A., to the production of solid emery whetstones. The result has been a great practical success, though the prejudice of the trade and the novelty of the article have conspired to make the demand irregular and scattering. That this state of the trade is not due to the quality of the artificial whetstone is evidenced by the fact that in quarters where it has once been introduced the demand is regular. The Tanite whetstone is adapted to the mill pick, the carpenter's and stonemason's chisel, the bit of the moulding mill and the axe of the woodman.

LAST month the smooth wire manufacturers held a meeting, at which they decided to reduce the prices of their goods, in order to meet American competition. The lines chiefly affected are annealed, oiled and annealed, and galvanized wire, the decline in some cases being over 10 per cent. A new list had been decided upon only a month previous.

Mining Matters.

UPPER MUSQUODOBOIT, N.S., gold mines are being worked vigorously.

THE "Stemwinder," Midway, B.C., is showing ore which assays at \$54.60 per ton.

MR. JENNINGS is engaged in putting down a shaft on his Wild Creek property, near Fort Steele, B.C.

THE Surprise mine, Slocan, B.C., is working steadily, and about 100 tons of ore are ready for shipment.

THE Stellarton, N.S., Gold Mining Co.'s property turned out a gold brick valued at \$8,000 from January's output.

SEVERAL locations have been recently made on Ten-mile Creek, B.C., the ore assaying from 500 to 1,000 ozs in silver.

THE new machinery for the Goldenville, N.S., Mines will be put in next month. Development work will then go on as rapidly as possible.

THE Cumberland, N.S., Railway & Coal Co. have started to rebuild the boiler house at the North Slope, which was burned down recently.

THE "Last Chance," Slocan, B.C., has shipped 60 tons of ore from its 120 ft. tunnel. The ore runs about 150 ozs. in silver and 60 per cent. lead.

SEVERAL gold properties in Nelson, B.C., district are likely to be purchased by Duluth and Minneapolis capitalists during the next two or three weeks.

THE "Goodenough," Slocan District, has galena sampling 768 oz. of silver and 66 per cent. lead, and 375 oz. silver and 17 per cent. lead in carbonates to the ton.

THE output of the Leamington, Ont., gas well No. 1 is now stated as being about 7,000,000 feet, which is worth, if it could be utilized fully, over \$200,000 per year.

THE Ontario Natural Gas Co. have elected the following officers: President, Hiram Walker; managing director, Dr. S. A. King; general superintendent, S. T. Copus.

THE ore chute in the upper tunnel of the "Cumberland," near New Denver, B.C., is 70 feet long, and shows four feet of good clean ore and some occasional grey copper.

R. M. SHERMAN has purchased from F. T. Kelly and J. M. Harris a half interest in the "Deadman" and "Wild Goose" properties, New Denver, the price being \$7,000.

J. A. MARA, Jas. McIntosh and others will likely purchase the "Homestake" claim, Kamloops, B.C. Development work will be continued so as to prove the true nature of the mine.

THE ore which the Bonanza Nickel Mining Co. have been taking out of their gold vein property near Lake Wahnapiatae, Nipissing District, is said to assay as high as \$100 per ton.

THE Sunshine Mining Co., of Duluth, Minn., are commencing work on their claims at Ainsworth, B.C., known as the "Sunshine" and "Free Silver." W. W. Warner is superintendent.

D. GALLOP and his partners have been working on their group of claims near Nelson, B.C. They recently struck a 2-foot vein of carbonates, assaying 381 ounces silver and 40 per cent. lead.

THE Kootenay Hydraulic Mining Company have commenced work on the foundation of a new pump to draw water from the Pend d'Oreille River, in order to wash up their claim near New Denver.

THE Boston & Nova Scotia Coal Company (Ltd.) will make Mabou Harbor, 16 miles from the mines, their shipping port. A new railroad will be built to connect with the I.C.R. at Orangedale.

It is stated that an American syndicate are negotiating for the purchase of a gold property at Oldham, N.S., which was worked some years ago. The property is believed to be still very valuable.

A LARGE party of gold miners will, next May, leave Buffalo for British Columbia, where they will engage in mining on the Fraser River on an extensive scale. Each man in the party contributes \$750 to a general fund devoted to the purchase of machinery, which will be obtained in Toronto.

THE Campbell-Payne Placer Mines, in the Trall Creek, B.C., district, are being worked vigorously. The first clean-up, which was held two or three weeks ago, netted \$4 per day of six hours for each man.

THE Kansas City Smelting Co., who have smelters at Kansas City, Pueblo, and elsewhere, are thinking of establishing a smelting plant in Vancouver, B.C., for the treatment of lead, silver and copper ores.

THE American capitalists who are thinking of establishing a steel manufacturing plant in Belleville, Ont., have been looking into the matter more closely, and will decide definitely within the next few days.

D. W. McVICAR and his Nova Scotia syndicate are hard at work developing "Number One" mine, Ainsworth District, B.C. Twenty-four hands are at work, the output being about 1 tons of dry ore per day.

H. T. HAMILTON, a manufacturer of Youngstown, O., has been discussing with the Kingston and Pembroke Mining Co. and the Kingston and Pembroke Railway Co. the establishment of a smelting works, steel plant and billet mill in Kingston.

JOHN WHITZ, Robt. Jardine, K. Shevès, C. N. Skinner, and Sherwood Skinner are applying for incorporation as the Dunsinane Mining Company, with a capital stock of \$50,000. They will work a coal mine about two miles from Penobscquis, N.B.

THE Brookfield, N.S., Mining Association are working two shafts in the McGuire lead. The main shaft is 300 feet and the west one 125 feet deep. Forty men are employed at present. The main lead is very variable, but sometimes attains a width of 20 inches.

