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The Canadian Engineer

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The Canadian Engineer.

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For THE CANADIAN ENGINEER.

THE MONTREAL, OTTAWA AND GEORGIAN BAY CANAL.

BY MACLEOD STEWART, OTTAWA.

It is now a good many years since the project of connecting Lake Huron with the lower St. Lawrence by a line of navigation *via* the French River, Lake Nipissing and the Ottawa was first mooted; and, although circumstances have led to the neglect of this route hitherto, its merits are such as should have long ago received greater recognition. The enterprise is one involving no unreasonable expenditures, and in the carrying on of which no unusual engineering difficulties are to be met with; and those difficulties which do exist are within certain defined limits, and already known with a fair degree of accuracy from surveys made at different times. The benefits to be derived from its completion are both great in degree and manifest as to character.

Since the subject of canal building first excited interest in this country, Canada has grown from a paltry colony with a slight fringe of sparsely populated settlement along her southern border, and back of that a vast stretch of unbroken wilderness, known only to the hunter and the Indian, to a great Dominion embracing half a continent, and developing with marvellous rapidity resources of great variety and untold richness. When the first surveys of the Ottawa were made, Renfrew was the last post of civilization. Our Great North-West" had no existence. The whole country about Lakes Superior and Nipissing, and the Upper Ottawa, now known to abound in mineral wealth, and to contain many valleys of extreme fertility and excellent climate, was supposed to be utterly worthless, except for the timber which covered it. Now we have a great North-Western domain clamoring for the best and cheapest means of carriage of its surplus products to European markets, a domain whose future is in no doubt largely dependent on the satisfactory solution of that very problem of transportation. And we have also, in North-Eastern Ontario and North-Western Quebec, a vast extent of country of recognized value only awaiting the development which cheap transportation will bring about, to become capable of sustaining a large population and adding immensely to our national wealth.

Although as early as 1801 there was a small settlement at Hull, opposite the present capital of the Dominion, composed chiefly of Americans from Massachusetts, among whom Philemon Wright was most prominent, it was not until the construction of the Rideau Canal that Bytown was founded where Ottawa now stands. The beneficent effects of the opening of the Rideau route were so apparent, that there was soon a strong feeling in favor of continuing the navigation of the Ottawa beyond the Chaudiere Falls, which opposed an obstacle to progress farther westward. As the country about Lakes Michigan and Huron was then being settled, the more daring minds soon conceived the possibility of making the Ottawa the grand highway for the traffic from the new empires bordering upon those lakes. Many of the arguments then used are as applicable now in favor of the route, as will be seen by perusal of the following quotations from a series of resolutions moved by Mr. Wm. Stewart, of Bytown, in the Canadian Assembly in July, 1847:

Resolved,—That the distance from Lake Huron to the city of Montreal by the Ottawa River is less than half the distance by the route of the lakes and River St. Lawrence; that a water communication such as can be attained would avoid all the risk, exposure and expense inseparable from lake navigation, and would be a short, safe, and natural outlet for the minerals, fish, and immense agricultural produce of the extensive country bordering on Lakes Superior, Michigan and Huron.

Resolved,—That it is incontrovertible that no other line of communication, capable of embracing so much of the north western trade of this portion of America, can ever be made so completely within the heart of the province, and which would perpetually secure such trade to the cities of Montreal and Quebec, besides the immense trade it would create and immediately embrace in facilitating the lumber trade through an extensive region of country, more abundant in lumber (the great export staple of this province) than any other portion of Canada.

Resolved,—That such a communication considered as a means of defence (literally encircling the most valuable portion of Canada) and as a military highway to place troops and munitions of war at the highest settled points in the province, in a short space of time, and entirely unexposed to any invading army, is of itself a matter worthy of grave and serious consideration.

In pursuance of the object set forth in these and accompanying resolutions, an appropriation of £50,000 was obtained for the construction of one link in the chain of navigation, viz., a canal of 2.83 miles in length between the Deschenes and Chats Lakes, designed to create a stretch of fifty miles of navigable water. Nearly $500,000 were expended, in rock excavation, etc., on this work until 1858, when a discussion arising

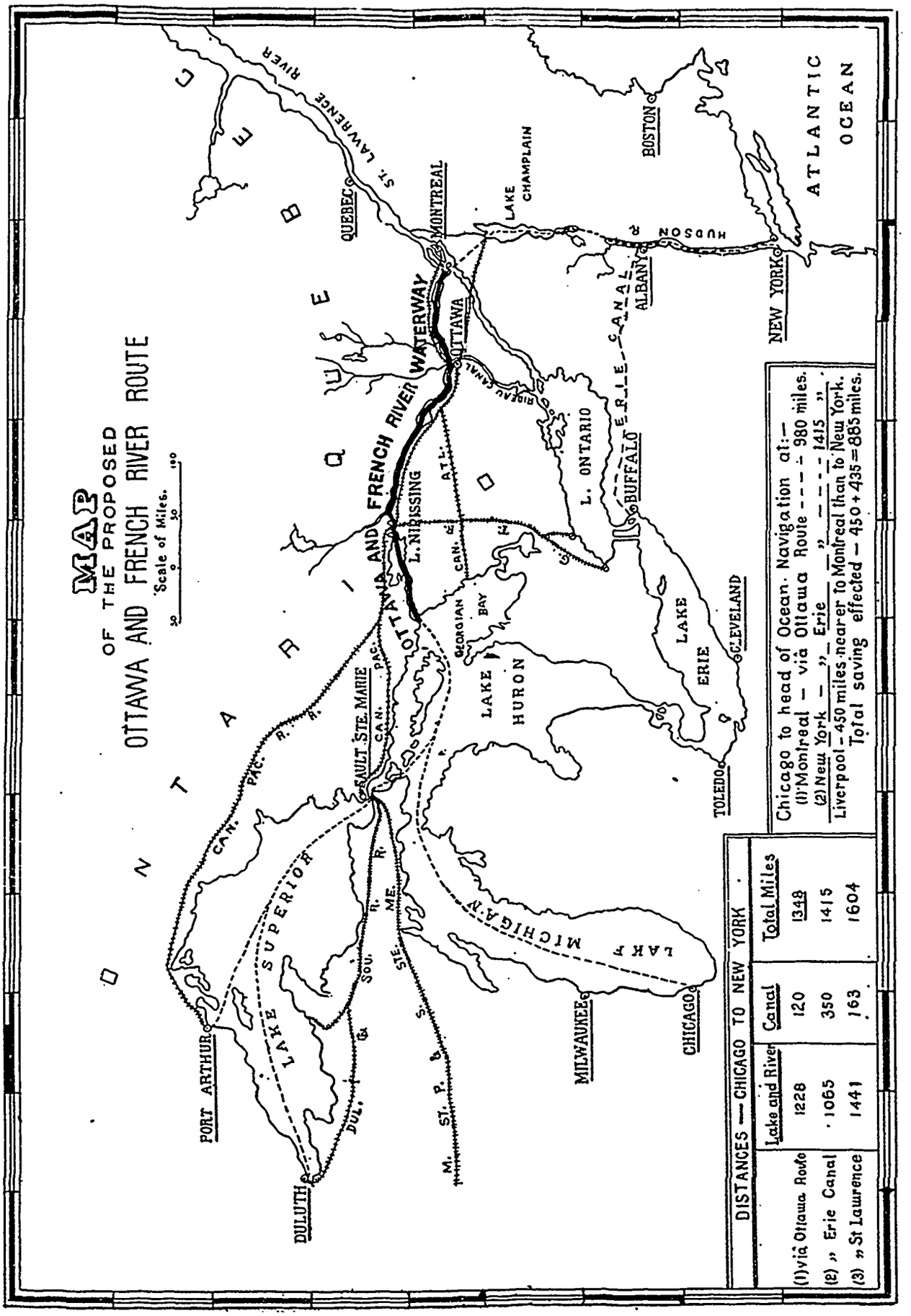
with reference to the scale of navigation to be adopted, and the Government having decided on undertaking a survey of the whole route, work was abandoned, and was never afterwards resumed. In that year the first general survey was made under the superintendence of Walter Shanly, C.E, who reported on the scheme the same fall; and in the following year a further examination and survey and a more extended report were made by T. C. Clarke, C.E., of New York. The apparently very great discrepancy between the estimates of costs submitted by these gentlemen, coupled with the opposition arising from local prejudice, and the general ignorance and misconception of the nature of the route existing outside of the Ottawa valley, no doubt had a deterrent effect on the authorities at that time. The Ontario influence in the House was entirely against the project, and in favor of the opening of the St. Lawrence. A few, who saw that the Ottawa alone could build up our Canadian ports, Montreal and Quebec, and that the St. Lawrence system would not avail to prevent the deportation of traffic to New York, but would always prove rather more beneficial to the Americans than to Canadians themselves, advocated it strongly, but the demands of the many prevailed, and in spite of the enthusiastic recommendation of the route by both the eminent engineers named, the work on the Ottawa was finally abandoned, and that on the St. Lawrence carried to completion.

In the years immediately following the surveys mentioned public attention was diverted by the American Civil War, which greatly paralyzed undertakings of various kinds on this side of the line for the time being. One effect it had, however, promotive of the interests of this route. Attention wss turned to the military condition of Canada, and a commission of defence was appointed to make due enquiry thereinto. Sir John Michel, then Commander-in-chief of her Majesty's forces in Canada, and Sir James Hope, Admiral on the North American and West Indian Station, were appointed to go over the Ottawa route and report upon it from a military point of view. They did so and afterwards reported most favorably on its merits as a line of defence. However the excitement soon died out, and it led to nothing being done. In 1873 the Canal Commission merely pursued the course already undertaken of developing the St. Lawrence route. Later on the building of the Canadian Pacific Railway absorbed the public mind and energies, and though the claims of the Ottawa to recognition have found frequent champions in Parliament, among whom may be mentioned the late Senator Tasse, Hon. Speaker White, Thomas Murray, Mr. Bryson and others, the completion of the undertaking has remained in abeyance. In 1893 the Montreal, Ottawa, and Georgian Bay Company, comprising a large number of influential gentlemen of the Ottawa Valley and elsewhere in Canada, was organized for the purpose of pushing the construction of the necessary works to complete a through line of navigation to the Georgian Bay, and thus rescuing from undeserved oblivion an undertaking of nothing less than national importance. Having thus given a brief resumé of the history of the project,

ITS ENGINEERING FEATURES

may be next considered, and the all important questions of practicability and probable cost. That the Ottawa River is by nature supremely fitted to become a great highway for traffic is amply demonstrated by the result of surveys already made. Geologists say that formerly a large portion of the waters of the Great Lake region found their way eastward through the Ottawa, which probably constituted their main channel, until an upheavel of the country about Lake Nipissing, and a gradual draining of the basin, led to their gradual diversion to the present course through the Niagara River. Thus the rocky bed of the Ottawa has everywhere been deeply eroded by the flow for centuries of a stream of much greater magnitude than that now existing in its well-worn channel, and very much larger than the present St. Lawrence River. To this fact is due the peculiar character of the stream, than which there could be none better suited to the formation of a magnificent system of inland navigation, consisting, as it does, of long, deep basins of still water separated by short bars at points where the outcroppings of harder rocks occur. Its chief characteristic is great volume even in the upper stretches; while the short rapids and falls are mostly so situated as to be readily overcome by mere locks and dams, with very little canaling. And it would afford an open navigation often preferable even to that of the great lakes themselves, because of the immunity from the effects of storm and headwinds enjoyed on these land-locked waters. In ascending the river from Montreal we encounter successively Lake St. Louis, 13 miles in length; Lake of the Two Mountains, 25 miles; Deschenes Lake, 27 miles; Chats Lake, 19 miles, and Coulonge Lake, 20 miles long, all with a channel depth of 14 feet or over, often of 30 feet or more. Still farther up is Deep River, a stretch of 30 miles of smooth water of very great depth, and from 1,000 to 2,000 feet wide. Both the Mattawa and French Rivers are of the same general character, consisting of long, deep lake-like basins, separated by short shoals. Only about five miles out of the forty-two of the course of the Mattawa have naturally less than a ten-foot channel. On the French River depths of 20 to 30 feet are most common. All that is to be done is to connect these deep basins by short canals, or mere locks and dams, and the system is complete. Thus Mr. Clarke in his report states that of the total distance of 430 miles between French River and Montreal, 351 miles are already a good natural navigation, and require no improvement, and that it is perfectly practicable so to improve the remaining 79 miles as to convert the whole drain of waters into a first-class navigation for steam-vessels drawing 12 feet of water, by the construction of 20.82 miles of canal, exclusive of the Lachine canal. And H. K. Wicksteed, C.E., in a recent communication on the subject, says that if made for a nine-foot channel, probably 75 per cent. of the route would be available for an 18-foot channel without further improvement. From all which it may be readily inferred that the general character of the streams traversed is highly favorable to the construction of a great through waterway. Other points affecting the question are: water supply at the summit level and terminal harbor facilities.

Passing through a country filled with lakes which act as natural reservoirs, the rivers under discussion have not only great volume, but also steady flow, and are not subject to sudden floods. The Ottawa River, with a drainage area of 80,000 square miles, and a length of 700 miles, has a mean flow of 85,000 cubic feet per second, at Grenville, 35 miles from its mouth; and to compare it with European rivers, is roughly about three times as large as the Rhine, or seventeen times as large as the Thames. Mr. Clarke says of it:



	Lake and River	Canal	Total Miles
(1) via Ottawa Route	1228	120	1348
(2) " Erie Canal	1065	350	1415
(3) " St Lawrence	1441	163	1604

"Its common rise is one inch per day, and it never averages over three inches in twenty-four hours for any number of days in succession. Its rise to high-water mark, stand and subsequent fall, occur every year at nearly the same dates with the utmost regularity." Trout Lake, four miles east of Lake Nipissing, on the headwaters of the Mattawa, is the summit-level, being about 23 feet higher than Lake Nipissing. It is 8½ miles long, and one mile wide, and could not furnish water enough for even a less scale of navigation than the one required. To overcome this difficulty, Mr. Shanly proposed to raise Lake Nipissing to the same level, an expedient now clearly impracticable, since it would drown the town of North Bay and flood the Canadian Pacific tracks for miles. Mr. Clarke's plan contemplated the elevation of the surface of Lake Nipissing nine feet only; but in a very recent report on the undertaking, Marcus Smith, C.E., suggests that the object in view can be best achieved by raising Nipissing merely five feet, and lowering Trout and Turtle Lakes to that level. This presumably would flood little land of value, and would only tend to increase the excavation at the summit ridge. The result would be to give a continuous summit-level 58 miles in length, with a catchment basin eighty miles long, and from half a mile to twelve miles broad, making a surface of 330 square miles. Lake Nipissing, a magnificent body of water 40 miles long and from 12 to 18 in breadth, and copiously fed from streams of large size, would thus become the summit feeder, and furnish *a supply of water practicably inexhaustible.*

"An alternative plan, which would not call for any interference with the existing level of Lake Nipissing, and would probably be much cheaper, is advanced by Mr. Smith. This consists in diverting a portion of the waters of Sturgeon River to Trout Lake, leaving that the summit level, and overcoming the lift by additional locks. But his own preference is decidedly with the formation of a long level by bringing the three lakes to the same height. A short distance from the shore the waters of Trout Lake are of great depth, so that lowering it 18 feet will not affect its navigation. Immediately below, and separated from it by a rocky bar of 400 feet in length, is Turtle Lake, only one foot lower than Trout Lake. It is 4¼ miles long, and in it there are some detached shoals extending in all over about 1,500 feet, and chiefly composed of needle rocks, having seldom less than eight feet of water over them. With these exceptions the depth throughout is rarely less than 18 feet, and generally over 30 feet. The average width of the lakes is about a mile."

The main question then becomes one of the amount of excavation of the summit ridge required. Here, again, nature has signally favored the Ottawa route. The amount of cutting needed on the Toronto and Georgian Bay line is practically prohibitory of that route, but the Ottawa watershed affords a happy contrast in that respect. The facts may be best stated in the words of Mr. Smith's report already referred to: "The distance from Lake Nipissing to Trout Lake by the little river Ojibwaysippi is a little over four miles, of which, for over three miles, the land is little, if any, higher than near the shore of Lake Nipissing. Then for continuing the canal on the same level as Lake Nipissing when raised five feet, and for giving a clear depth of water of at least ten feet, as proposed by Mr. Shanly, the depth of cutting for probably 3½ miles in length would average twelve feet. On the next half or three-quarters of a mile to Trout Lake the land rises to very little above the level of that lake and is marshy. The maximum depth of cutting would be about thirty feet, the major part of which would most probably be in crystalline rock."