THE Dominion Coal Co. are seeking accommodation for the handling of their coal business in St. John. They have already leased a large wharf, and will shortly build a trestle, by means of which coal will be run into the sheds on hoppers and chutes after being unloaded from the vessels.

J. DIX FRASER, of the Nova Scotia Iron Works, Ferrona, has returned from Newfoundland, where he superintended the sinking of shafts on the iron property at Belle Isle, owned by the New Glasgow Iron, Coal and Railway Company. They will commence to ship iron to Nova Scotia in July.

AT the "Blue Bell," Ainsworth district, B.C., a vein carrying copper ore has been discovered on the tunnel level. It shows a width of over six feet, the ore sampling from eleven to seventeen per cent. copper. A shaft will be sunk 100 feet in order to determine the permanency of the find.

THE "Le Roi" mine in the Trall Creek, B.C., district, is shipping on the average 30 tons of ore per day. The main shaft is down 355 feet, and work is being pushed on the 300 and 350 feet levels with a force of fifty men. The ore goes to the smelting-works at Helena, and is netting a good profit.

TRALL CREEK, B.C., district is now producing 70 tons of ore per day. The chief mine is the "War Eagle," which is said to be in a position to pay a net dividend of \$20,000 a month for two or three years to come. Altogether about \$100,000 worth of gold is produced in this district every month.

THE annual meeting of the Le Roi, B.C., Smelting and Mining Co., was held in Spokane two or three weeks ago, and the old directors were re-elected as follows: G. W. Forster, G. Turner, W. W. D. Turner, D. W. Henley, W. M. Redpath, L. F. Williams, J. W. Binkley, I. N. Peyton and W. J. Harris.

OPERATIONS have been resumed on the Elkhorn claim, Midway. It is the intention of Mr. Thomet, the owner, to tunnel on the ledge to the depth of 200 feet. If his expectations are realized, he will then make a shaft. The claim carries a rich vein of gold and silver ore, and is believed by experts to be a valuable property.

A DEPOSIT of low-grade ore on Seven-mile Creek, near Nelson, B.C., is attracting no little attention. Its owners claim that it is fully fifty feet wide and that it shows up for a distance of over 500 feet. The ore goes about \$5 in gold to the ton and is free milling. The owners are Messrs. Duhamel, Revesbech, Paterson and Campbell.

THE Robb Engineering Company, Amherst, N.S., have received the following letter from Principal Grant of Queen's University, Kingston: "The Mining Institute of Ontario held its quarterly meeting here last week, and we took that occasion of formally opening the Mining Laboratory, and your engine and boiler were both voted satisfactory. As a Nova Scotian, I was delighted that we had so much of our machinery from Nova Scotia, and as this is the only Mining Laboratory in Canada, I was delighted that you had contributed to its equipment."

HAMILTON MERRITT, C.E., Toronto, a few days ago paid a visit to the "Glendower" mine, near Kingston, in company with students of the Prospectors' Class, School of Mining, their object being to see the Government drill at work. Iron ore has not been met with in any quantity so far, but should the prospecting work prove successful the ore will be shipped to the new smelting works in Hamilton. Mr. Merritt thinks there is plenty of iron ore in the vicinity.

T. E. McWILLIAMS, of Peterborough, draws attention to the rich mineral country lying south of Moose Jaw. Besides vast masses of iron ore, there are veins of bituminous coal some 12 feet wide. This coal is of the sort known as petroleum shade, yielding 150 gallons of crude petroleum to the ton. Copper, magnesium and antimony are other metals present. He also states he obtained some wonderful samples of beautiful sandstone, which is present in large quantities and might easily be worked.

THE mica industry languished during the greater portion of last season but towards the end it brightened up considerably, and work was carried on actively by the Vavassour Mining Association Hull, Que.; Lake Girard Mica Mining System, Templeton; Wallingford Bros. & Co., Templeton; Cascades mica mine, Hull; Blackburn mine, Templeton; Beaver Lake mines, Saguenay; Hayes mica mine, Murray Bay; McGie mine, Saguenay, and Goldering mine, Templeton. The total production in the Province of Quebec was about 400 tons, about 150 men being employed.

THE Colonial Iron and Coal Co. (Ltd.) are applying to the N.B. Legislature for incorporation, with a capital stock of \$1,000,000 and power to increase it to \$2,000,000. The object is to acquire coal and other mineral lands, and to work mines, etc. Several million dollars will be spent in developing the mines of Queens county and in establishing blasting works, etc., at St. John. If successful in their application for a charter, they will begin work at once, and have their works in operation by next year. The Londonderry Iron Works will be removed to St. John, owing to that latter city's superior distributing facilities.

THE shipments from Kootenay, B.C., for January aggregate in value a quarter of a million of dollars. Trail Creek is shipping at the rate of \$150,000 worth of ore a month with but two mines in active operation; Slocan is producing less tonnage than Trail Creek, but its ore sells for twice as much. Ainsworth has two shippers, and the great low grade Blue Bell Mine, opposite Ainsworth, is shipping on an average one hundred tons a day to the smelter at Pilot Bay, and within a month will be shipping two hundred tons a day. Southern Kootenay is beginning to be in it. Toad Mountain, believed to be the richest of them all, is not now shipping.—*Victoria Colonist.*

Railway and Marine News.

THE C.P.R. bridge at Farnham, Que., was totally destroyed by fire last month.

THE I.C.R. are shortly to build a new station house at Moncton, N.B.

QUEBEC city council has awarded the contract for the construction of a pontoon to M. Fortin, Quebec.

THE Miramichi-Midland, N.B., Railway Company are seeking incorporation from the Provincial Legislature.

TORONTO city engineer recommends the purchase of a sand pump for dredging in the harbor and Ashbridge Bay.

THE Westinghouse Brake Co., New York, contemplate putting up a branch factory in Montreal, Ottawa or Woodstock.

THE Guelph Junction, Ont., Railway Co. have elected Wm. Bell president, and the mayor of Guelph vice-president.

WM. DAVIS was blown to pieces last month by the premature explosion of some dynamite which was being thawed out for use on the Toronto, Hamilton & Buffalo Railway, near Hamilton.

CONSOBLY BROS' new steel-hull dredge, which is now being constructed at Kingston, Ont., will, it is said, cost \$100,000.

THE Johnston Steamship Line Co., Montreal, has decided to run a weekly service to Liverpool and a ten-day service to London.

THE directors of the Studholm and Havelock Railway will ask for a renewal of their charter to build a railway from Havelock to Sussex.

CAPT O'NEIL, International Pier, N.S., is building a steam yacht. It is supposed the captain will put her in the towing business.—*Sydney Reporter*

STEPS are being taken for the widening of the Scugog river, at Lindsay, Ont., between the bridge and the locks.

THE G.T.R. have awarded the contract for supplying about 750,000 tons of coal to Shipman & Co., Detroit.

THE Dominion Government will shortly award a contract for the construction of a wharf at Burnt Church, N.B.

MR. HATHERLEY is building a steamer at Salmon Arm, Kamloops, B.C., to ply on Shuswap Lake and the Thompson River. It will be 85 feet long.

A RAILWAY will probably be built from Port Hawkesbury to St. Peter's, N.S., and a contract will be awarded for its construction some time this month.

THE Dominion Government are about to place an order in England for a new ice-steamer to take the place of the "Stanley" on the Northumberland Straits, N.B.

THE work of repairing the Richelieu and Ontario Co.'s boats now in Louise Basin, Quebec, is now going on under the superintendence of H. Pelletier, Montreal.

THE C.P.R. is having a new boat built on the Clyde, to put on the route between Owen Sound and the Sault. It will be a side-wheeler, and will run 22 miles per hour.

THE Toronto Dredging and Constructing Co. have been awarded the contract for making borings across the bay for the proposed tunnel, and work will start at once.

THE St. Lawrence & Adirondack Railway Co. will apply to the Legislature for authority to increase the issue of bonds on their line to a sum not exceeding \$30,000 per mile.

THE new French-Canadian line of steamships between Belgium and France and Canada will start running next month. Montreal will be the summer and Halifax the winter terminus.

THE Ottawa River Navigation Co. have elected the following officers—President, R. W. Shepherd, Vice-President, J. J. Gibb; directors, G. W. Simpson, H. W. Shepherd and R. Belton.

THE Lake Erie and Detroit River Railway station at Merlin, Ont., was last month burned to the ground. Loss, \$5,000; besides about \$3,000 worth of goods in two freight cars which were also destroyed.

THE report that the Bangor and Aroostook Railway was to be taken over by the Maine Central and Boston and Maine is denied, and it is stated that there has been no consideration on the subject whatever.

TORONTO capitalists are agitating for the immediate construction of the James' Bay railway, which would do much towards the development of the country north of North Bay. A new charter will probably be applied for.

THE International Steamship Co. held their annual meeting at Portland, Me., last month, and elected the following officers:—W. H. Hills, Boston, C. F. Libbey, G. S. Hunt, J. S. Winslow, and J. B. Coyle, all of Portland.

"KING BEN," a new steam barge built for Capt. Ira Folger, at Davis' shipyard, Kingston, was launched last month successfully. She is 111 feet long, 22 feet beam, 8 feet 6 inches hold and 160 tonnage, and will run between Oswego, Kingston and Ottawa.

MORE than \$25,000 has been already expended in construction work on the Canadian Western Central Railway, the proposed new transcontinental line to parallel the C.P.R. to the north.

NEWCASTLE, N.B., Board of Trade is petitioning the Dominion Government to buy the railway from Indiantown to Blackville and run it as part of the Indiantown branch. Its price is \$60,000.

THE Toronto, Hamilton and Buffalo Railway are asking Toronto's endorsement of their project, and if this is granted they will apply to the Dominion Government for a bonus of \$3,200 per mile.

THE London, Ont., Merchants' and Manufacturers' Co. (Ltd.) are applying for incorporation with a capital of \$50,000. John McClary, F. Leonard and other London capitalists are interested.

THE Thousand Island Steamboat Company, Kingston, is having a fine sidewheel steamer built in Philadelphia. The new vessel is to have a speed of 20 knots, and is to be completed by July. The estimated cost is \$85,000.

THE East Hamilton Improvement Co., which are building the new incline railway, have decided to issue \$5,000 more stock. The following have been elected directors: J. T. Middleton, J. Thomson, J. N. Lake, Chas. Gurney, and D. Newton.

Two parties of civil engineers, one working from the east and one from the west, are surveying along the line of the G.T.R. from Coteau Landing to Kingston. Their object is to settle a discrepancy of about 4 feet in the levels between the two points.

THE North Shore Navigation Company, Collingwood, Ont., have re-elected the following officers: President, Jas. Scott; vice-president, J. L. Burton; secretary-treasurer, C. E. Stephens, manager, M. Burton.

AT Midland, Ont., last month, a public meeting empowered the town council to employ an engineer to locate a site for a dry dock and estimate the cost of the work, the dock to be 400 feet long, 16 feet deep and 50 feet wide.

THE Kingston and Pembroke Railway Co. have re-elected the following Board of Directors—R. P. Flower, H. H. Porter, H. Siebert, G. A. Kirkpatrick, B. W. Folger, M. H. Folger, J. D. Flower, James Swift and C. F. Gildersleeve.