Thus it will be seen that there is to be dealt with in this case *a summit ridge rising only about four feet above the existing summit water level, and that for a distance of less than a mile.*

Ideal terminal facilities on Georgian Bay are afforded by the harbor at the mouth of the French River. A thorough hydrographic survey of that part of Lake Huron was completed in 1894, and lights have been placed in position marking the channel to the entrance of the river, which the steamers of the North Shore Navigation Company now ascend to the foot of the first rapids. The harbor is formed by the sheltering group of Bustard Islands to the southwest and a high promontory to the northwest affording admirable protection from the violent autumnal gales, and is both safe and commodious. Doubtless some rocks would require to be removed, but, generally speaking, Mr. Shanly says that it fulfils all the conditions of a noble harbor. At its eastern extremity the route debouches upon Lake St. Louis, gaining entrance to Montreal harbor by the Lachine Canal. An alternative route would be, as suggested by H. K. Wicksteed, *via* the Black River, which would perhaps be preferable as giving Montreal, like New York, a double water frontage, and thereby affording greatly increased and much needed additional harbor accommodation. Water supply, summit ridge cutting, terminal facilities, and general character of the route being thus all alike favorable to the consummation of the undertaking, there remains the question of cost of construction and time required for same.

Mr. Shanly's plan contemplated the construction of 58 miles of canal with a ten-foot channel, and his estimate of cost (made in 1858) was $24,000,000, or upwards of $370,000 per mile, while he states the cost of the St. Lawrence canals as then built to have been $150,000 per mile. His reasons for this high estimate were: the hard, unyielding nature of the materials to be worked upon; the distance which materials for building the locks would have to be carried; the great cost of transporting materials, plant, and supplies to a large portion of the route, "with no roads, and in a wilderness without inhabitants." Since the railroad now runs contiguous to 380 out of the 430 miles of the entire distance, the last named difficulty has been greatly lessened, as the second has also been, by the discovery in several instances of fine building stone at no great distance from the works. Improvements in machinery and methods have materially reduced, too, the importance of the remaining cause of expense, namely, the hardness of the rock encountered. A further lowering of his figures will result from making a deduction for the 8.50 miles of the Lachine Canal, the cost of which was included in his estimate, but which has since been constructed by the Dominion Government. That would leave 50 miles at $370,000 per mile, equal $18,500,000. From this Mr. Smith deducts for improved facilities afforded by the construction of the Canadian Pacific Railway and improvements in machinery, etc., 20 per cent., or $3,700,000, leaving $14,800,000 as the total cost on Mr. Shanly's plan.

Mr. Clarke recommended damming the river more freely wherever the shores were steep and little land of any value would be flooded, and thus made 20.82 miles

of canal, exclusive of the Lachine, suffice for the whole route. In his elaborate report, giving quantities and prices of all works required, he sets the cost of a 12-foot channel at $12,057,680. Mr. Clarke's report was made in the beginning of 1860, and is also affected by the improved communication, and other considerations referred to above. Much of the rock excavation he estimated at $2.50 per cubic yard. He gives as the total quantity of rock to be excavated 2,370,190 cubic yards at a cost of $3,940,875, or $1.66 per cubic yard. With improved machinery rock excavation has been done on the Chicago drainage canal as low as 30 cents per cub. yd. Even the crystalline rocks of the Ottawa region should not average six times that in cost of excavation. Mr. Smith says of this report as a whole: "I think some of the prices were too low for that date, but with the present improved facilities, if the quantities can be relied on, the estimate cannot be far out. I should, however, add for contingencies, such as that which prevents the raising of Lake Nipissing and other unforeseen difficulties, not less than 20 per cent., making the estimate in round numbers $14,500,000. Thus Mr. Smith puts the cost approximately at $15,000,000; and in so doing agrees with Mr. Wicksteed, R. Adams Davy and other engineers, among whom the general concensus of opinion is to the effect that a navigation of the scale required, viz., with a ten-foot channel, can be completed on this route in three years time at a cost not to exceed $15,000,000. Differences of opinion exist as to the exact scale of navigation most suitable. Mr. Shanly recommended 10 feet of water, Mr. Clarke 12, being on the largest scale for canals constructed at that time. More extended surveys may show some other scale to be better adapted to a modern canal suited to future as well as present needs. Several prominent engineers have often expressed the belief that this route will be found eminently well adapted for a deep water navigation for large vessels. Mr. Wellington says on this point: "My conviction is a fixed one that the Ottawa River *affords the best opportunity on the globe for a well-planned ship canal.*"

(*To be continued.*)

For THE CANADIAN ENGINEER.

KEROSENE MOTORS.

THEIR METHOD OF ACTION AS APPLIED TO VEHICLES, &c.

BY J. H. KILLEY, HAMILTON.

Not having seen in any periodical a description of the method of action of kerosene motors when attached to vehicles or yachts for propelling purposes, I have thought that it might interest some of your readers to have an explanation of what takes place when these motors are in motion, and the very beautiful and simple method adopted to operate them. The motors run in one direction at an ordinary speed of 600 to 700 revolutions per minute; this speed is not varied no matter what may be the grade of the road. I will endeavor to explain the method of connection between the motor and the road wheels on one of the best vehicles yet constructed. It will be seen that no gears are rendered necessary; there are five grades of power: this, in the instance I refer to, is brought about by a friction discover which a friction pulley one-fourth of the diameter of the disc moves the pulley. The disc is covered with materials that very largely increase its frictional action. When the pulley is running on the outside face of the disc it takes six revolutions of the motors on vehicles to one of the driving wheels to overcome steep grades, say 8 per cent. ones, yet it is claimed that 10 per cent. ones have been surmounted, of course at proportionally slower speeds; 20 miles an hour can easily be made on ordinary level roads, the average on all roads being from 10 to 15 miles per hour. The action of the pulleys and discs is as follows: as the pulley is pulled by the hand lever with which it is connected toward the centre of the disc the speed of the road wheels is increased, increasing the speed of the carriage; when the pulley is its own diameter from the centre of the disc, it runs at the same speed as the motor, and three to one of that of road wheels; in this way the carriage would approximate 20 miles per hour; the disc is attached to the road wheel axle by chain and sprocket wheels, as in bicycles. When the pulley is at the centre of the disc, the motion of the wheel ceases, as it is clear of the pulley at this point; when it passes over the centre to the opposite side the motion of the wheels is reversed, and the carriage backs up at a speed in proportion to the position of the pulley on the disc. It will be seen that the carriage will be under perfect control of one lever in the hands of the person in charge, as far as speed is concerned. The motor governs itself, never exceeding the normal speed. This is done by a very simple governor acting on the oil supply. The motor is kept in motion during the whole time of the trip, whether the car is at rest or not; the whole work of the attendant is to steer the vehicle and handle the regulating lever; the motor requires no attention further than filling the tank with oil once in every 200-mile run.

The reversing and regulating motion referred to is now being used on engine lathes; it takes the place of *the cone pulleys, the counter-shaft, the loose and fast* pulleys, the two belts for continuing and reversing the motion; it is found to answer well, and will, before long, come into general use.

To perfect a motor adapted to the propulsion of high road vehicles, and for many other purposes, is a problem that has received a large amount of attention from engineers and others, many failures having been made in the attempt to meet the difficulties that presented themselves to those endeavoring to accomplish the wished-for result. Since the steam high road carriages, the Automaton and the Autopsy, ran from the Bank in London, England, to Paddington, some fifty years ago, and were withdrawn, many unsuccessful and costly attempts have been made; the weight of the boiler, engines, tanks, water and coal, and the heavy vehicle required to carry these, together with the passengers, rendered steam out of the question. Electric traction has also been unsuccessful by reason of the great weight of the storage batteries, and the time and trouble of recharging them, etc.

The light and powerful kerosene motor, small weight of oil fuel required, and comparatively light vehicles, met the required conditions in a perfectly satisfactory manner, with the prospects of still further success, by anticipated improvements in the present motor. At the present time they are the lightest, smallest and most powerful motors known, with no outside source of power, being a unit within themselves; the four-seated motor car runs over all grades with an average of two quarts of oil per hour. This I have taken from the printed records of the tests. Motors are now being built in Europe and the United States for street railway cars

with very satisfactory results. In Europe they are used for fire engines. For this purpose they are stated to have no equals, as they are light, can be moved by their own power, are ready for work at a moment's notice, require no fireman and skilled attention, are always ready when water is available, and without annoyance of smoke, sparks and exhausted steam. The French and German motors are mostly made with vertical cylinders, so as to economize space and reduce friction and wear. The base of the motor consists of a circular chamber, made gas tight, in which the crank, composed of two discs and crank pin, works, the discs serving the purpose of balance wheels. In one of these discs is formed a double cam groove, which passes twice around the discs and again passes into itself. In this groove is placed a follower, which so adjusts the valve gear that it makes every alternate stroke a working stroke. On this circular base is mounted the working cylinder, made according to the power required; each cylinder contains a piston, furnished with a valve in it. For the transfer of the air and gaseous mixture from the base to the apex of cylinders, both the connecting rods from the piston of each cylinder are connected to one crank. In the space in the upper end of each cylinder is where the mixture is expanded, and with which is connected the inlet and exhaust valves. All the valves are poppet valves, these being found to be much better than slide valves and less liable to wear. During the up stroke of the pistons a preliminary charge of gas and air is drawn into the lower part of the working cylinder; at the same time the upward movement of the pistons forces the useless products of combustion into the atmosphere through the exhaust valve, which is opened by the cams for this purpose. During the following stroke the air in the cylinder is forced into the working part, and at the same time a charge of combustible gas is admitted; the up stroke of the piston compresses this mixture in the expanding chamber, forcing it against the heated capsule and exploding it, thereby producing the power that works the motor. The speed is controlled by a centrifugal governor acting on a spring, and arranged to intermit the action of the combustible gas when the speed exceeds the normal one. There are no gears whatever for working the valves and motor, doing away with rumble and noise; the machines are therefore practically noiseless. The explosion chamber is surrounded by a water jacket that keeps the cylinders cool. The time required to start the motor to full power is under two minutes.

This article is written to direct the attention of Canadians to the opening that there is in the manufacture of these cars, fire engines and motors in Canada, for a large and profitable business; in England, large firms are preparing to engage in their manufacture; in the United States, also, large factories are under construction, or in active operation; the machines are in a mechanical sense an entire success, so much so that the French and German manufacturers are unable to supply the demand for them.

I have endeavored to explain the action of these motors as well as I could without illustration. I however think that their general principle will be understood by most of your mechanical readers. I have purposely avoided a technical description, only giving results, which are more easily understood by the general reader. If this will interest manufacturers or capitalists to commence the manufacture of these very successful and useful machines in Canada, this will not have been written in vain.

For THE CANADIAN ENGINEER

CONCRETE SUPERSTRUCTURES—DELAWARE BREAKWATER.

BY W. G. WARNER, C.E., TORONTO.

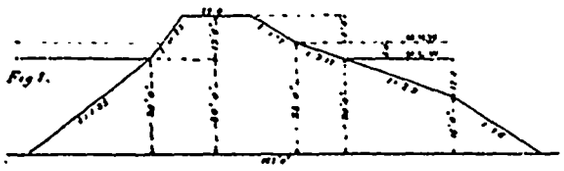
The project for this work, in progress since 1883, may be summarized under three heads:

1. Placing bush mattress foundation 2 feet thick and 100 feet wide along the axis of gap to prevent scour.

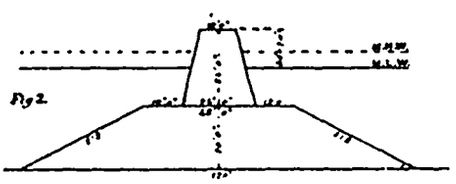
2. The formation of random stone foundation upon mattress sill, brought to a height of 12 feet below the plane of mean low water, having a top width of 48 feet and side slopes of 1 over 2.

3. The construction of concrete superstructure, upon random stone foundation, superstructure having a bottom width at 12 feet below mean low water of 24 feet, and a top width at 12 feet above mean low water of 12 feet.

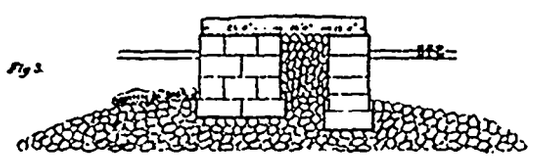
CONSIDERATIONS TO DETERMINE WHETHER CONCRETE SUPERSTRUCTURE IS MORE ECONOMICAL THAN TO CONTINUE WITH BREAKWATER OF MEAN SECTION SHOWN ON PLATE I, FIG. 1.



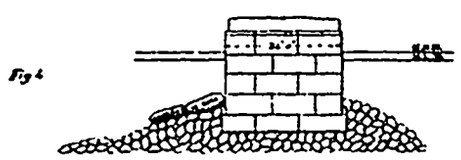
Mean Section of present Breakwater



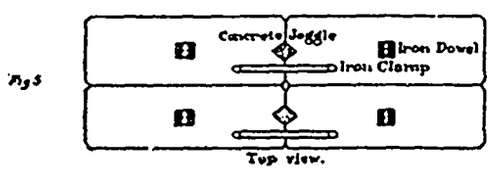
Section of the project of 1881



As built for 1300 feet



As subsequently built



The present slopes considered as slopes of equilibrium, resulting from the action of the waves thereon, and it is therefore not safe to assume a lesser section for a random stone breakwater.

The original depth over site in 1828 was 30 feet; the mean depth in 1881, 32 feet. Applying this increase in depth to the mean section of the breakwater, the cross section will be 495.3 sq. yards, or the volume for a random stone breakwater of 165.1 cubic yards per lineal foot. Of this volume of 165.1 cubic yards, 106.3 cubic yards are *below* the plane of 12 feet and 58.8 cubic yards *above* the plane of 12 feet below mean low water. The average volume in random

stone foundation, 65.1 cubic yards per lineal foot. From this it follows that there would be an excess in rubble stone of 100 cubic yards per lineal foot (165.1 - 65.1), if the present section was used instead of proposed random stone foundation with concrete superstructure. This excess of 100 cubic yards is divided as follows: 41 cubic yards *below* the plane of 12 feet, and 59 cubic yards *above* the plane of 12 feet below mean low water.

From experience gained in construction it has been found that each cubic yard in volume of breakwater = 1.5 gross tons of stone deposited Taking these figures as a basis, the above excess of 100 cubic yards would be divided as follows:

(41 × 1.5) 61.5 gross tons *below* — 12-foot plane.
(59 × 1.5) 88.5 " " *above* — 12 "

The contract cost of placing this stone is estimated as follows:

61.5 gross tons at $2.50 = $153.75
88.5 " 3.50 = 309.75

$463.50

This amount ($463.50) per lineal foot of breakwater represents the difference in cost of an entire random stone breakwater and random stone foundation required in the present project, or, it is the amount which must be compared with the cost of a concrete superstructure upon a rubble base.

For the purpose of reaching an approximation, it may be assumed that the cost of plant for making and placing concrete superstructure will not exceed $60,000, or about $2 per cubic yard for portable section of concrete. If it is further assumed that in addition to this the concrete will cost $8 per cubic yard in place; this brings price up to $10 per cubic yard. By dividing the previously obtained $463.50 by this cost ($10 per cubic yard), we obtain 46.3 cubic yards, or 1,250 cubic feet per lineal foot of superstructure.

Assuming height of superstructure to be 24 feet, as provided for in existing project, the resultant mean width (1,250÷24) = 52 feet. The project provides for a superstructure 24 feet wide at base and 12 feet wide at top. If this section be increased to uniform width of 24 feet, there still remains a margin of (52 — 24) 28 feet in favor of the concrete superstructure, or a *saving of 25 cubic yards per lineal foot of breakwater.*

This quantity represents a saving of $250 per lineal foot, taking price as $10 per cubic yard, or it can thus be stated:

With an assumed section to concrete superstructure (24 x 24) of 21⅓ cubic yards per lineal foot, the $463.50 would permit concrete to cost ($463.50 ÷ 21⅓) $21.73 per cubic yard. Such a price is undoubtedly double that which would be obtained in practice.