THE Fredericton, N.B., Boom Co. are about to ask the Legislature for power to boom from the foot of Oromocto Island to the eastern shore of the St. John river, and will transfer their operations to that spot. They will expend about \$70,000 on the works.

THE Ottawa River Navigation Company are replacing the 'Prince of Wales' with a new steel steamer. The new vessel will be 158 feet keel and 27 feet beam, and will be ready for operations about June 1st. The hull is now being built in Tate's dry dock, Ottawa.

THE Langenburg and Southern Railway Co. are applying for incorporation, their object being to build a line from Langenburg, Assa., to join the C.P.R. between Red Jacket and Elk Horn, Man. They also want power to lease the Leamington and St. Clair Railway Co.'s line.

THE Lower Laurentian Railway has been sold to the Quebec & Lake St. John Railway, and will be known in future as the Lower Laurentian division of the Quebec and Lake St. John Railway. It will before long be amalgamated with the Parry Sound Railway.

F. C. GAMBLE, Dominion Government Engineer, is starting the work of building protection works on the banks of the river at Revelstoke, B.C. This work consists of cribwork in the deep water under the bridge and mattresses along the bank. It is to cost about \$10,000.

THE Clarence Township, Ont., Council have voted a bonus of \$1,000 to aid the Central Counties Railway Co. in building depots at Cheney's Corners and Clarence Creek. This railway runs from South Indian to Rockland, and will next year pass into the hands of the Canada Atlantic.

IT is announced that the loan for which Sir Wm. Van Horne has been negotiating in London, for the extension of the Duluth and Winnipeg road through Dakota to Winnipeg, will not be forthcoming, owing to the representations of J. J. Hill, President of the Great Northern Railroad.

INCORPORATION will be shortly applied for for a company to build a steam or electric railway from Berlin southerly in the valley of Grand River to Brantford, and westerly from Berlin to Listowell or Stratford, or northerly to Elora, Colquhoun and McBride. Solicitors of Brantford have the matter in hand.

GORDON KANE and Mr. Rithet, of Victoria, B.C., are pushing the British Pacific railway scheme. This line is projected to parallel the C.P.R. on the north, in British Columbia, thence going eastward to the head of Lake Superior, and thence to Baie des Chaleurs, making the latter the port for European traffic.

TWO contracts for construction work on the Ottawa, Arnprior and Parry Sound Railway, west of Long Lake, ten miles each, have been awarded—one to E. F. Fauquier, Ottawa, and the second to O'Neill & Ferguson, of the same city. Mr. Fauquier has sub-let his contract to D. R. McDonald and Bruder & McNaughton.

BRACEY BROS., contractors on the Toronto, Hamilton and Buffalo Railroad, have assigned to J. V. Teetzel, Hamilton. This action was hastened by the strike of their employees and the pressure brought to bear by their creditors, some of whom entered legal actions against them. The firm owes about \$20,000 for tools, wages, board bills and sub-contracts.

THE Dominion Government deep-water terminus buildings in Halifax were destroyed a few days ago by fire. The large grain elevator, the freight shed, emigrant sheds and spirit warehouse were all burned, as were also about \$150,000 worth of goods which had just been landed from three steamers. The total loss will reach \$500,000, only partly insured.

THE preliminary survey of the Red Mountain, B.C., railway has been completed from the mines as far as Barney O'Brien's on Sheep creek. From the mines down to the Sheep creek divide there is a fall of 150 feet, equal to 3 per cent. grade, while from the divide to O'Brien's it is 1,150 feet, equal to 5 per cent., and the line will therefore have to take a higher level and more distance,

THE survey of the Ottawa, Arnprior and Parry Sound Railway between Long Lake and the western point where construction work ceased last fall, about forty miles east of Parry Sound, is now about complete. The completion of the road between these points will probably take place in the summer. The distance is about 65 miles.

THE collapse of the South Shore Railway from Yarmouth to Lockport, N.S., appears to be complete. It should have been evident at the start that two roads paralleling each other over such a district of Nova Scotia could not pay. A report from Yarmouth states that the company owes over \$40,000 to men and merchants in that town, and the guarantees given by the treasurer of the company appear to have been delusive.

LAST season the quantity of freight carried by the Canadian route down the St. Lawrence via Kingston and Montreal showed a considerable decrease, and vessel-men have made many complaints. They state that the reason for the trade falling into the hands of Americans is that there is a depth of only 9 feet in some parts of the main channel, whereas the majority of vessels require at least 14 feet.

THE total income of the St. Clair Tunnel Company last year reached \$249,479.50, and the total expenses, including taxes, amounted to \$101,186.38, thus leaving a net income of \$148,293.12. After paying \$126,014.81 interest, \$22,278.31 was left for dividends. The cost of the tunnel was \$2,898,026. The company employs 75 men; and it costs \$29,806.90 a year for fuel, water, oil and waste for the locomotives.

THE Government have decided to call for tenders for the construction of the Peterboro' and Lakefield division of the Trent Valley Canal. The surveyors have decided on the river route as the best, as it will do away with a cutting of some three or four miles in length. R. B. Rogers is the engineer in charge of the canal. Tenders must be sent in to the Department of Railways and Canals by March 23rd.

A BILL has been introduced into the American Senate authorizing the formation of a committee to confer with any similar committee appointed by Great Britain or Canada for the purpose of looking into the feasibility of a canal for ocean vessels between the lakes and the Atlantic, and to report as to its probable cost and if any part of the canal should be built in Canada, what arrangements should be made to preserve it for use to the people of the United States.