DESCRIPTION OF BREAKWATERS CONSISTING OF A CONCRETE SUPERSTRUCTURE, FOUNDED ON RANDOM STONE SUBSTRUCTURE.

LOCALITY.	Base of Superstructure below Mean L. W.	Top of Superstructure above Mean L. W.	Total height of Superstructure.	Width of Superstructure.	Range of Tides.	Height above High Water.	Depth of Water over Site.
2ND CLASS.	Feet.	Feet.	Feet.	Feet.	Feet.	Feet.	Feet.
Colombo ...	*20	12	32	34	2'.0"	10'.0"	18'@40'
Madras	22	8	30	24	3'.3"	4.7'	24'@45'
Mormugao...	†18	‡20	38	30	6'.0"	14'.	20'@28'
Manora	15	9	24	24	8.7'	0.3'	18'@30'
1ST CLASS.							
Kustendjie § .	†16	12	28	12@18	....	12	12'@20'
Odessa §	22	10	32	22@28	....	10	20'@30'
Fiume ‖.....	22¾	....	24	23¾	1.5'	1.5'	20'@70'
Ymuiden	†25	18	43	23@38	5.5'	12.5'	10'@30'

* Rubble and 10 ton bags of concrete extend about 5'.0 above base.
† Sea face and slope protected with large concrete blocks.
‡ Includes parapet 7'.0" high, 15'.0" thick.
§ On west shore of Black Sea. ‖ Adriatic Sea.

The exposure to which these breakwaters are subjected may be divided into two classes: 1st class, ocean exposure, to which five of above belong, and remaining three to the 2nd class.

DEPTH TO WHICH CONCRETE SUPERSTRUCTURE SHOULD BE CARRIED BELOW M. L. WATER.

In the works contained in the 1st class the foundations of concrete superstructure are placed from 15 feet to 25 feet below mean low water. This might have been done for two reasons, (1) economy, (2) stability. In case of Ymuiden, which has a rubble base 3¼ ft. thick, it is highly probable that the depth of 25 ft. was chosen for economical reasons, stone being scarce. Excluding Ymuiden, the depth for concrete foundations of remaining four works varies from 15 feet at Manora to 22 feet at Madras.

In earliest forms of breakwaters, even when provided with superstructure or parapet, they presented to the sea a face of random stone with slopes of 1 to 5 to 1 to 7 between high water, and about 12 feet below mean low water.

The effect of these long flat slopes leading up to the parapet naturally reduced force of the waves, and materially lessened the back draught of the seas, and their effect upon stone forming the sea slope below surface of low water.

From experience gained in older types it was inferred that waves had no influence upon large rubble at a depth of twelve feet mean low water; but that which was true of older types, with flat slopes extending well above the surface, ceased to be so when the wave was met by a vertical wall, founded at a depth of twelve feet or more below mean low water. The recoil of a wave from a vertical face is so much more severe than the recoil from a long flat slope, it seems only natural to expect that in the former case the rubble base will be disturbed to a much greater depth than in the latter.

Consequently, the limiting depth at which rubble has been found undisturbed in the older types of structures, is not a safe criterion when applied to breakwaters surmounted with a vertical superstructure extending well below the surface of mean low water. This radical difference between the action of a vertical wall and flat slopes of random stone, has resulted in material changes of opinion as to the limiting depth of wave disturbance, and when, in former times, a depth of 12 feet was considered sufficient to place stone beyond the action of waves, depths of 18 feet and even 22 feet are now advocated and used.

At Alderney, the rubble base was originally placed 12 feet below mean low water; but before the condition of stability was attained, the top of the rubble mound had been reduced to a depth varying between 15 feet and 18 feet, and even at this depth it was necessary to maintain the top of rubble with added material to replace that swept away.

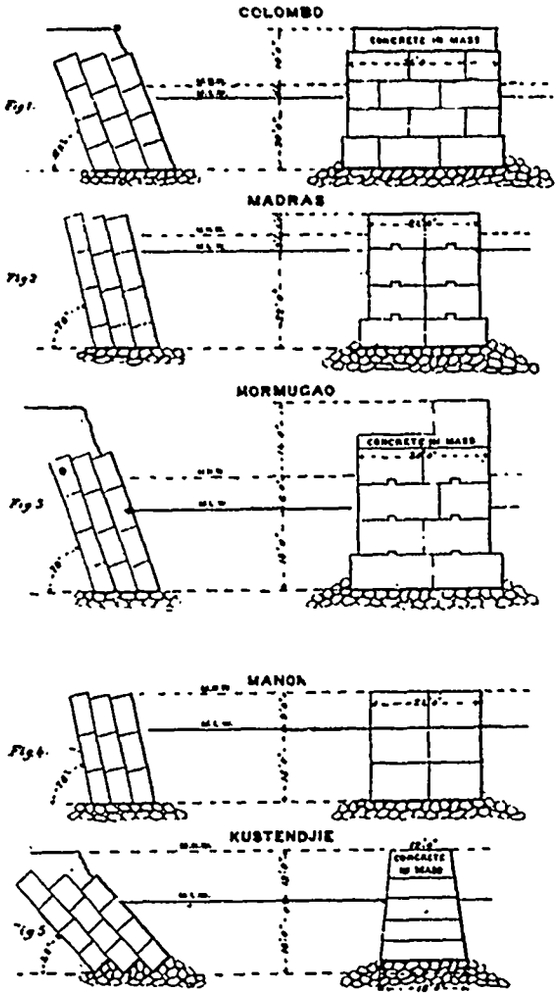
It is manifestly economical, either in the first place, to place rubble low enough to secure stability, or else protect with stone too large to be removed.

At Tynemouth, with superstructure founded 20 feet below mean low water, it was found necessary to protect the top of rubble mound on sea face with a double row of large concrete blocks.

Colombo.—The base of superstructure, situated in 30 feet of water, 2,000 feet from shore, is placed 16 feet below mean low water; but the sea face is protected by large rubble stone raised 5 feet above the base, and

such stone is still further protected with a close layer of ten ton bags of concrete.

At 3,000 feet from shore, in 40 feet of water, the superstructure is carried to a depth of 20 feet below mean low water, and then protected by large rubble and concrete bags.



Madras—The base of superstructure is 22 feet below mean low water, which seems to have been sufficiently deep to protect the top of the rubble base from the effect of wave recoil. But, in an amended project for an extension of breakwater, a wave breaker is provided along the sea face superstructure, consisting of large random blocks of concrete piled against the sea face and extending to the plane of high water.

Mormugao—Base of superstructure, 18 feet below mean low water, is protected on the sea face by a wave breaker of 20-ton concrete blocks extending above the plane of high water.

Manora—Superstructure 15 feet below mean low water, has not suffered from any reduction in the rubble base. This is probably due to reduced exposure, with fact that superstructure is so low (practically plane of mean high water) that the seas easily pass over the work and thus greatly reduce recoil of waves.

Kustendjie—Superstructure founded 16 feet below mean low water, protected on sea face by large random stone blocks, extending about 8 feet above the base of superstructure.

Odessa—Where the superstructure is founded at depth of 22 feet below mean low water the rubble base has not required protection.

Ymuiden—Superstructure founded 25 feet below mean low water; the sea face is provided with a wave breaker of large concrete blocks extending above plane of high water. This precaution is probably necessary because rubble base is only 3½ feet thick, and being founded on yielding sand it became imperatively necessary to protect sea face from currents which would produce scour and consequent settlement of the entire work.

With exception of Manora—the top of which is not above mean high water—we find that even when the base of superstructure is placed at from 18 feet to 22 feet below mean low water, it has been considered necessary to give increased stability to rubble base by special protection. While the formation of wave-breakers undoubtedly strengthens otherwise weak superstructures, it is highly probable that the expenditure of a lesser sum of money applied to placing foundations at a lower level or in giving increased thickness to superstructure would produce better results.

From foregoing it is assumed that the best modern practice would place, in localities subject to ocean exposure, the base of superstructure at from 15 feet to 22 feet below mean low water, and even then give top of rubble mound additional security by use of large stone or concrete blocks.

The forces tending to destroy a breakwater depend on the exposure of site, or, in other words, upon height and velocity of maximum waves, which work will be required to meet, and the angle such waves form with the breakwater.

Colombo—Waves 15 feet high, velocity 35 feet per second.

Madras—More exposed than any.

Mormugao—Waves strike at angle of 30°.

Manora—Waves 15 feet high, 300 feet apart, velocity 3 miles per hour, angle of incidence 70°. Heavy seas pass over the work. During gales the superstructure has a swaying motion, and even with moderate swells it rocks laterally at the top about one-quarter of an inch.

Kustendjie, *Odessa*, *Finne* being on inland seas, the conditions of exposure are modified.

Ymuiden, the sea end of Amsterdam Canal; no definite information as to the height and velocity of waves, beyond the statement that low, flat shores are exposed to heavy seas and high surf. The inference is that shallow depth in the vicinity greatly reduces velocity with which waves reach breakwater.

In considering the question of proper dimensions for breakwater superstructures, more valuable data is obtained from failures of works than from successful ones.

Madras failed entirely, due to an error in construction detail, by which no bond was given to blocks of superstructure in direction transverse to axis of breakwater.

Manora suffered from same weakness, but the reduced height saved the superstructure of the remaining cases. Colombo is the only case of partial failure, and could be used as a valuable indication of necessary section for breakwater to withstand action of exposure in places similar to that of Colombo.

As originally designed, the breakwater was rectangular in section (see figs. 3 and 4, pt. I). The breakwater was built 50 feet wide at top, so that it might be used for a quay.

This width consisted of a sea wall 24 feet thick, a hearting wall of rubble stone 14 feet thick, and a harbor wall 12 feet in thickness. During construction the sea wall was kept 700 feet in advance of the harbor wall.

In July, 1878, when breakwater extension was 1,300 feet from shore, and the sea wall was 700 feet ahead of the harbor wall, a heavy gale caused a displacement of the outer end of sea wall to the extent of 15 inches, pivoting on a point 150 feet landward, and leaving the outer end 12 inches, diminishing to nothing 450 feet inshore.

Signs of weakness, indicating the inadequacy of the sea wall to sustain unaided the thrust of the sea, led to a modification of plan.

The use of the breakwater for a quay was abandoned, the waves sweeping over the top with too much force.

The failure of superstructure 24 feet thick to withstand seas was demonstrated, so that further progress of sea wall was delayed until the harbor wall came up to outer end. The dimensions of the superstructure were then modified by omitting rubble hearting between the sea and harbor walls, and uniting both walls in one section 34 feet thick. This width was continued for remaining 3,000 feet of breakwater. At the time of failure of sea wall, the top concrete blocks had not been covered with monolithic concrete 4 feet thick, which after all settlement had ceased, was finally placed so as to unite the tops of the blocks. Although increased stability would have been given to the wall by this capping, yet the additional height 4 feet would have subjected the superstructure to an increased displacing force from the waves.

This experience is a most valuable one, and it shows that under similar exposure, in order to insure stability, the thickness of superstructure must be greater than 24 feet.

With a wall of 34 feet thickness no difficulty has occurred, and it has *not* been *demonstrated* that a wall of a thickness *between* 24 feet and 34 feet would not have been stable.

For THE CANADIAN ENGINEER.

THE INDICATOR AND ITS USE.

ARTICLE 3.

BY A. C. M'CALLUM, PETERBORO.

Having taken the card, we are now in a position to study the various changes that take place in the cylinder during the admission of steam, the expansion of the same, the exhaust, and the compression of the remaining quantity of steam left in cylinder by the closing of exhaust valves. Fig. 3 will enable those of us not acquainted with the indicator card to obtain an idea of how the steam acts in the cylinder, and to reason back to the cause that produces those effects. After we have carefully studied the indicator card, we will naturally conclude that the only positive information it affords us, whatever may be the form of the card, is the pressure in the cylinder; all the other information we glean from it comes through processes of reasoning.

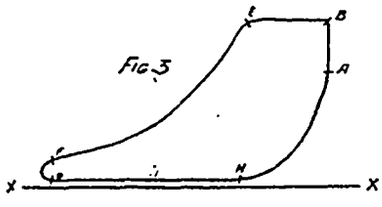
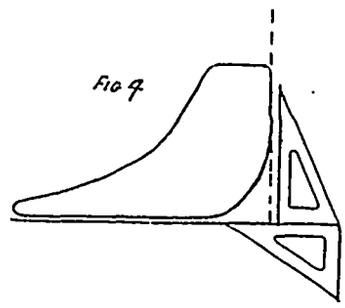


Fig. 3 delineates all the lines that would be traced by the pencil of the indicator for one revolution of the steam engine, taking it for granted that the action of the steam in the cylinder be nearly theoretically correct. In order that we may better understand the subject figures of reference have been given to the lines traced.

A to *B*, line of steam admission; *B* to *E*, the steam line; *E* to *F*, the expansion line; *F* to *G*, the exhaust line; *G* to *H*, back pressure, or line of counter pressure; *H* to *A*, the compression line. The first four of those lines are drawn during the forward motion of the piston, and until it is at or very near to the finish of its stroke, and the last two are drawn during the return stroke. *XX*, is the air line.

THE ADMISSION LINE.

The admission line *A*, *B*, represents the rise of pressure due to the admission of steam to the cylinder; this line is generally very nearly vertical, and when such is the case, it shows us that steam of nearly boiler pressure is admitted to the cylinder at the commencement of the stroke; when the piston is nearly stationary, this line, *A*, *B*, indicates the position of the steam valves at the commencement of the stroke (when speaking of "steam valves," and "exhaust valves," we simply use them as a convenience, without considering the card as one from an engine which has only one or four valves). Should the card show a line perpendicular to the air line, which can easily be tested by means of a pair of set squares, see figure 4—if then the admission line is parallel to the line just drawn, the steam admission to cylinder is perfect; should the line



A, *B*, however, lean outward to the line drawn square off the air line, it clearly indicates that the steam admission is too early, something to be carefully avoided. The only reason why it might be so, would be where we required to use live steam to cushion, in cases where the cushion or compression of the exhaust steam is not sufficient — cases requiring early admission, overloaded engines or condensing engines. Its action is that of a counter motion on the piston, but must always be reckoned as a loss of power and economy, and were it not for the stored energy of the fly-wheel assisting the engine past the dead centres, the engine would come to a stand still. If the line, however, falls away from the perpendicular line, the admission is shown to be late; there are many arguments used pro and con for early and late admission; as a rule, engineers favor prompt admission, and hold as an argument that as the walls of the cylinder and face of piston block have become cooled off during the exhausting of the steam to the condenser or atmosphere, those exposed surfaces should be heated up as early in the stroke as practicable; others again argue that if the admission be early, that while the crank is at or near the dead centre, the application of pressure against the piston will have no effect to turn the shaft, but rather will cause undue pressure and friction to take place at the crank pin, crank shaft, journals, etc., and retard the turning of the shaft. Of a choice to be made between "too early" and "too late" steam admission, that of late admission is preferable; there is

doubtless reason for the arguments used in both cases, yet loss or gain by late admission is, we believe, of small moment. The direction of this line is determined by the amount of lead given to the valve, and for which no general rule can be laid down. It may, however, happen that the ports are small in area, and the clearance is large; late admission then would show a steam line lower than it should be, comparing it with the boiler pressure, which is not a condition favorable to economy, and it is a case where lead to the valve would prove profitable. There are factors to be considered, however, that have a bearing on this line, which depend upon the speed of the piston, the relation between the area of the ports and that of the area of the cylinder, the rapid or slow action of the valves, the density of the steam present in the cylinder at the moment of opening. The proper lead to be given an engine can be determined only by the use of an indicator; we require its assistance; determining the lead without the application of the indicator is liable to error in a case presenting peculiar conditions.

THE STEAM LINE.

From *B* to *E*, Fig. 3, represents the interval during which the steam is admitted to the cylinder, and continues to flow into it in order to maintain a constant force more or less against the moving piston. This line of pressure should be maintained from the point where the admission line terminates to the point of cut-off, at which point the return movement of the valve has completely cut off the supply of steam. It is sometimes hard, however, to determine accurately the point of cut-off or closure of steam valve, because as the valve is closing over the port, the port becomes contracted, causing a fall in pressure, sometimes considerable; before that the valve has completely covered the port. We do not often obtain full boiler pressure in the cylinder at admission; there are various causes for drop in pressure, for instance, the length of steam pipe between engine and boiler, insufficient steam pipe area, steam chest, and ports, which can only be ascertained by means of an indicator. To maintain a high steam pressure in the cylinder requires then the careful consideration of all the parts that conduct the steam from boiler to cylinder. Another cause which largely contributes to reduction in pressure is excessive expansion of steam in the cylinder; especially is this so in condensing engines, the result of which is very rapid condensation of the incoming steam, and a corresponding reduction of pressure. There is then a point beyond which expansion cannot be carried but at a serious loss of economy.

THE special committee of the Canadian Society of Civil Engineers on "close corporation" has counted the ballots, and will report in a few days to the council.

BEGINNING with this number, THE CANADIAN ENGINEER is enlarged by four more pages. This is the fourth time the paper has been enlarged since it started. It is now twice its original size.

OTTAWA will be made lively this month by two conventions, that of the Canadian Electrical Association and that of the Canadian Association of Stationary Engineers. The former will be held on the 17th, 18th and 19th (the date having been changed in accordance with the wishes of the Ottawa members), and the latter from the 24th to the 28th. The programme of the electrical convention will be found in another part of this issue, but that of the stationary engineers has not been received up to date of going to press. The programme, however, will include some interesting papers; and as Ottawa will be well worth visiting for its own sake to those who have not often been there, we anticipate a good attendance at both conventions.

THE breaking of the main conduit pipe of the Toronto water works system is a calamity which, apart from the heavy expense of repairing, is one which should show the citizens the folly of trifling with so important a thing as the water supply. The City Engineer has repeatedly warned the Council of the danger of this kind of mishap, which is always liable to occur, so long as the present method of bringing water to the city exists. The one thing lacking to make Toronto almost an ideal place of residence is a safe and pure water supply, and any hesitation to pay the cost of obtaining this is the worst kind of false economy. Probably the best settlement of this vexed question would be to draw the supply from a point at or near Scarboro Heights, where the lake water is clearest and purest.

THE tenth annual meeting of the Executive Medical Health Officers' Association was held in Belleville on the 14th and 15th ult. There was a good attendance of members, and a full list of papers, some of which had to be read by title for want of time to discuss them. The number of papers on engineering subjects was the largest ever presented. This close connection between the medical health officer and sanitary engineer is productive of much practical benefit in carrying on the work connected with the protection of public health and administration of the Public Health Act. The president, Alan Macdougall, C.E., delivered a well prepared address, in which he drew attention to the alterations in the Public Health Act, passed at the last session of the legislature, which make important changes, and place increased powers in the hands of the provincial board.

A NEW electric battery of a very interesting sort has been devised by Dr. Borchers, of Driesburg, in Germany; its chemical peculiarity being that the current is generated, not by the solution of metal, but by the conversion of hydro-carbons and carbonic oxide into carbonic acid. As this is practically the same reaction that takes place in burning coal, the useful energy derived from the oxidation of a given weight of carbon in the battery can be directly compared with the effect of burning coals or coal gas to drive a steam engine, or in a gas engine. It is well known that a steam engine utilizes about 12 per cent., under the most favorable circumstances, of the theoretical energy produced by the oxidation in the boiler furnaces of the coal used to drive it; and a good gas engine utilizes about 20 per cent.; while Borchers' battery is said to have delivered at times, in available form, 38 per cent. of the energy liberated by the consumption of carbon in it, and at no time to have delivered less than 26 per cent. It would be curious if the oxidation of carbon in the wet way, in a battery, should give more than three times as much power per pound of coal consumed as burning it in a boiler furnace; but this is just what is claimed for the new battery, and it is obvious that if the claim is sustained it will not be long before steam boilers are abandoned and power derived entirely from batteries and distributed through wires and electric motors to persons desiring to use it.

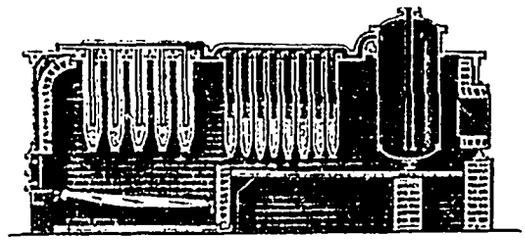
FACTS ABOUT BOILERS.

In buying a boiler, it is just as necessary to know what *won't* do as what *will* do.

A certain set of elementary forms or units have been repeatedly used in the construction of sectional and water-tube boilers, and have by repeated failures demonstrated their unfitness for the service required.

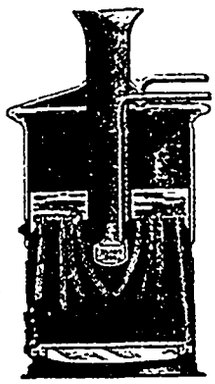
The primary cause of their failure can be traced, in every instance, to the impossibility of removing the accumulation of scale that must result from the evaporation of water (despite the claims made by the inventors that the rapidity of the circulation in their particular design prevents the deposit of scale); and until some inventor succeeds in evaporating salts of lime into steam, failures of these particular forms must be expected.

Re-inventing a device, or disposing of a well-known unit in a slightly different position, retaining all its elementary defects, cannot alter the final results. Boilers come within the Darwinian law of "*the survival of the fittest*," as surely as does any form of animal life, and the re-appearance of unsuccessful forms must be regarded as a freak, not of nature, but of inventors. It is time that some of these unsuccessful elements should be blacklisted by all engineers, and as it would be impossible to chronicle all the deaths and resurrections that have occurred among these unfortunate families, we have selected typical cases, emphasized by the prominence they have attained at their first appearance, or subsequent prominence in engineering circles due to their repeated failures



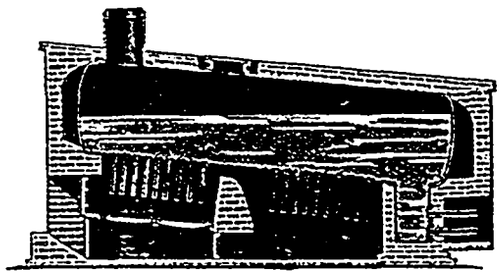
NO. 2. 1857.—BURGH ON BOILERS, p. 166.

MERRYWEATHER brought out a vertical fire-box boiler in 1862, using drop tubes hanging vertically from the crown sheet, and adding inside circulation tubes. This was used principally for fire engine purposes, and as rapidity of steaming was the main requirement, lasting qualities and economy being secondary, it met with fair success for its special work.



NO. 3. 1862.
BRITISH PATENT, 1862.

FIELD used a cylinder boiler slightly inclined from the horizontal, with radiating drop tubes fitted to the lower side

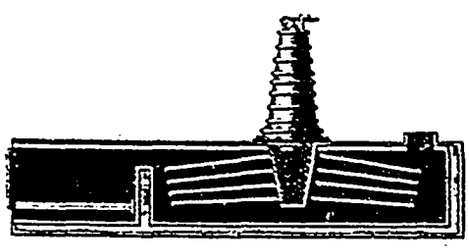


NO. 4. 1866.—BURGH ON BOILERS, p. 142.

UNIT NO. 1.

RADIAL WATER TUBES WITH ONE END CLOSED, THE OTHER END HAVING FREE CONNECTION WITH A WATER RESERVOIR.

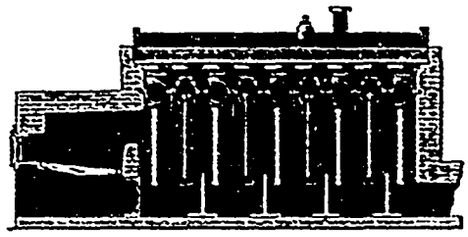
JOHN COX STEVENS, an American engineer, was the first inventor of this unit, using it in the boiler of a small steamboat on the Hudson River in 1805. It consisted of a vertical steam and water reservoir, the lower portion of which projected downwards into a fire box The main heating surface was made up of closed ended tubes radiating from the fire-box section at a slight inclination from the horizontal.



NO. 1. 1805.—TRANS. AM. S. M. E., VOL. VI., P. 601.

MR. JOLY first used this unit in the construction of a *sectional* boiler in 1857, feeding each vertical drop tube with a separate internal pipe, extending nearly to the bottom.

FIELD also re-invented, with slight changes, the Joly boiler of 1857, and adopted Merryweather's inside circulating tubes.

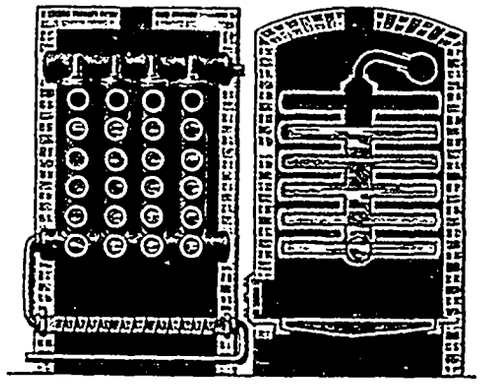


NO. 5. 1867.—TRANSACTIONS SOCIETY OF ENGINEERS. VAUGHAN PENDRED'S PAPER ON WATER TUBE BOILERS, 1867.

FLETCHER used a vertical fire-box boiler with horizontal cone-shaped tubes radiating from the sides of the fire-box towards the centre. This is probably the least objectionable form of the closed end tube.

NO. 6. 1869.—BURGH ON BOILERS, p. 85.

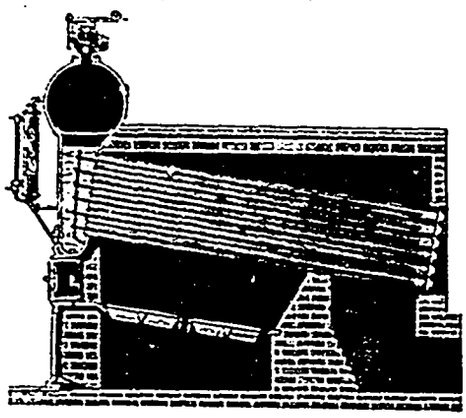
B. T. BABBITT, of New York, used a cast-iron construction of vertical tubes connected together, top and bottom, each vertical



NO. 7. 1869.—TRADE CIRCURAR ISSUED IN NEW YORK.

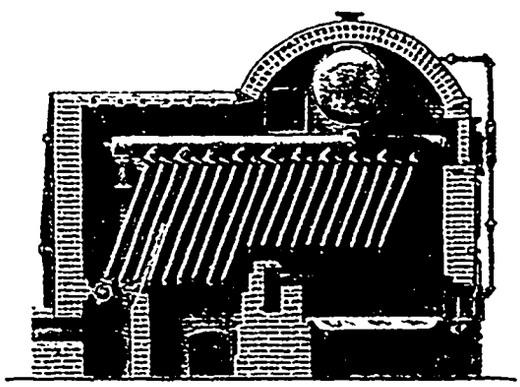
tube having horizontal radial tubes on each side, thoroughly demonstrating the folly of placing a combination of thick cast metal and scale between fire and water.

J. A. MILLER used cast headers, to which were fixed closed ended tubes with an inner circulating tube. These stood at an angle of about 15 degrees from the horizontal, and were of such length as to allow of two passages of the gases across them.



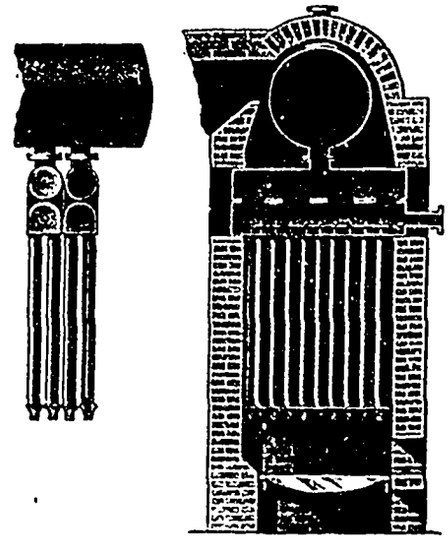
NO. 8. 1870.—U. S. PATENT NO. 1.6,388.

ALLEN nearly duplicated Joly of 1857 and Field of 1866, using cast-iron drop tubes (screwed into a horizontal tube at the top), slightly inclined from the vertical.

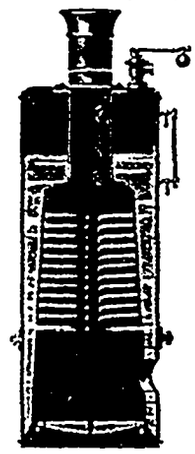


NO 9. 1871. REPORT AMER. INST. FAIR TESTS, 1871.

WIEGAND connected groups of vertical tubes, having inside circulating tubes, to an overhead steam and water reservoir. Caps were screwed on the bottom of the tubes for cleaning (?), but they generally came off without the assistance of a wrench.



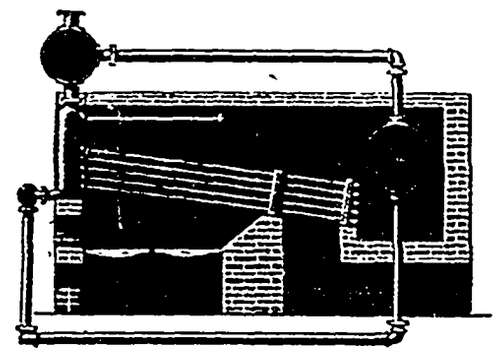
NO 10. 1872.—JUDGES' REPORT, CENTENNIAL EXHIBITION, 1876.



PLAMBECK & DARKIN modified Fletcher's design of 1869, substituting cylindrical for conical tubes and making his outer shell removable. This being taken off, the tubes could be bored out.

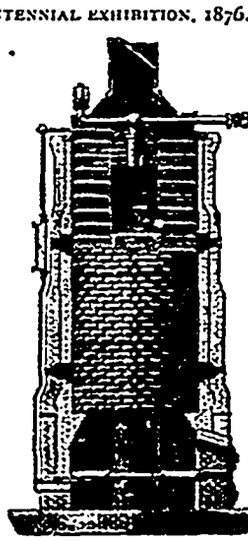
NO. 11. 1874 (ABOUT).
TRADE CIRCULAR.

W. E. KELLEY, of New Brunswick, N.J., adopted J. A. Miller's design of 1870, adding a drum or so and a subterranean feed and blow-off pipe. He was also among the first to put in superheating surface, to dry the wet steam made, due to his construction.

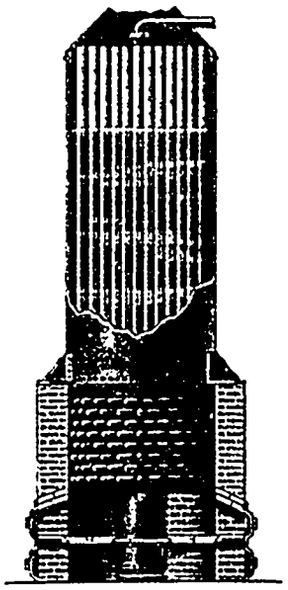


NO. 12. 1876.—JUDGES' REPORT, CENTENNIAL EXHIBITION, 1876.

M. HAZLETON turned Plambeck & Darkin's 1874 boiler inside out, using a vertical cylinder with radial tubes, making wet steam and drying it afterwards in the upper set of superheating tubes. This boiler has also appeared and disappeared under the names of "Adams," "Porcupine," "Minerva" and others.



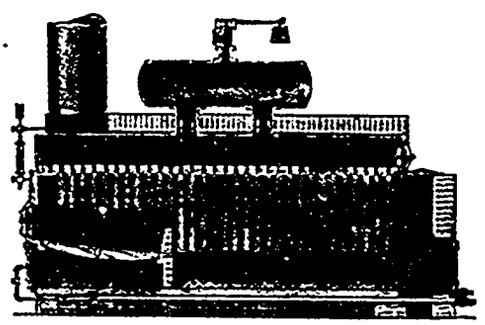
NO. 13. 1881.—TRADE CIRCULAR.