A DEPUTATION from Almonte recently waited upon J. R. Booth, the Ottawa "Lumber King," to obtain his financial interest in the proposed Carp, Almonte and Lanark Railway, the Almonte people claiming that they are the victims of a railway monopoly, only one line, the C.P.R., passing through their town. The scheme is to run a line from Carp to Bridgewater via Almonte, Huntley, Ramsay and Lanark townships, and through the mining country round Sharbot Lake, connecting with the G.T.R. at Bridgewater. Almonte and Ramsay have already voted bonuses to the road.

THE building of railways has not entirely destroyed the steamboat interests on the Red river. It is stated that a boat is being built at Grand Forks, Dakota, which will be one of the largest ever floated on the river. The building of this steamer at Grand Forks would indicate that the steamboat interest on the river is reviving. With the improvement of that portion of the river lying in Canadian territory, especially between Winnipeg and the lake of the same name, we will see an important revival of the shipping interest here. Some day Winnipeg will own a large fleet of steamers and barges.—*Winnipeg Commercial*.

IN spite of the strong opposition which the Atlantic and Lake Superior Railway promoters have met with, they seem to be going ahead with their scheme. The *Canada Gazette* contains notice of an application to Parliament on the part of the company for power to enter into agreements for the purchase or lease of, or making running arrangements with, the Central Counties Railway Company, the Canada Atlantic Railway Company, the Ottawa, Arnprior and Parry Sound Railway Company, the Grand Trunk Railway Company, the Brockville, Westport and Sault Ste. Marie Railway Company, the Drummond County Railway Company, the United Counties Railway Company, the South Shore Railway Company, and any other companies whose lines connect with the railway of this company; also to authorize the construction of a branch line from the company's main line to a harbor on Lake Huron in Huron or Bruce, and also to connect its telegraph lines with the European telegraphic system by means of a cable across the Atlantic Ocean. It is stated that there is a strong probability of the company obtaining the required loan of money in England.

Electric Flashes.

AN electric lighting plant will shortly be put in at Roberval, Que.

AN electric railroad between Owen Sound and Meaford is talked of.

RENFREW, Ont., council will shortly ask for tenders for lighting that town by electricity.

THE Bell Telephone Co. will probably extend their line from Avonmore, Ont., to Moose Creek.

HAMILTON city council have authorized an appropriation of \$38,000 for additional street lighting.

PERTH, Ont., town council is considering the expediency of purchasing a municipal electric plant.

It is proposed to establish systems of waterworks and electric power and lighting in Gravenhurst, Ont.

It is likely that Stellarton, N.S., will shortly put in an electric lighting plant for the lighting of the town.

THE *Petrolia Advertiser* is agitating for an electric railway between that town and Sarnia via Marthaville.

THE Montmorency Electric Power Company is very busy at present putting in lights in various large buildings in Quebec.

THE Kingston, Ont., Electric Street Railway Co have decided to extend their lines in different townships neighboring the city.

THE Calais-St. Stephen Electric Railway Co. are at work clearing the road to the Shore Line, with which they will make connection.

FARNHAM, Que., electric lighting plant was last month destroyed by fire. Loss, including a saw-mill, which was also destroyed, \$6,000.

WORK will commence this month on the establishment of an electric light plant in St. Boniface, Man., the by-law authorizing the same having passed.

THE Muskoka Improvement Co., Huntsville, Ont., capital stock \$25,000, are applying for incorporation. They will build and operate electric railways, etc.

THE Welland Electric Light and Power Co. intend removing their plant across the river to the banks of the hydraulic canal, where cheaper power can be obtained.

THE Stormont Electric Light and Power Co. are applying to the Ontario Legislature for permission to increase their capital and consolidate with the Cornwall Gas Co.

THE Holmes Electric Protection Company, Montreal, have re-elected the following directors: A. Desjardins, Robt. Bickerdike, T. J. Drummond, G. R. Lighthall, and J. B. Wood.

MEREDITH, CAMERON & JUDD are petitioning the council of East Williams, Ont., for the right of way for an electric railway from London, Ont., to Lucan, Ailsa Craig and Parkhill.

GALT and Preston Electric Street Railway Co. have re-elected the following board of directors: Thos. Todd, H. McCulloch, D. Spiers, W. H. Lutz, R. G. Cox, J. D. Moore and F. Clare.

THE Westport, N.S., and Digby Telephone Co. have re-elected R. W. Ford manager, and A. Staling, of Digby, and L. C. Bowers, J. A. Peters and J. A. Collins, of Westport, have been elected directors.

THE Galt and Preston Street Railway Co. have received letters patent for the extension of the present line from Preston to Hespeler, and for the increase of the capital stock from \$50,000 to \$100,000.

THE Peterborough and Chemong Park Railway Co. are applying for incorporation for the purpose of constructing an electric railway from Peterborough to Chemong Park. Capital stock, \$50,000.

WINNIPEG fire, water and light committee have recommended the council to call for tenders for the electric lighting of the streets for a term of three years from next month. From 150 to 200 arc lights will be called for.

THE London, Ont., Street Railway Company held their annual meeting recently. The annual report showed that the gross receipts for the past year were \$57,010, and the operating expenses \$45,529. The profits were thus \$11,481. The following officers were elected: President, H. A. Everett; vice-president, E. W. Moore; manager and treasurer, Chas. E. A. Carr; secretary, S. R. Break; assistant secretary, Chas. Curry; superintendent, L. H. Deharte.

O. HIGMAN, electrical expert for the Government, is instructing the gas inspectors in their new duties as inspectors of electric light meters. The Act is to come into force on April 1st.

THE Hamilton Storage Battery Co. (Ltd.) is applying for incorporation with a capital of \$10,000. The applicants are Dr. Stark, Dr. Oberson, W. D. Long, G. H. Bisby, Geo. Lowe, Joseph Farrell and H. E. Copp.