NO 14. IN SERVICE ABOUT 1882.

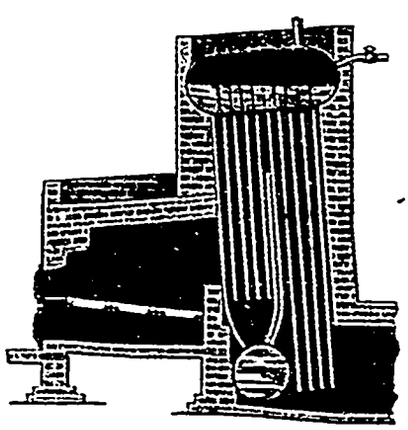
Even GEORGE H. CORLISS was seduced by this unit. He made a boiler with its lower half like a Hazleton, and its upper half of his regular vertical tubular.

KINGSLEY brought out an internal fire-box and flue boiler with stayed sides and crown sheet, and vertical tubes dropped from the latter, being a slight modification of Marshall's British patent of 1864.



NO. 15. 1883.—FROM KINGSLEY & HOOK'S TRADE CIRCULAR ISSUED IN KANSAS CITY, KAN.

ALLAN STIRLING exploited another form in Canada called the Field-Stirling boiler, joining to the closed tube unit, bent tubes and stayed surfaces, with a wrought metal mud drum at the bottom, placed in the most advantageous position for both interior and exterior corrosion.



NO. 16. 1887.—FROM PHOTOGRAPHS ISSUED BY THE INVENTOR.

The failure of this particular unit of heating surface has been accelerated by the inadequate facilities for circulation. The incoming current of water has to fight its way in against the outgoing current of steam and water, slightly modified where inner circulation tubes or diaphragms are used, and in all cases the tendency is to deposit the scale-forming material at the end of the tubes where the current slows down, due to its change of direction, with the inevitable result of burning out.

Nearly all of the above boilers are practically out of the market.

Can any success be expected by re-inventing in any new combination this unit of a closed ended tube?

It has been tried and failed in the following positions:

HORIZONTAL.

Fletcher	1869
Babbitt	1869
Plambeck & Darkin	1874
Hazleton	1881
Corliss	1882

VERTICAL.

Joly	1857
Merryweather	1867
Field	1867
Wiegand	1872
Kingsley	1883

There is only one position in which it has *not* been tried, and that is standing vertical with the closed end up.

Who will invent this for the waiting public?

INCLINED FROM HORIZONTAL.

Stevens	1805
Miller	1870
Kelley	1876

INCLINED FROM VERTICAL.

Field	1866
Allen	1871
Stirling	1887

(*Continued in next issue.*)

A NOVA SCOTIA TORNADO.

Editor CANADIAN ENGINEER:

MONCTON, N.B., Aug 26, 1895

On the 4th inst. a very unusual thing occurred in Nova Scotia At 6 p.m. a tornado, lasting fifteen minutes, visited that part of the country lying between Paradise and Bridgetown. Its course was from the southwest to the northeast, the track being 1,650 feet wide and six miles long. It was preceded by several weeks of dry weather. At 5 p m. thunder was heard At 5 45 p m. rain fell. At 6.30 p m. the storm broke with violence, rain fell in torrents for three-quarters of an hour and then ceased. The rain storm passed

on up the valley to a point west of Paradise, where it developed into a destructive tornado, some of the effects of which may be seen in the accompanying photographs. Large trees were snapped off like pipe-stems, others, three feet in diameter, were uprooted, branches twelve inches in diameter being broken off and carried one hundred feet Large apple trees loaded with fruit were carried bodily two hundred feet Flying wreckage penetrated through the walls of buildings and landed on the floors inside The top story of a barn was carried one and a half miles, and the lower story filled with hay, moved three feet from its foundation. A piece of scantling two inches by three inches, by five feet long, was found driven vertically three feet into the earth. Small buildings were blown into atoms, and fences leveled to the ground. Window panes were broken, the sashes driven into the rooms, and furniture and glassware smashed by the force of the wind. Chimneys were also blown down An orchard of 250 fruit-laden trees twenty years old, some one foot in diameter, was completely destroyed, not a tree being left standing

Perhaps some of your readers may tell us the wind-velocity and pressure per square foot required to break windows and blow down chimneys

WILLIAM B MACKENZIE,
Asst-Engr. I C Ry

CANADIAN ASSOCIATION OF STATIONARY ENGINEERS.

The meetings of Toronto No. 1, C A.S.E., have been fairly well attended during the past month. The question has been discussed as to whether it would not be well to hold the general convention every second year instead of annually as now, and a motion on the subject will probably be made at the forthcoming convention at Ottawa this month The objection seems to be that if the conventions were held only once in two years the members would lose interest in the organization, while important interests might suffer because of such delay The delegates to the Ottawa convention from Toronto are Bros Wickens, Fox and Huggett, but Bros. Philips, Edkins, Blackgrove and others expect to be in attendance, and the Toronto party contemplate a side trip to Montreal after the convention is over.

At a regular meeting of Toronto No. 1, C.A.S.E., held Aug. 9th, the following resolution of condolence was passed Whereas, it has pleased Almighty God to remove from our midst the beloved daughter of our esteemed Bro. E. Dunn, be it, therefore resolved, That we do extend to Bro. Dunn and family our heartfelt sympathy in this their hour of bereavement, and commend them to our All-wise and Supreme Ruler, who doeth all things well; and be it further resolved, That a copy of the above be entered on our minutes and the mechanical press be furnished with the same W G. Blackgrove, G. Fowler and T Eversfield, committee.

The following are the officers of Guelph Branch, C.A S E. for the current year President, Jas. Tuck; vice-president, P. Ryan; recording secretary, H. L Flewelling; financial secretary, H Gerry, treasurer, C. J. Jorden; conductor, T. Anderson doorkeeper, J McCrea. The meetings are held at the K. of L. hall on the second and fourth Fridays in the month. The address of the recording secretary is P.O. box 8, Guelph, Ont.

The Executive secretary, Jas Devlin, writes as follows. I send you a schedule of the branches with the names and addresses of the secretaries, which I trust you will find of sufficient worth to insert in your paper As you are already aware, the annual convention is to be held at Ottawa on the 24th, 25th, 26th and 27th of September Elaborate preparations are being made for the entertainment of delegates, and it is expected that the gathering will be one of unusual interest. The annual reports of the branches are very satisfactory, and a large representation of delegates is expected Bro F. Robert, of Ottawa, has been appointed secretary of management committee, and I know he will make personal sacrifices in order to make the affair a success.

ONTARIO

No	Location	Secretary's name.	Address.
1	Toronto	T Eversfield	University College
2	Hamilton	Wm Norris	211 Wellington St.
3	Stratford	.....	.....
4	Brantford	Joseph Ogle	Brantford
5	London	.....	.....
6	Guelph	Hy Flewelling.	P O Box 8
7	Ottawa	Frank Merrill	352 Wellington St
8	Dresden	Thos King.	Dresden
9	Berlin	W. J. Rhodes	Berlin
10	Kingston	John Taudvin	97 Wellington
12	Kincardine	Andrew Scott	Kincardine
13	Wiarton	D. E. Dunham	Wiarton
14	Peterboro	W. L. Sharp	Peterboro
15	Brockville	Wm. Robinson	Brockville
16	Carleton Place	A. M Schofield	Carleton Place

QUEBEC.

1	Montreal	Thos. Ryan	Customs House
2	Montreal (St Laurent Branch)	B Archibald York.	222 Bd. of Trade bl.lg

MANITOBA.

1	Winnipeg	Jacob Moeller, *pro tem.*	Winnipeg

The C.A.S E., No. 10, of Kingston, held a large and enthusiastic meeting on Tuesday evening, Aug. 6th, for the election of delegates to the convention at Ottawa. Brothers Sandford Donnelly and Harvey Hoppins, our worthy president and vice-president, were elected unanimously, and Brother Frederick Simmonds as proxy. The meeting closed after a spirited debate on several subjects likely to be brought before the convention at Ottawa. We had one candidate for initiation, making three this term, and expect more shortly. JOHN TAUDVIN, secretary, 97 Wellington st.

The following are the officers elected by Dresden branch No. 8, C.A.S.E., for the current year: Thos. King, president; William Bear, vice president. Thos. Steeper, recording secretary, O. S. Merrill, treasurer; M. J. Bardwell, conductor; Harry Bishop, doorkeeper There are now sixteen members in good standing. We are getting along very nicely, and expect to have quite a few come in with us soon. THOS. KING, president.

J G. Bain, engineer at the Toronto high level pumping station, who is spending a holiday in Northern Ontario, writes that there is talk of forming a branch of the C.A.S.E. at Bracebridge.

WATER POWER FROM LAKE ERIE.

Wm Golding, C.E., of New Orleans, La., whose articles on the question of bringing water power from Lake Erie to Hamilton will be remembered by our readers, sends us a copy of the following letter addressed by him to R. Wynne, Engineer, of St. Catharines, Ont., on the relative merits of that scheme and the Welland Power Company's plan:

"Your letter of July 26th last relating to the matter of conveying water from Lake Erie to Lake Ontario for the development of power, has received careful consideration.

"The plan proposed by the Welland Power and Supply Canal Company is to take water from the Niagara River through Chippewa River to the point where the new work begins, a distance of five miles- the new work being a canal six and a quarter miles long, leading to the brow of the mountain.

"The practicability of this plan as an engineering work is beyond criticism, yet there remains to be answered, how to dispose of the product? There is not in the immediate vicinity any considerable demand for power, Hamilton, the greatest manufacturing centre of Canada, being 40 miles away, Buffalo being practically the same distance Toronto entirely out of the circuit, thus leaving but a few unimportant towns to supply with power.

"The conditions would be entirely different with a power plant established at or near Hamilton, where, at least, 30,000 horse-power

could be utilized within a radius of five miles, from which service there would be sufficient profit to pay interest on the investment.

"It is not definitely known to what distance power can be economically transmitted by electricity, yet sufficient is known to warrant the assumption that fifty miles is the maximum, and that, at least, one-half of the power developed should be expended within a radius of thirty miles.

"In regard to water supply for towns and cities, I argue that water of Lake Ontario is not inferior to the water of Lake Erie, and can be pumped by electric machinery at much less cost than by direct supply through pipes

"The plan of taking water from Niagara through Chippewa, is precisely the same as that of taking water direct from Lake Erie through Grand River, the latter will cost more money, but will be by far the best investment.

"Now, I do not desire to discourage your scheme, yet I must say that the great distance from the power plant to the industrial centre will be prohibitive of profit.

"I hope to see this great natural power utilized, and if my humble efforts in directing attention to the subject shall hasten the consummation of any practical scheme, the satisfaction I shall enjoy will be ample recompense for the service rendered.

"Very truly,

"WM. GOLDING, *Engineer.*

"New Orleans, La., August 31st, 1895."

CANADA'S RAILWAY SYSTEM.

At the International Railway Congress held in London the first week of August, Sir Charles Tupper represented Canada, and submitted a very carefully prepared paper on "Railway Progress in Canada. Sir Charles divides the history of railway construction in this country into the following epochs. 1. The commencement of railway construction in Canada in 1836. 2. The completion of the Grand Trunk Railway from Riviere du Loup to Sarnia in 1860. 3. The Confederation of Canada, in 1867. 4. The completion of the Intercolonial Railway main line from Halifax to Levis, in 1876. 5 The commencement, in 1877, and the completion, in 1868, of the Canadian Pacific main line from Montreal to the Pacific. 6. The present date, 1894 1895 Sir Charles contended with much force, supporting his case with a mass of statistics, that the 15,000 miles of railway in Canada had not only been of incalculable service to Canada, but were calculated to produce a revolution in the travel and commerce of the world Halifax, which is only about four days' sail (for a modern Atlantic steamer) from Southampton, is brought within five and one-quarter days from Vancouver, on the Northern Pacific Ocean, which city in turn is only eleven and one-half days from Yokohama.

WRIGHT'S REDUCER FOR INDICATOR USE.

Capt. J. Wright, of Montreal, has invented and patented a reducer for indicator use, which is put forward as a solution of the problem of obtaining a true reduction of the reciprocating motion and behavior of a piston during the stroke of an engine. With this reducer the speed of an engine is of no consequence. It is as steady and uniform in action at 400 revolutions per minute as at 40. It can be kept constantly in action, and ready for use at any time, on board ship or in power and lighting stations, where engines are expected to work 24 hours per day for several days in succession, and without a stop. Diagrams can be taken of any desired length, from one inch up to the limits of the indicator, and without stopping the engine to make the change. It can be erected temporarily or permanently at any angle. In every case the operating string or wire is led direct from the reducer to the indicator without the use of intermediate sheaves.

This reducer can simultaneously and independently operate indicators at each end of the cylinders of tandem compounds or tandem compound Worthington pumps. In cross compounds, ordinary diagrams can be taken from both ends of either cylinder, and quadrant or lead and exhaust action diagrams from the other. Where the length of string or wire is objectionable, the reduced reciprocating motion can be extended any required distance, and the indicators operated with short strings.

This reducer, in constant service, is warranted to retain accuracy and do an amount of work that would wear out other contrivances, if the test is made on engines running 300 revolutions per minute or more.

Capt. Wright has received many testimonials on the efficiency of his reducer. Among others, John J. York, chief engineer of the Montreal Board of Trade building, says:

"Your reducer operates steady and uniform on our high-speed Robb engines. As for durability, I may say that it has now made some 500,000 strokes per day's work for about 30 days, and shows no trace of wear. The method you have adopted for changing the length of diagram can hardly be improved upon. It looks and acts so much like a part of the engine, that I have decided to leave it on permanently. It is all you claim, and I cheerfully recommend it to any engineer requiring a correct and durable reducing gear."

THE FIRST CASTING OF IRON.

Cast iron did not come into commercial use before 1700, when Abraham Darby, an intelligent mechanic, who had taken some Dutch workmen to establish a brass foundry in Bristol, England, conceived the idea that iron might be substituted for brass. This his workmen did not succeed in doing, being probably too much prejudiced in favor of the metal with which they were best acquainted A Welsh shepherd boy, John Thomas, had some time previous to that been received by Abraham Darby into his workshop on the recommendation of a distant relative. While looking on during the experiments of the Dutch workmen, he said to Darby that he thought he "saw where they had missed it." He begged to be allowed to try, and he and Darby remained alone in the workshop all night, struggling with the refractory metal and imperfect molds. The hours passed on and daylight appeared, but neither would leave his task. Just as the morning dawned they succeeded in casting an iron pot complete. The boy entered into an agreement with Darby to serve him and keep the secret. Although enticed by offers of higher wages to leave his master, he continued faithful, and from 1709 to 1828 the family of Thomas were the confidential and valued agents of the descendants of Abraham Darby. For more than a hundred years after that night, in which Thomas and his master succeeded in making an iron casting in a mold of fine sand contained in frames and with air holes, the same process was practised and kept secret at Coalbrook Dale with plugged keyholes and barred doors.

THE WATEROUS ENGINE WORKS.

The foundation stone of the Waterous Engine Works Company's new buildings at Brantford, Ont., was laid on August 21 by H. Morice and I. Cockshutt. Mr. Morice became connected with the firm forty-eight years ago and Mr. Cockshutt was the first president, over fifty years ago, when the business was started. The new buildings of the firm are built with all the most modern improvements for saving labor. The main building is 300 feet long and 120 feet wide, and has a central space of 40 feet wide, running to the roof, over which a travelling crane will be operated. On each side of the centre is a 40-foot space, with a gallery the full length of the building. The foundry or moulding shop is 80 feet wide by 100 feet long, with a central space of 20 feet, and two side spaces of 20 feet each, in one of the latter the cupolas will be placed. The pattern room is separated from the foundry by a solid and heavy fire wall. The power house is 40 x 60 feet and the boiler house 87 x 120 feet. Heating will be by the hot blast system. The railway track will enter the end of the building, and there will be other tracks in the yard from which shipments can be made and material received without the need of teaming When completed the works will be capable of giving employment to 400 men. About 240 men are employed. The new works will be completed sometime next spring.

CANADIAN ELECTRICAL ASSOCIATION.

The following is the programme of the fifth convention of the above association to be held at Ottawa, September 17, 18, 19:

BUSINESS PROGRAMME.

September 17th, 11 a m.—Formal opening of the convention in the Railway Committee room of the House of Parliament, when His Worship the Mayor will read an address of welcome

At the conclusion of the address members and ladies will be shown through the Senate, the House of Commons and Parliamentary Library.

2.30 p.m.—Opening of first session at Board of Trade rooms, Elgin street. President's address Reading minutes of last meeting. Secretary-Treasurer's report Reception of reports of Committees on. Constitution, Statistics, Legislation. General business. Presentation of papers. Discussion.

September 18, 10 a.m.—Consideration of reports of Committees. Election of Standing Committees for the ensuing year. Selection of place of next meeting. Election of officers and Executive Committee. General business. Presentation of papers. Discussion.

September 19th, 10 a.m.—Presentation of papers. General business.

LIST OF PAPERS

"Some Notes on the Consolidation of Two Systems of Electric Supply," A A Dion, Ottawa · "The Telegraph in Canada," Chas P Dwight, Toronto "Suggested Forms for Electric Light Accounting," D R. Street, Ottawa, "From the Coal Pile to the Meter," Jas Milne, Toronto · "Some Modern Alternating Current Apparatus," H. T Hartman, Peterborough, "Non Interference Diplex Relay," "A Percentage Method for Circuit Measurements," D. H. Keeley, Ottawa; "————————," J. J. Wright Toronto.

SOCIAL FEATURES.

September 17th, 8 00 p m —Members and ladies will be conveyed by special electric cars to view the Chaudiere Falls, the Lumber Mills, and Electric Power Houses. This is a sight which for novelty and interest can scarcely be duplicated outside of Ottawa.

September 18th, 8.00 p m —Banquet to members and ladies at the Russell House.

September 19th.—Immediately after the adjournment, electric cars will be provided to carry members and ladies over the Street Railway Company's lines out to Rockliffe Park and return.

It is anticipated that arrangements will be consummated for members and ladies to run the water slides on a raft of square timber. His Excellency Lord Aberdeen has placed his electric launch at the disposal of members and ladies.

Arrangements have been made with all railways for a reduced rate of one and one-third fare for members and ladies accompanying them To obtain this concession, members must purchase a first-class ticket, obtaining from ticket agent a Standard ertificate, which will entitle them to purchase at Ottawa a return ticket at one-third the usual fare. This concession is not obtainable prior to 14th Sept It has also been arranged that members going from Toronto may get tickets to Montreal *via* Ottawa, and covering the dates of the convention, at $7 for the round trip, good by both G.T R. and C.P.R. Special hotel rates have been arranged for as follows. Russell House, $2 per day, Grand Union, $2, Windsor, $1.50.

OFFICERS.

President, K. J Dunstan, local manager Bell Telephone Co, Toronto; 1st vice-president, A. B Smith, superintendent G.N W Telegraph Co., Toronto; 2nd vice-president, C Berkeley Powell, Ottawa Electric Co, Ottawa; Secretary-treasurer, C H. Mortimer, publisher *Electrical News*, Toronto.

Executive Committee—L. B. McFarlane, manager Eastern Department Bell Telephone Co., Montreal; Geo Black, manager G.N.W. Telegraph Co., Hamilton; T. R. Rosebrugh, lecturer in Electricity, School of Practical Science, Toronto; E. Carl Breithaupt, electrical engineer, Berlin; John Yule, manager Guelph Gas and Electric Light Co., Guelph; D. A. Starr, electrical engineer, Montreal; J. J. Wright, manager Toronto Electric Light Co., Toronto; J. A. Kammerer, general agent, Royal Electric Co., Toronto; J. W. Taylor, manager Ottawa Carbon and Porcelain Co., Ottawa; O. Higman, Inland Revenue Department, Ottawa.

A TIDAL MOTOR.

Editor CANADIAN ENGINEER.

SIR,—Having read with great interest the letter of Mr. Horace J Smith, with your foot note to same, in THE CANADIAN ENGINEER, *re* tidal motors, allow me to say that after more than twenty years experimenting, and a large outlay of money, I have successfully solved the problem of working from the rise and fall of the tides every minute of the twenty-four hours throughout the year. I can put my apparatus to work from any rise and fall of the tide from twelve feet upwards. I have tried a small plant to work a dynamo, and kept ten incandescent lights going day and night for three months without any stoppage This I think you will allow is a sufficient test as to its usefulness The first cost will compare favorably with steam engines boilers, engine house steam valves, pipes, purchase of land etc whilst ever after if working day and night throughout the year, the cost of working by tidal apparatus will only be one fifth of the cost of working steam engines, power for power A breakdown with my plant will be next to impossible, whilst every engineer knows that the same cannot be said about steam engines with boilers etc and my plant will last a lifetime. Then again by the use of tidal power electric tramways, lighting cities, and even villages, can be carried out most economically, and enable electric light companies to pay an increased dividend It is also the very power for working mills, factories, iron works, and in fact all kinds of machinery It would also be useful for forcing water under pressure for long distances, for working lifts, etc., in towers, and for baths, watering streets and various other purposes, so that there is scarcely a limit to the purposes for which it can be used. Then, again, it has an advantage over working from various rivers, brooks, etc., as we have always plenty of water in the sea. My plant is as near automatic as it is possible to make machinery, so that a man and a boy for days and the same for nights, could attend to hundreds of horse power. I may here say that I have the tidal apparatus patented in this country, and am open to treat with capitalists for taking out patents for Canada and the United States. I can show by drawings and manuscript the working of my apparatus to a nicety; and I may say that although the invention took me so many years to find out and perfect, it is very simple in all its parts. I think you will see from the foregoing that this invention, if properly pushed and a plant put down, could be made a very big thing indeed. To conclude, I may say that one of the greatest scientists of the day says I have solved one of the greatest problems of the age.

Yours, very truly,

E. DAVIES,

Cambridge Cottage, Ewart Grove, Wood Green, London N., Eng.

THE WINNER OF THE QUEEN'S PRIZE.

Machinists and mechanical men will be proud to enrol the winner of the Queen's Prize at Bisley among their number. Private T. H. Hayhurst, who has this distinction, was born at Kirkby, Lonsdale, Westmoreland, on 3rd October, 1868. His father receiving the appointment of governor to the Kendal Union in May, 1870, the family removed to Kendal, where the subject of our sketch received an education at the public and grammar schools. On his leaving school in 1882, he secured a position with the well-known firm of Messrs. Gilbert Gilkes & Co., hydraulic engineers, Kendal, remaining with them till 1888. While with this firm he attached himself to the Volunteer Brigade, joining in 1884 the 2nd Border Regiment, where he early took an interest in rifle shooting, and acquitted himself at several local meetings, and also at Wimbledon.

In 1888 he accepted a position with the Naval Construction and Armament Co., of Barrow-in-Furness, and still kept up his rifle practice, and attended the Wimbledon meeting of 1889, winning the Prince of Wales Prize of £100 and badge, shooting as a representative of Westmoreland.

In 1890 he received an appointment with the Lancashire Watch Co. and remained with them two years. Having a desire to see the New World, he came out to Canada in 1892 and took up his residence in Hamilton, obtaining a position with the Bowman Hardware Co., of that city, and always having a liking for tool work, accepted an engagement with the Canada Tool Works, Messrs. John Bertram & Sons, Dundas, where he was a great favorite among a large circle of friends. He remained with this firm till December, 1894, when he was obliged to return to England to settle up his father's estate.

His love for rifle shooting still being uppermost, he joined E company of the XIII. Battalion, attending closely to his regimental duties, and attended all the rifle meets of this crack battalion, and was very successful both at the Provincial and Dominion Rifle

Association Matches, representing Canada on the Bisley Team in 1894, and again in 1895, where he achieved the high distinction in winning the Queen's Prize, £250, gold medal and badge, as well as being in second place to the winner of the Prince of Wales' competition, an honor achieved by few marksmen. We are pleased to see that he is again to represent Canada on next year's Bisley Team, having been one of the first twenty in the last Dominion Rifle Association Matches.

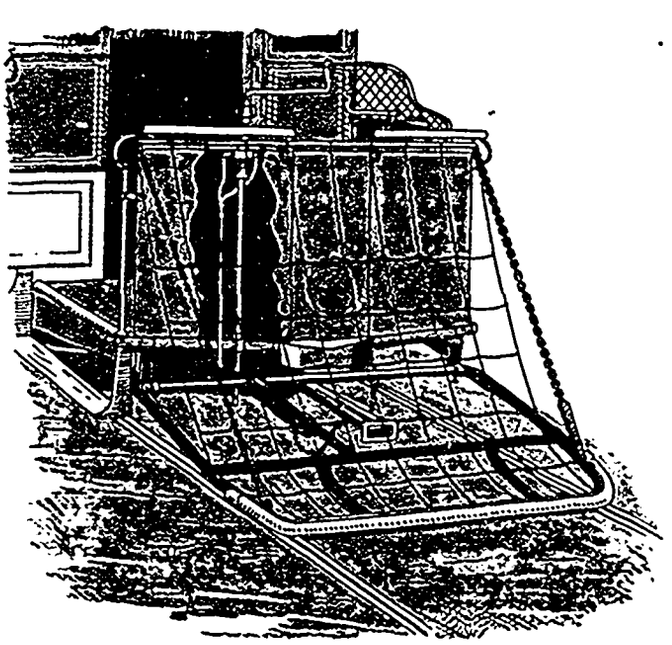
R. W. SHEPHERD, SENR.

The death of R. W. Shepherd, senr., at Como, on August 29, removes one of the oldest of Montreal's prominent citizens. Mr. Shepherd was well known as the president of the Ottawa River Navigation Company; he held also the position of vice-president of Molsons Bank and took an active interest in the work of the Montreal General Hospital, of which he was a governor. Mr. Shepherd was a member of St. George's church, and previous to his illness held the position of church warden. Deceased was 76 years of age and had been ill since the early summer; up to that time, however, he had taken a very active part in all the business of the company.

Mr. Shepherd was an Englishman, and emigrated from Norfolk, England, in his boyhood. Among his earliest employments after settling in Canada was a situation as purser on one of the Ottawa River Navigation Company's boats. In a little while his talents and integrity began to be appreciated, and he rose step by step until, in the days when Sir George Simpson was president of the Ottawa River Navigation Company, Mr. Shepherd was captain of one of the steamers. He shortly afterwards was made manager of the company, and finally president. Mr. Shepherd was always a very charitable man, and was a good friend to most of Montreal's benevolent institutions. Mr. Shepherd married Miss Deladesnier, of Como, who survives him. He leaves nine children, four sons and five daughters. The sons are Dr. F. J. Shepherd, professor of anatomy at McGill University; S. A. Shepherd, now in England, R. W. Shepherd, and D. Shepherd. The daughters are Mrs. W. A. Molson, Mrs. A. S. Henshaw, Mrs. G. R. Robertson, jr., Mrs. H. Haswell, and Miss Shepherd.

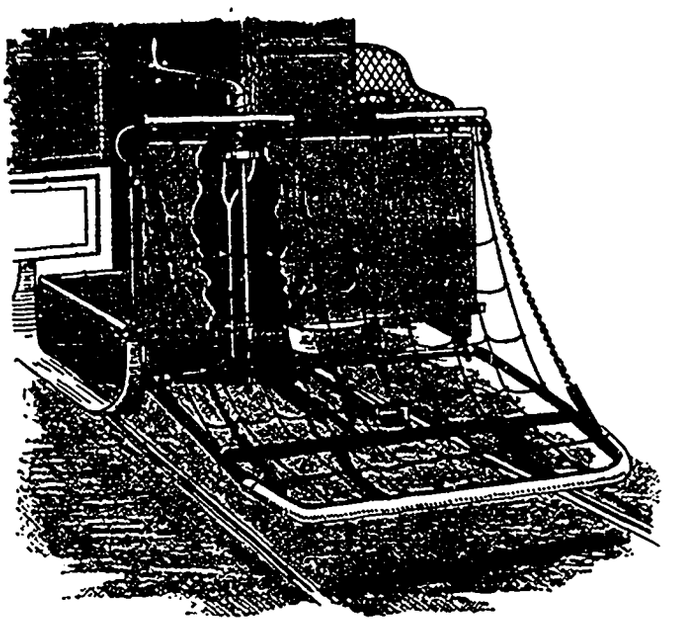
THE TORONTO AUTOMATIC CAR FENDER.

We give herewith illustrations of a style of street car fender which has been successfully put to a long and practical test on the Toronto Street Railway. The principal feature of this fender—which is the invention of a citizen of Toronto, D. S Macorquodale—is a specially constructed screw attached to the brake rod. One turn of the brake crank places the fender within one inch of the track, or closer, if desired, so that almost any small object can be carefully picked up. Further revolutions of the brake rod have no bearing on the fender, so that the brake may be put on hard without wrecking the fender, and on the first reversal of the brake the fender is once more placed in its usual position, some 8 inches from the ground.



This fender has been the means of saving at least one man's life, besides a number of dogs and other animals. By the removal of one pin the fender may be folded up close to the front of the car, thus allowing the cars to be closely packed in the sheds, and permitting the pushing of a car in front. The fender can be made very cheaply, as it has only one weld in the whole construction.

The front netting is preferably made of steel chain, which, while the material is more expensive than rope netting, yet can be made up for a tithe of the price of the other. Railway managers can readily see that they can afford to pay a relatively high price for the right to use a fender, the cost of construction and maintenance of which is relatively low.



One of these fenders has been in use on a car of the Toronto Street Railway from June to November, 1894. A large part of this time it passed over the railway tracks at the Don an average of 44 times a day. These tracks were about eight feet apart, and at different levels resulting in a pitching motion of about eight inches going each way. These tracks were crossed by Mr. Macorquodale's fender during the whole period without injury, while most other fenders that hung at a fixed height were wrecked. The Toronto Street Railway Company are now equipping their cars with this fender.

BRITISH METAL TRADE WITH CANADA.

The following are the values in sterling money of the exports of metals, hardware, etc., from Great Britain to Canada for July and the seven months ending July of this year and last:—

	Month of July.		Seven mos. end'g July,	
	1894.	1895.	1894.	1895.
Hardware and Cutlery	£4,375	£4,199	£40,427	£28,664
Pig iron.....	2,311	5,186	11,470	13,823
Bar, etc.....	863	1,286	11,965	7,529
Railroad	26,791	21,678	135,061	52,985
Hoops, sheets, etc.....	14,101	6,934	50,828	24,150
Galvanized sheets	4,189	4,461	28,383	35,144
Tin plates	15,987	13,588	101,949	73,097
Cast, wrought, etc., iron ..	10,144	5,781	41,066	27,897
Old (for re-manufacture)..	3,196	3,145	7,671	4,732
Steel	13,820	6,357	58,344	32,763
Lead	1,980	3,014	4,998	12,344
Tin, unwrought	2,527	2,787	12,104	13,809

NOVA SCOTIA STEEL COMPANY.

At the first annual meeting of the Nova Scotia Steel Company, Ltd., of New Glasgow, under its new organization, the report referred to the amalgamation of the Nova Scotia Steel and Forge Company, Ltd., and the New Glasgow Iron, Coal and Railway Company, Ltd., which had been confirmed by Acts of the Dominion and Provincial Legislatures.

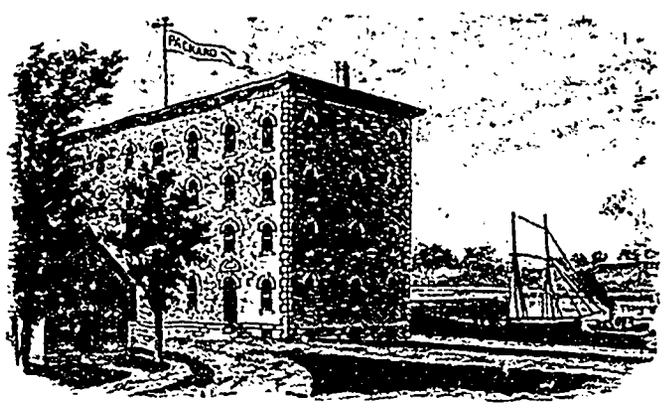
The report goes on to state that the extreme depression of the iron industry, particularly in the United States during the past year, had the effect of reducing prices so much below former years that profits were greatly decreased. Owing to the large accumulation of unsold pig iron, and the necessity of a partial re-lining, the furnace was out of blast during five months of the year. The output of the steel works was largely curtailed during the month of July, 1894, owing to the cogging mill engines having broken down, involving a large loss through the stoppage of the works and cost of repairs.