THE St. Catharines & Niagara Central Railway Company will ask power from the Dominion Parliament to extend its line from Hamilton to Brantford, and thence to Woodstock, with a branch to Port Dover or to Port Burwell.

OTTAWA Electric Street Railway Company are preparing plans for the extension of their system called for by their contract with the city. Additions to their lines must be completed in both the east and west ends of the city before June 1st.

THE Canadian works of the Whitney Electrical Instrument Co., at Sherbrooke, Que., which were burnt out on the 29th Dec., are now running and in complete working order. A lot of special machinery has been added since the fire.

THE Montreal Street Railway Co. recently unearthed a conspiracy for defrauding it. It was found that some of the conductors were provided with a small metal trough which fitted into the slot at the top of the fare-box and caused five-cent pieces to slide out into the holder's hand.

THE annual meeting of the Hamilton Electric Light & Power Co. was held last month. The reports presented were very satisfactory. The directors elected were as follows: R. Thomson, president, John Knox, vice-president; J. T. Teetzel, secretary-treasurer, and Alex. Turner, of Hamilton, and S. F. McKinnon and H. M. Pellatt, of Toronto.

THE Sarnia Gas and Electric Light Co. held their annual meeting a few days ago, and re-appointed the old board of directors, viz., Thos. Kenny, Chas. Mackenzie, Geo. Leys, W. B. Collins and Wm. Storey. Thomas Kenny was elected president, and William Williams manager and secretary.

THE Hubbell Primary Battery Company of Ottawa has been incorporated, with a capital stock of \$45,000. The provisional directors are Alex. A. Henderson, N. C. Sparks, J. W. McRae, Archd. Stewart, J. A. G. Trudeau, H. B. Spencer, S. M. Rogers, and E. Fitzroy Hubbell, Ottawa.

CRERAR, CRERAR & BANKIER, of Hamilton, are applying to the Ontario Legislature for power to build an electric railway through the townships of Barton, Ancaster, West Flamboro', and Beverley, through Wentworth county to Waterloo, with a branch from West Flamboro' or Beverley to Guelph. The line will be known as the Hamilton, Valley City and Waterloo Railway.

J. J. MACFARLANE, manager of the British Columbia Iron Works, Vancouver, B.C., was arrested last month on a charge of bribing Ald. McCraney, in connection with the city's contract for the construction of an electric plant. Both MacFarlane and McCraney deny the charge. The court decided that there was not evidence to warrant prosecution, and ordered defendant's release.

MAITLAND YOUNG is promoting a scheme to build a trolley line from Hamilton to Burlington, and has given notice of his intention to apply to Legislature for a charter for a company, to be known as the Hamilton, Burlington and Lake Shore Electric Railway Co. They will ask for power to build a line either *via* the south side of Burlington Bay and across the Beach, or *via* the north side of Burlington Bay, or both.

THE Toronto, Hamilton and Niagara Falls Electric Railway has now been surveyed from Toronto Junction, through Lambton Mills, Islington, Cooksville, Credit, Trafalgar, Palermo, St. Ann's, Nelson, Burlington, *via* the Beach, to Barton township and Bartonville, where it will connect with the Hamilton, Grimsby and Beamsville Road. The line will extend from Grimsby to St. Catharines, whence there will be a belt line to the Falls, *via* Merriton, Thorold, Stamford, Lundy's Lane and St. David's. The whole railroad is expected to cost \$10,000 per mile.

THE electrical power houses at the Chaudiere, Ottawa, had much difficulty for a few days last month in obtaining a full supply of current, owing to the sudden fall of the river to the extent of four feet. The fall was probably due to the formation of an extra amount of anchor ice in the vicinity of the falls, owing to the extremely cold weather. The trouble is causing the Electric Street Railway Co. to talk of establishing an auxiliary steam plant, and one is also proposed for the waterworks. Some prominent Ottawa citizens are agitating for the formation of a commission to investigate the water problem and suggest some means for preventing a repetition of the failure.

THE St. Jean Baptiste Electric Co., of Montreal, will put in several new lines this year, and will add new dynamos and engines. They are applying for power to increase their capital to \$500,000.

THE Gananoque, Ont., Carriage Co. have just put in an electric welder. It is said to be able to weld $\frac{3}{4}$ inch steel bars as quickly as they can be handled, and will unite brass with steel, or steel with iron, just as well.

THE Ontario and Sault Ste. Marie Water Light and Power Co. will apply to the Legislature for power to have their name changed to the Lake Superior Co., and to increase their capital stock from \$400,000 to \$2,000,000.

THE American Telephone Co., Chicago, who have the patent of a new cheap telephone working with a dry battery, are arranging for the establishment of exchanges in all the principal towns of the United States and Canada. Work will be commenced this spring.

THE surveys for the Hamilton and Lake Erie power scheme were completed about the middle of last month. As now decided on, the plan is to tap the Welland River, $1\frac{1}{2}$ miles east of Wellandport. From there a canal 8 miles in length will connect with the Jordan River.

THE Hamilton, Grimsby and Beamsville Electric Railway Co. have decided, on account of the opposition they have met with, to drop their project for the present of extending their line to Grimsby Park and Beamsville. The company have elected the following officers: President, C. J. Myles; vice-president, T. W. Lester; secretary-treasurer, Adam Rutherford.

IN the agreement of the Hamilton Radial Railway Company with the Niagara Central, the former was to take formal possession and pay over the money on January 27. The purchase price was \$250,000, but the Radial Railway Company, it is said, failed to hand over the money on the date named.—*Hamilton Herald*.

THE Valley Telephone Co., Nova Scotia, held their annual meeting last month, a dividend of 8 per cent. being declared. It was resolved to increase the capital stock by \$4,000 for the purpose of completing new lines. The old board of directors was re-elected, except A. E. Calkin, who was appointed in place of R. G. E. Leckie.

CHIEF ELECTRICIAN DAVIS, of the Toronto Street Railway Electric Company, whose name came up frequently during the recent municipal investigation, has left the service of the Toronto company and engaged with the Detroit Street Railway Company, in which Mr. Everett, vice-president of the Toronto company, is largely interested.—*London Free Press*.

A NOVEL point has come up lately for decision by the Controller of Customs, namely, whether electricity is dutiable or not. The people of Niagara, Ont., want to obtain their current from the new water power on the American side, and it is proposed to transmit it by wire across the river. They are doubtful, however, whether electric currents can be imported free of duty, so a few days ago they sent a deputation to the Controller of Customs in order to obtain a ruling of that department bearing on the subject.

FRANK R. GREEN, of Chicago; Mr. W. Worth Bean, of St. Joseph, Mo.; Mr. Joel Hunt, of Atlanta, Ga., and Mr. W. J. Richardson, of Brooklyn, N.Y., met in Montreal a few days ago as a committee to arrange preliminaries for the next convention of the American Street Railway Association, to be held in Montreal in October. The Windsor hotel was fixed upon as the place of meeting. G. C. Cunningham, general manager, and Ed. Lusher, secretary of the Montreal Street Railway, met the committee and assisted in their work.

THE Halifax Electric Tramway Company (Ltd.) has been incorporated, for the purpose of acquiring the Halifax street railway and converting it into an electric road. Prominent in the new company are H. M. Whitney, of the Dominion Coal Company, and formerly president of the West End street railway, Boston; G. B. M. Harvey, Boston; James Ross, Montreal; M. Dwyer, David McKean, J. Y. Payzant, Allan Haley, Thos. Lynch, A. Burns and W. B. Ross, Q.C., Nova Scotia.

TORONTO fire and light committee recommend the presentation of a by-law to the citizens for the raising of \$250,000 or \$300,000 for the purchase of a civic electric lighting plant. The by-law will probably be voted on in about six weeks. The city engineer speaks very favorably of the offer of the Geo. Bertram Engine Works to put in a plant for \$210,000, but thinks the question of operating it had better be left for further discussion, especially as the suggestion had been made to operate the plant in conjunction with the water works, which would lead to complications.

Personal

B. C. TISDALE, who, ten years ago, carried on an extensive foundry in Brantford, Ont., died last month.

WILLIAM ROSS late of the I.C.R. shops at Moncton, has been appointed foreman of the I.C.R. shops at Halifax.

HARVEY GRAHAM, general manager of the Ferrona Iron Works, New Glasgow, N.S., visited Montreal a few days ago.

W. DALE HARRIS, chief engineer of the Ottawa and Gatineau Valley Railroad, has also been appointed managing director of that line.

THOMAS GRAHAM, assistant fire chief, Toronto, has been appointed chief, to fill the vacancy caused by the death of Chief Ardagh.

ALEX. WOOD, of the firm of Frost & Wood, agricultural implement manufacturers, Smith's Falls, Ont., died last month at the age of 71.

JOHN E. HARDMAN, president of the Mining Society of Nova Scotia, has been seriously indisposed, but is now on the high road to recovery.

JOHN EDINGTON, engineer to Moncton, N.B., Water Co., has been appointed to fill the same position under the city's management of the waterworks.

FRANK TURNER, C.E., has been appointed chief engineer of the Cobourg, Northumberland and Pacific Railway. Operations will be commenced shortly.

CHAS. E. A. CARR, private secretary to Mr. Everett, of the Toronto Street Railway Co., has been appointed general manager of the London Street Railway Co.

W. W. ROCHE, of Kingston, has been appointed mechanical manager of the Ontario Government diamond drill, which is working this month in Bedford township.

A. C. McCALLUM, M.E., of the Wm. Hamilton Mfg. Co., Peterborough, Ont., was in Montreal a few days ago. Mr. McCallum reports business good in Peterborough.

JAS. DEVLIN, executive secretary of the Canada Association of Stationary Engineers, paid a flying visit to Montreal a few days ago, looking better than before his recent illness.

P. W. RESSEMAN has been appointed general superintendent of the Ottawa and Gatineau and Pontiac Pacific Junction Railways, in the place of J. T. Prince, who recently assigned.

WM. ROUTLEDGE, formerly mine manager to the Federal Mining Association and a member of the board for granting certificates to colliery officials, died at Grand Narrows, N.S., last month.

W. J. SADLER, brother of George W. Sadler, of the firm of Robin, Sadler & Haworth, leather belting manufacturers, was married last month to Miss Janet Weir, youngest daughter of Robert Weir, contractor, Montreal.

J. H. ECKERT, the manager of the Bell Telephone Co. in Brantford, has been promoted to a more responsible position of a similar character in Windsor, Ont. His successor at Brantford will be D. Roberts, of St. Catharines.

WILLIS CHIPMAN, C.E., Toronto, is the originator of a new project for reaching the North Pole, which will be referred to in this journal later. Mr. Chipman was recently appointed examiner in civil engineering in Toronto University.

J. C. MULLIN, foreman of the Electric Railway Car Works, Ottawa, has left for Valparaiso, Chili, where he intends to open in the electrical business. Before leaving, Mr. Mullin was presented by the members of Ottawa Electric Association with a purse containing \$130 in gold.

W. S. KEARSEY, of the Might Directory Co., Toronto, is visiting Montreal in the interests of a new business directory, which is to include the cities of Montreal, Toronto, Ottawa, Hamilton and London. The new work, published by this well-known company, should be a valuable hand-book for business men.