As to the future—prices have improved considerably during the past three months; orders for a large quantity of steel have been received. Pig iron during the past two months is being sold as fast as the blast furnace is producing it We enter the new year with very fair prospects.

The accounts submitted deal with the operation of the amalgamated companies for the twelve months ended 30th June, 1894:—

The profits of the year ended 30th June, 1895, were ...	$ 22,578 35
To this must be added the balance at credit of profit and loss account, N.S. Steel and Forge Co., Ltd. 1st July, 1894	3,886 75
Also balance at credit of profit and loss account, New Glasgow Iron, Coal and Ry Co., Ltd., July 1, 1894	90,814 59
	$117,279 69

THE NEW PACKARD LAMP WORKS.



The removal of the Packard Electric Co.'s lamp works from Montreal to St. Catharines has already been chronicled in these columns. The company obtained a long lease on very favorable terms of what is perhaps the most substantial factory building in Canada The walls are 36 inches thick, of solid stone, and the interior, with inexpensive alterations, has been admirably adapted to the company's special work The building is 100 x 55 feet, four stories high, besides the basement, and is excellently lighted. They can get 300 horse-power out of one flume, and if required a spare flume belonging to the old mill can be used, giving them altogether 400 horse-power From eight to ten acres of land is also included in the property, and there are a number of outbuildings, such as stables, oil shed, shipping house, ice house, and a detached building which is being used as a furnace room for carbonizing purposes. The commercial facilities of the place are completed by a private wharf on the canal which runs close by the building. The company have looked after the comfort and convenience of their employés by providing dressing rooms, lavatories, etc, and everything about this fine factory bespeaks thoughtfulness and enterprise Gas is used as fuel, and the company are now the largest consumers of gas in St. Catharines

In opening business in the new building the company announce that in order to give the business personal attention, W. D. Packard, the vice-president, has assumed the general managership of the company, with G. A. Powell as assistant, and they assure their customers that any orders with which they may be favored will receive careful attention With revised price lists, and the "new Packard" lamp to put on the market, the company will have a marked increase in their trade.

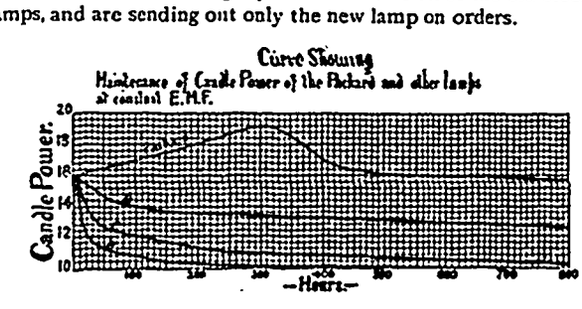
With regard to the new lamp, the *Electrical World* gives a report of the test of it made by Prof Thomas, of the Ohio State University, Columbus, Ohio. Our readers may be aware that Prof. Thomas was chairman of the World's Fair committee on incandescent lamps and is an authority on the subject. The *World* says the test forms a notable addition to the literature of the incandescent lamp. Weston instruments were used for the electric readings; and for candle power readings a Summer-Brodhun sighting box was adapted to an accurately graduated portable photometer bar 100 inches long. The lamp under test was placed at one end of the bar, and a 100-volt 16-c p. lamp, which had been used some time, was placed at the other end and used as a working standard. This lamp and three similar check lamps were first carefully measured on the university standard photometer, against a Harcourt pentane lamp, whose value was well known from many series of comparison with the best sperm candles. During these tests the incandescent lamps were supplied with current from a good storage battery. All photometer readings at the university and at the station were made by Prof. Thomas. At least four settings were taken for each reading, and the sighting box was severed after each setting. Successive settings seldom differed by more than one per cent.

One hundred lamps, labelled "16-c.p., 100 volts," were received, being about equally divided into two lots, having distinguishing marks inside the bulbs Twenty-five lamps were taken at random from each lot for test. In order that the lamps might be run at as nearly constant voltage as possible, wires were run to the test room from the station circuit, which is brought back from the junction box of the mains of the general lighting system of the company. The mains were kept at as nearly constant potential as possible by an attendant at the switchboard, who was guided by the readings of a Weston voltmeter attached to pressure wires from the mains. It unfortunately happened that at a point between the mains and the station, a motor was run from the station circuit which supplied current for the test. The running of this motor caused momentary changes in voltage during the day, but at night it was not running, and the voltage was then quite steady. If the lamp circuit had been run from the station switchboard, it would have been necessary to provide for constant watching and regulation of the lamp voltage As already stated, the voltage was not perfectly constant, and no attempt was made to secure unusual constancy for the reason that the circuit arrangement used enabled the lamps to be worked under the conditions ordinarily existing in central station practice. The results may, therefore, be considered as a better indication of what lamp users may reasonably expect from similar lamps than if the lamps had been run at an unvarying voltage.

The 50 lamps were mounted, vertically downward, in four rows of keyless wall receptacles, wired at the middle of each row to a common point, and provided with a double pole switch and with fuses. The standard station voltage being 110, an iron wire resistance was inserted in one of the wires leading to the lamp rack, and adjusted so as to secure as nearly as possible 100 volts at the lamp terminals.

The photometer was carefully enclosed and thoroughly screened with dead black cloth, to cut off all indirect and reflected light. The rheostat used enabled the one observing the voltmeter to adjust the voltage very closely when taking photometer readings. The lamp under test and the standard lamp were arranged in parallel, and wired with No. 14 wire, and all connections carefully made, so that there should be no appreciable drop or fall of potential in the wires or connections, the absence of such drop being verified by proper measurements. The arrangement of the lamps in parallel, as adopted, made it unnecessary to wait for such periods of steady and proper voltage before taking the photometer readings; the slight momentary variations of voltage from the correct value affected the candle-power of both lamps alike within the range allowed in reading. The work was thus more rapidly done than otherwise would have been possible. This very convenient method is largely used in lamp factories, but it is a safe method only in case the voltage is quite steady, or the lamps under test are of the same efficiency as the working standard. If the test lamp's efficiency differs much from that of the standard, the ratio between the candle-powers of the test and standard lamps will vary with varying voltage. If their efficiency is the same, the candle-power ratio will be constant, though the voltage may vary.

We have not space for the various tables given in the report, but Prof. Thomas closes by the following statement: "Taking economy, maintenance of candle power, and freedom from blackening into account, the results obtained from these lamps are much superior to any heretofore published, and I congratulate you on the excellent showing made." This is surely a very strong and important statement The company have laid aside all of the old stock of lamps, and are sending out only the new lamp on orders.



In a circular just issued describing the Packard lamp, the accompanying diagram is given, showing the relative value of the Packard and three of the other standard makes of lamps. The circular goes on to say: "Our own lamps were selected at random from our stock, and the other lamps were purchased in the open market."

METAL TRADE REVIEW.

September 9th, 1895.

Since last month the prices have stiffened up considerably, thus bearing out our report that such would be the case There has been a general alteration in prices, copper and lead being well advanced. The last month in the hardware trade has been quiet, but the result of the large Manitoba wheat crop will be to make business brisker than ever during the late fall. Current prices are as follows.—Summerlee, $20 to 20.50, Eglinton, $18.50, America, $17.50 to 18, Carnbroe, $18.50, Ferrona. $16.50 to 17. Siemens, No. 1, $16.50 to 17, wrought scrap, No. 1, $14.50 to 16, bar iron, $1 60 to 1.65; tin plate cokes $2.75, I. C. charcoal, $3, Canada plates, $2.10; terne plates, $5.50 to 5 75, galvanized iron. 4 to 5c according to brand; Orford copper, 12½ to 13c.; ingot tin, 15½ to 16½c.; lead, $3.15 to 3.25; spelter, $4.25; sheet zinc, $4 50; cut nails, $2.50; black sheets up to 16 gauge, $2.20; 17 to 24 gauge, $2 ; 26 gauge, $2.10, 28 gauge, $2 20.

LITERARY NOTES.

"Turning Lathes" is the title of a valuable hand book published by the Britannia Co., of Colchester, England, and edited by James Lukin, B.A. It is an instructive manual of 225 pages, designed as a guide to turning, screw-cutting, metal spinning, ornamental turning, etc., and suited for technical schools, apprentices, and for general use. It is illustrated by numerous wood cuts of machinery and of designs showing fancy work in these departments and the principles of producing such work

The Petrolia *Advertiser* has issued a souvenir cycling edition to commemorate the opening of Petrolia's new bicycle track The Petrolia *Advertiser* is one of the most enterprising papers issued in Ontario, and the cycling number will fully sustain its reputation. The number is printed in blue and gold, and is embellished by some thirty half-tone cuts of the town and leading bicycle men.

The report of the city engineer of Halifax, N S., for the past year has been issued, as part of the report on civic government, and takes up 102 pages of the work. Mr Doane's report is an improvement on past returns, and is very interesting to other Canadian corporations by reason of the detailed statistics he gives regarding costs and quantities of material used in the various works, which include the water department, sanitation, fire department etc. The report will be further referred to in this journal.

The *Electrical Journal* pub'ished at San Francisco by Geo. P. Low is the latest electrical exchange to hand It is designed to represent the electrical interests of the Pacific coast and has a large amount of local information. Beginning with the September number it will be called the *Journal of Electricity*.

The Robb Engineering Co., of Amherst, N.S., have issued a very neat set of office cards, containing illustrations of the Robb-Armstrong engine and electric generator connected, the Robb-Armstrong compound engine, the cross-compound engine and the Monarch economic boiler.

The nineteenth issue of the "Gas and Electric Lighting and Water Companies' Directory and Statistics," for Great Britain, is to hand. In previous years the Directory and its kindred publications have been published in three separate books, viz. "The Gas, Water, and Electric Lighting Companies' Directory," "Gas Works Statistics," and "Water Works Statistics," all arranged in tabular form. This year the tabular form has been replaced by the far more clear and convenient paragraph form of arrangement, and this has rendered possible a further improvement - the combination of the Gas and Electric Lighting Companies' Directory with the Gas Works Statistics in one volume, entitled, "Gas and Electric Lighting Companies' Directory and Statistics," and the exclusion of the Water Companies' Directory to form, in conjunction with the waterworks statistics, a separate volume entitled, "Water Companies' Directory and Statistics" The reviews of the leading events of the year in relation to gas, electric lighting, and water supply are again included, and lists of associations of engineers and managers of gas, electric light and water undertakings in Great Britain and abroad are also given The price of the "Gas and Electric Lighting Companies' Directory and Statistics" is 6s; the "Water Companies' Directory and Statistics" is 6s., and the two books, bound in one volume, 10s. Published by Hazell, Watson & Viney, Ltd., 1 Creed Lane, London, E.C.

The Canadian Marine Engineers' Association has issued a very useful little handbook containing a collection of tables, rules and formulæ of interest to marine engineers, and designed also to awaken a keener sympathy among marine men with the aims and objects of the association. It appears from the introduction of this interesting compilation that the first association of marine engineers in Canada was formed at St. Catharines, Ont., in 1868, and branches were afterwards started in Kingston, Hamilton and Collingwood but owing to the removal of the active members and the depression of 1877-8 the pioneer association died. The present association was formed in Toronto in 1883, and similar, though independent, associations exist now in Halifax, St. John and Victoria. The amalgamation or affiliation of these associations has been proposed in THE CANADIAN ENGINEER, and is now, we understand, under consideration. The objects of these associations, like those of the Canadian Association of Stationary Engineers, are education, mutual improvement, and the increased respectability of its members, and the good work already done on these lines is apparent. The compiler of the instructive book under notice is O. P. St. John, the president of the association, Claremont, near Toronto.

TO COMPUTE THE WEIGHT OF PIPES PER FOOT.

Subtract the square of the internal diameter from the square of the external diameter, both in inches, and multiply—

For cast iron pipe	by 2 45
For wrought iron pipe	by 2 64
For brass tubes	by 2 82
For copper tubes	by 3 03
For lead pipe	by 3 86

Industrial Notes.

CHATHAM, Ont., is to have a new $25,000 public school.

A NEW sewer is to be laid at Sault St. Marie; the cost will be about $1,200.

THE new sewerage system at Woodstock, N B., will cover eight miles, and will cost $30,000.

THE Rat Portage town council are spending $10,000 on improvements to the streets, etc.

THE town of Parrsboro has decided by popular vote against the expenditure of $40,000 for a water system.

CHILD & BAMBRIDGE contemplate erecting a sawmill on Union Creek, in the Alberni mining district, B.C.

THE saw mill owned by G A. Pringle, Dobbington, Ont., was destroyed by fire last month. Loss about $2,500

THE B.C. Iron Works have received an order from C. P Burton for the machinery for a saw mill at Naas Harbor, B C.

T. C. DAWSON is offering his 44 horse-power sawmill at Renfrew, Ont., for sale Failing health is the reason of the sale.

W. H. STOREY & SON, of Acton, Ont., are enlarging their glove factory, and will purchase a new engine and other machinery.

THE Cookshire Mill Company's saw mill at Sawyerville, Que., was burnt down last month. The company will rebuild at once.

A FIRE in Casselman, Ont., on Aug 28, destroyed a saw mill and other property. Loss, $35,000. Half covered by insurance.

THE Dominion Bridge Co. of Montreal obtained the contract for the Osborne street bridge in Winnipeg. The price was $8,749.

H. NEWCUS, employed by the Cookshire Mill Co., at Sawyerville, Que., was caught in the shafting while at work, and instantly killed.

THE Mona saw mill on the Lachine Canal, owned by the Hon J. K. Ward, was destroyed by fire on August 13th. Loss about $50,000.

THE contractors said that the Montreal civic incinerator would cost $7,000. It is costing $18,000, $11,000 more than the contractors estimated

E. M. FOWLER, Chicago, A Hill and M N Quinn, of Saginaw, have visited Pembroke, Ont., with the idea of selecting suitable sites for erecting saw mills.

THE Wolseley Milling Company, Wolseley, Assa., is installing new machinery, etc. The municipal council has been petitioned to loan the company $4,000 for eight years.

W. W. OGILVIE, of Montreal, has presented the Winnipeg General Hospital with a pair of steam boilers, with machinery and fitting, for establishing an electric light plant.

THE Hudson Bay Company are building a new flour mill of brick at Prince Albert, Sask. The mill will be lighted by electricity, and fitted with the latest machinery.

BLENHEIM, Ont., will probably build a $6,000 town hall

BRACEBRIDGE, Ont., is to spend $6,000 on water works extension.

A NEW Y. M. C. A. building, costing $20,000, is to be built at London, Ont.

THE St. Antony Lumber Co. will probably build a new sawmill at Pembroke, Ont.

THE Humphrey glass works, at Trenton, N.S., are to be operated all the coming winter.

THE waterworks at Alexandria, Ont, will be proceeded with at once. The cost is to be $23,000.

THE Point Ellis Iron Works, Victoria, were burnt out last month. Loss, $3,500; insurance, $1,500.

THE effects of the B C Pottery and Terra Cotta Co., Ltd., Victoria, have been sold by the liquidator.

F J WESLEY & Co, woodenware manufacturers, of Toronto Junction, have assigned with liabilities of $20,000.

SHAW & FOULDS, of Toronto and Oakville, have leased the Welland, Ont., flour mills, and are to operate them.

AN iron bridge is to be built over the river at Middle Stewiacke, N S. Tenders were received up to noon, September 5th.

CAMERON BROS., of Hawkesbury, Ont, are commencing to rebuild their sawmill, which was burned down some time ago.

H. A. LOZIER & Co., of Cleveland, are building a factory for the Canadian branch of their bicycle business at Toronto Junction.

JAS. HAY & Co., of Aylmer, Ont., have issued a writ against the town, claiming $10,000 damages for illegal seizure of machinery.

THE St. Francis Lumber Co. is to build a large new sawmill at East Angus, Que., and have appointed R. H. Pope general manager.