A. F. BURY AUSTIN, C.E., for the past eleven years with the Canadian Pacific Railway, has commenced business on his own account as a broker in lumber and dimension timber. The experience in the engineering construction work, and in the lumber purchasing department of the railway, has given Mr. Austin an opportunity of acquiring an intimate practical as well as a mechanical knowledge of all requirements connected with the trade, and made him acquainted with the best markets for obtaining any particular

description of material that may be required for railway construction or for general building purposes. He has been appointed representative in Montreal for the Pembroke Lumber Company of Pembroke, Ont., whose specialties are planed and rough lumber, railway and building timber; the Gillies Bros. Company, Ltd., of Braeside, Ont., manufacturers of and dealers in red and white pine lumber; and of H. Harris, Ottawa, telegraph poles, railway ties, piles, etc., and oak in all sizes. To the established reputations of these reputable firms Mr. Austin adds the benefit of his personal experience and attention; and THE CANADIAN ENGINEER, in wishing Mr. Austin every success in his new venture, bespeaks for him a goodly portion of the vast business that is done in lumber throughout Canada. Mr. Austin's office is No. 411 Board of Trade Building, Montreal.

The Patent Review.

- 46,682 Blackman Patent Pulp Co., New York, apparatus for recovering alkali.
- 46,683 Edw. Best and J. D. Lebel, London, Ont., safety switch.
- 46,684 C. W. McBryer and H. B. Schilling, St. Louis, Mo., device for preventing railway cars from leaving the rails.
- 46,685 G. T. Hawes, Owensburgh, Ky., truss for bridges.
- 46,686 A. Philipsborn and Max Schiemann, Berlin, Germany, electric locomotive.
- 46,687 H. K. Thiel, Alpena, Mich., electric motor and dynamo.
- 46,688 G. Blanchard, Brooklyn, N.Y., foundation for lighthouse and other heavy structures.
- 46,691 Dr. Carl Hopfner, Giessen, Germany, method of extracting metal from the ore.
- 46,692 J. L. Ketcher, New York, apparatus for generating and supplying electricity.
- 46,694 W. E. Worthen, New York, apparatus for applying and removing storage batteries.
- 46,695 A. S. Walbridge, Mystic, Que., arch bridge.
- 46,698 W. A. Wiley and J. F. Harvey, Rochester, Minn., hammer.
- 46,700 W. J. Still and R. Macdonald, Toronto, electrical propulsion of cars.
- 46,701 Magnetic Electric Co., Boston, electric railway system.
- 46,703 G. W. Rickett and S. Lesur, Denver, Col., rock drill.
- 46,706 C. Halpin, Tarrytown, N.Y., car coupler.

46,708 Jas. H. Turner, Pewee Valley, La., and J. M. McKnight, Louisville, Ky., locomotive oiler.
 46,709 A. Barré and E. Currier, Fall River, Mass., railway gate.

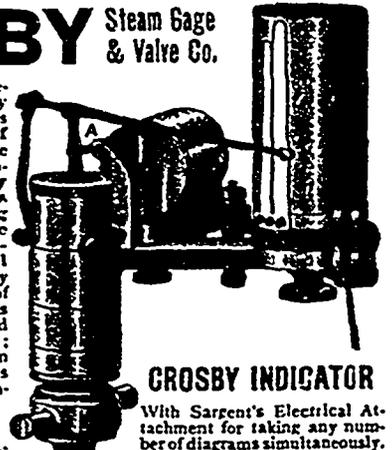
METAL IMPORTS FROM GREAT BRITAIN.

The following are the values in pounds sterling of shipments of metals, etc., from Great Britain to Canada, as shown by the British Board of Trade returns for January, and for the same period of last year:

	January.	
	1894.	1895.
Hardware and Cutlery	6,567	3,246
Pig Iron	1,553
Bar, etc.	1,965	1,302
Railroad	3,452
Hoops, Sheets, etc.	2,895	1,621
Galvanized Sheets	1,956	1,495
Tin Plates	18,139	10,589
Cast, Wrought, etc., Iron	5,335	1,996
Old (for remanufacture)	733
Steel	7,613	2,533
Lead	240	369
Tin, Unwrought	1,750	2,856
Cement	1,238	30

CROSBY Steam Gage & Valve Co.

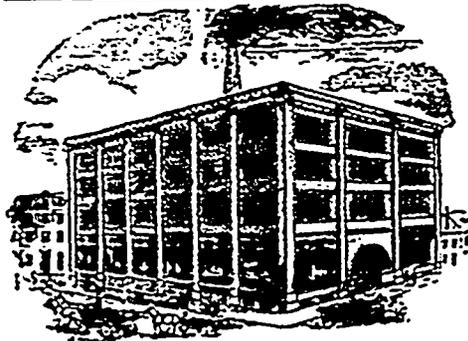
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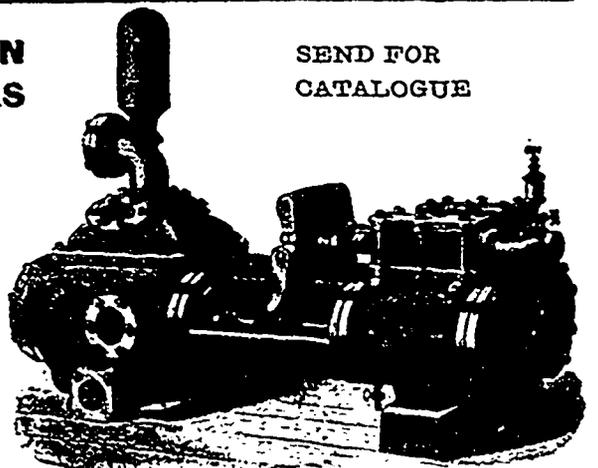
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