A LARGE number of hands are working on the new steel building and furnace of the Nova Scotia Steel Co., of New Glasgow, N.S.

WORK has been begun on a new brewery at Prince Albert, Sask. It will cost $25,000. The proprietors are wealthy Germans.

THE town council of St. Henri, near Montreal, has decided to increase the fire department apparatus and accommodation to double its present size.

A QUANTITY of machinery for the Hamilton Smelting Works arrived the other day, and the promoters are sanguine of having the works running by the end of the year.

A COMPANY with $100,000 capital is being organized by the Champlain Tannery Co. of Montreal, for the purpose of operating the large sole leather tannery at Warwick, Que.

WOODSTOCK, Ont., is to have a new patent baby carriage factory $10,000 stock has already been subscribed. The patent covers territory from Toronto to the Pacific coast.

A BOILER explosion took place at W Gordon's planing mill at Udora, Ont., on August 21 The mill was shattered and an employé named Thompson killed. Damage $1,000.

ROBERT MACGREGOR, of Macgregor, Gourlay & Co., has taken a large interest in the firm of Stevens, Hamilton & Co., machinists, of Galt, and in future the firm name will be Macgregor, Stevens & Hamilton.

A PUBLIC meeting was held in Lachute, Que., on Aug. 28, to consider a scheme of waterworks. E. J Rainboth, of Ottawa, stated that he would erect waterworks for the sum of $42,676. No decision has been yet arrived at.

A CONVENT, to cost about $42,000, is now in course of erection at the corner of Cadieux and Roy streets, Montreal. The building is of brick and stone, and will have two stories, with a mansard roof and basement. All the partitions between the rooms will be of brick.

THE largest milling industries in Western Ontario have been consolidated. The mills interested are the Kent mills, Chatham; the St. Thomas mills, the Aylmer mills and the Blenheim mills. The deal involves property to the value of $250,000, and contemplates an investment of capital stock to the amount of $500,000.

AN Aylmer correspondent writes: "An attempt was made the other night to move a lot of machinery from the Aylmer furniture factory at midnight. It seems that the lease of James Hay & Co., in whose name the factory is run, expired, and the town of Aylmer was to take possession of the factory under chattel mortgage. The manager of the factory loaded three large wagons with machinery of different kinds, and was teaming them to Woodstock, when the council got wind of the affair, and sent Constables Huffman and Pierce, and started after them this morning. They succeeded in stopping two loads near Springfield."

KASLO, B C., is to have a new water and fire protection system.

AN additional pumping engine is to be added to the Kingston Water Works.

IT is proposed to erect a bridge over the canal at Somerset street, Ottawa.

THE Condensed Milk Co., Truro, N.S., are putting in a 30 horse-power Robb-Armstrong engine.

WILSON, MOORE & Co., of Arden, Man., are building a new elevator of 30,000 bushels capacity.

AT a mass meeting at Stratford a resolution asking the council to submit a $30,000 by-law for sewer purposes was passed.

THE employes of John Bertram & Sons, machine tool makers, Dundas, Ont., have been notified of an increase in their wages.

J. KENNEDY, formerly manager of the Gillies' machine shop, Carleton Place, died suddenly at Brooklyn, N.Y., a few days ago.

E. S. STEPHENSON & Co., St. John, N.B., have ordered a 50 horse-power Monarch Economic boiler from the Robb Engineering Company.

INCORPORATION is being applied for by the Mooretown Salt Co., Courtwright, Ont., to manufacture salt. Capital stock $10,000. Headquarters at Wallaceburg, Ont.

PLANS have been prepared by Peachey & Dussault for a new wing to the Levis, Que, College. It will be 80 by 60 and contain four stories, beside mansard and stone sub-basement.

A PROJECT is on foot for the starting of a beet root sugar factory at Edmonton, Alberta. Claus Spreckels, the Sugar King of the Pacific coast, is said to be interested in the project.

THE contract for dredging the Perche and Pulse creek drains in Sarnia township has been awarded to Pollard, Gough & Co., of Illinois, at $5 50 per rod. The work will cost over $20,000.

H CLARK, a Georgeville contractor, has been arrested charged with mailing an unregistered letter containing no money, but which he said had contained a $500 bill. The fraud was perpetrated with a view of deluding his creditors.

M. BROADBENT, the Hamilton court house engineer, has invented a heating apparatus which he thinks will revolutionize the heating of public buildings. Those who know of the details say the device is calculated to produce striking results.

THE town council of Dundas, Ont., have at length decided to replace the Creighton road bridge by an entirely new one, and the Hamilton Bridge Company has been awarded the tender for an iron one.

WINDSOR, Ont., is going to use natural gas for fuel at the electric light works and pumping station. The annual cost is estimated at $1,900 at the lighting station, and $4,000 at the pumping station, which will be a saving of several hundred dollars.

AT Sewrey's foundry, Barrie, on the 31st ult., S Sewrey and T. Morley were raising a large drill when the gear gave way and it fell. Mr. Morley lost two fingers on his right hand and one on his left, one of his knees was seriously jammed. Mr. Sewrey lost one finger, several others being severely bruised.

AN effort will be made to reclaim ten thousand acres of land along the Carp River, in Carleton County, Ont., that has been rendered useless by the overflow of the Carp river. The work will cost $15,000, the greatest part of which sum will be used to blast a rock near Kilburn which dams the stream.

LAST year the number of elevators erected in the Canadian wheat growing districts was five or six. This year fifty-six new elevators have been built, seventeen by the Ogilvie Milling Co., ten by the Lake of the Woods Co., three by the Northern Elevator Co., and seventeen by smaller corporations and private individuals.

THE Stadacona Waterworks Co., a company of Montreal capitalists, represented by L. H. Tache, will construct and operate the waterworks system at Perth, Ont., mentioned in a previous number. Three miles of mains are to be in operation by the 15th of December. The works will be required to pay municipal and school rates up to $30,000.

THE Dominion Cold Storage Company, of Montreal, are asking a site from the Harbor Commission and the City Council of Quebec for exemption from taxation for twenty years, and a bonus sufficient to provide electric power to the extent of about fifty horse-power, and if these conditions are granted they will commence immediately the erection of a cold storage building on the Louise Dock in the ancient capital, and have it ready for use by the 1st of April next. The building and plant would cost about $150,000, and be equal to the handling of all the perishable freight from the Quebec district.

M. D. Keyser-Verbiest, of Victoria, has been conferring with Vancouver with regard to the starting of a linseed mill in that city.

Bain Bros., of Brantford, contemplate removing their wagon factory to Woodstock. The Massey-Harris Co. are to be admitted as stockholders.

The Breithaupt Leather Co., of Listowel, are enlarging their tannery. They are putting in 30 more liquor vats and a new boiler, and are building a bark house.

The contract for the mason work of the Burlington bridge at Hamilton, Ont., has been awarded to G. F. Webb, of Hamilton. The bridge will cost about $35,000.

The bent chair factory at Owen Sound has had a large export trade, and its heavy orders from the United States have excited the opposition of American manufacturers.

Hartland, N.B., may probably have a new iron bridge built across the river there. Government Engineer Wetmore has been detailed to estimate the cost of the bridge.

F. H. Lamb and George Bengough, of Toronto, are the promoters of a new type-writer factory, to manufacture the Burns type-writer. The proposed capital is $200,000.

The Shippey Manufacturing Company, of Benton Harbor, Mich., has been negotiating with St. Thomas, Ont., for a branch factory for the manufacture of their odorless glue.

The Manitoba millers have formed an association similar to the Ontario Millers' Association. Andrew Kelly, of Brandon, is president, and R. Mair, of Winnipeg, secretary-treasurer.

A company, called the Killarney Farmers' Elevator Co., is being formed at Killarney, Man., to build an elevator of 30,000 bushels capacity Nathan Clark is one of the promoters.

J. E. Vanier, C.E., Montreal, is making a survey of Cote St. Paul with a view of preparing for a new drainage system The work is to be commenced by the spring of next year.

The Toronto Steel-clad Bath & Metal Co. have moved into their large new premises at 125-7 Queen street east. The building is 207 x 35 feet, and extends from Queen to Richmond street.

The Fredericton, N.B., city council has ordered the city engineer to prepare plans and levels for the purpose of estimating the cost of a drainage system. The estimated cost is about $58,000

The townspeople of Richibucto, N.B., are offering inducements to a number of capitalists to erect a pulp mill at that place. It is said that the negotiations will be brought to a successful termination.

Thos. R. Deacon, C.E., O.L.S., of Rat Portage, Ont., writes: "Please find enclosed post office order, $1, for year's subscription to The Canadian Engineer. It is the best value for a dollar in Canada."

A widely published report that T. J. Waters, of Ottawa had secured a position as manager of George Gould's mining property in Quebec at a salary of $6,000 a year, has been denied by Mr. Waters.

Henderson Black has purchased from G. B. Burland the property of the defunct Standard Card and Paper Co., of St. Johns, Que. The *News* hopes that its portals will soon be open again to active commerce.

John Whitfield, chain and iron works, Toronto, assigned last month to Geo. H. May, same place. He has had several good contracts from the Dominion Government and was supposed to be in good position.

The mayor of Huntingdon, Que., has been authorized to accept the contract with the Stadacona Water Power and Light Company for supplying the system of water works, sewage, and electric light under the special by-law.

A. W. Campbell, city engineer, St. Thomas, Ont., has prepared plans for a new truss bridge to replace the Dead Falls bridge across the Thames River, in the township of Dunwich. The bridge is 125 feet long and 65 feet high.

By the new tariff of Newfoundland, anchors, chains, fishing tackle, hoop iron, bars, bolts, sheets and plates, machinery and parts of machinery, nails, cement, plaster, saws, sheet and block tin, and engines are made dutiable at 10 per cent. ad valorem.

The incline railway up to the mountain at East Hamilton was opened a few days ago. The cable is of crucible cast steel 19 wires to the strand, tested to 139,000 pounds. The maximum strain on the cable with a 3,000-lb. car is 12,325 lbs. The speed of descent is 500 feet per minute. The boilers and engines are 150 horse-power. John Fensom, of the Fensom Elevator Works, Toronto, was the supervising engineer.

Mount Forest, Ont., citizens want a system of waterworks.

The corner-stone of the new city hall, Quebec, was laid last month.

The masons of Cayuga, Ont., have $10,000 subscribed for their new hall.

Shaw & McLeod, file manufacturers, Almonte, have sold out to Graham & Son.

T. and C. Baker, of Arnprior, Ont., are about to establish tile works at Casselman, Ont.

A new wing is being added to the Pembroke, Ont., separate school. Cost about $3,000.

Ricker & Nichol have started a starch factory in Winnipeg. They will make the starch from Manitoba wheat.

W. L. Ross, soda water manufacturer of Bonner's Ferry, Idaho, is moving his machinery, etc., to Rossland, B.C.

The contract price of Renfrew's new high school building is $5,042. $2,000 more will be spent on heating apparatus, etc.

The stables of the Halifax Street Railway were burned down a few days ago. Loss, about $4,000. Only small insurance.

The Mica Boiler Covering Company, of Toronto, are moving at the end of this month from the Esplanade to No. 9 Jordan street.

E. B. Eddy's new pulp factory at Hull, Que., is nearly approaching completion, and the machinery will be installed in a few days.

Alderic Gibeau, manufacturer of hay presses, St. Isidore, Que, has assigned on demand of J. H. Wilson, with liabilities of $8,000.

Those in the trade expect there will be a good deal of flour mill building in Manitoba and the North-West during the ensuing year.

A new geological museum will be built at Ottawa in a few months. According to the plans the building is to be a large and handsome one.

McAuley & Bolter, whose mill at Lower Millstream, N.B., was burned by fire some time ago, are busy erecting a commodious new mill on the same spot.

The Cashmere Manufacturing Company has been incorporated to manufacture staves, hoops, and lumber at Cashmere, Ont. Capital stock, $20,000.

The Stevens-Campbell Milling Company has been incorporated to carry on a general milling business. Headquarters, St. Thomas, Ont. Capital stock, $450,000.

The Imperial Brush Manufacturing Company has been incorporated to manufacture brush machineries, brushes, etc. Capital stock $140,000. Headquarters, Montreal.

The Vancouver Gas Company has offered to sell its plant and stock to the city for $350,000, or they will supply gas to the city at $1.50 per thousand, provided the city furnishes $125,000

Winnipeg is about to purchase a new 15-ton steam roller. Two tenders are being considered; one from the Waterous Engine Company at $4,390, and one from Kelly Bros. Co. at $3,785.

Mineral water is being used by the H., G. & B. engines at Stoney Creek, Ont., and a project has been set on foot to build a summer hotel there and utilize the water in baths and for drinking.

McClary's Stove Works, at London, Ont., were seriously damaged by fire on August 28th. Considerable injury was done to the stock by water, and about 100 feet of the roof was destroyed. Damages about $400.

The Crystal Beach Cottage and Improvement Company (Limited), has been incorporated to improve real estate in the town of Bertie, Ont., and to construct sewers, electric light plants, water works, etc., for that purpose. Capital stock $40,000.

The Gillies Mfg. Co., Carleton Place, are applying for incorporation with a capital stock of $120,000 to acquire the foundry business of John Gillies & Co., and the woolen factory of Gillies, Son & Co., to manufacture mill machinery, woolen goods, etc.

The proposed sewerage system for Galt, Ont., is being threshed out with much vigor. It is estimated that the cost to the town of building the six miles of sewers will be $50,000. A public meeting will shortly be called, and the matter finally decided.

The plans for a complete system of sewerage for the city of Belleville, as designed by Henry Carre, member Canadian Society Civil Engineers, have been accepted by the Provincial Board of Health, and are being carried out under the Local Improvement Act.

CITY ENGINEER SURTEES, of Ottawa, has submitted a main drainage scheme to the Ottawa drainage committee The scheme proposes to drain Dalhousie ward and outlying portions of the city, and as figured out by the city engineer would cost $543 895.

THE Richelieu and Ontario Navigation Company's shops which were burned down will be rebuilt, and are to be located again at Sorel The new works will be extensive, and will employ a large number of men The works include the boiler, tin, blacksmith and carpenter shops

THE town council of St Jerome, Que., have voted Smith, Fischel & Co., cigar manufacturers, a bonus of $20.000 and exemption of municipal taxes for fifteen years to move their factory to that town The firm will employ 200 hands The new factory will be built at once

JOHN SHIELDS and Ald Jas. Gowanlock, of Toronto, have taken the contract for building new waterworks for Orangeville. The cost of the proposed improvement will be about $45,000. They expect to complete the work early in November

FINDLAY, DURHAM & BRODIE S Windsor cannery, now being built on the Skeena River, B.C., is the largest in that region. The main building will measure 400 x 40, and will be two stories high. The cannery replaces the one burned last year, and will be completed by November

THE Metallic Roofing Company. Toronto, has recently supplied its Owl brand of galvanized corrugated iron for the Toronto Electric Light Company s buildings, and its galvanized "Eastlake" steel shingles for the roof of the Princess theatre, of Toronto.

THE new tank at the Wallaceburg glass works, which have been rebuilt, has eleven blow holes, or four more than the former one; while the new boiler is larger than the old one. A number of hands from the glass works of Hamilton, which are idle, have gone to Wallaceburg to work in the new factory.

ATTENTION is called to the advertisement of J. E Naud, which appears in this issue Mr. Naud is one of Montreal's most energetic and enterprising young business men. He has secured the Provincial agency of the celebrated M. T. Davidson Steam Pumps and Hydraulic Machinery, the manufacturers of which occupy a leading position in the trade across the line. Further reference to these pumps will be made in another issue

THE bursting of the water main on Atwater ave, Montreal, last month, is attributed to one of two reasons. (1) compression produced by expansion of the pipes, (2) excessive tension caused by the hydraulic recoil. There were three breaks in the pipe, and had they occurred on different lines the city would have been exposed to a water famine. The repairs cost $1,440 Acting Supt. Laforest proposes the extension of the Atwater main to the reservoir, a distance of 9,540 feet, the estimated cost of which would be $85,800.

THE Montreal Exposition, opening September 12th, will undoubtedly be a great success, if emulation on the part of exhibitors is any indication. In the machinery department there are more and larger exhibits than ever before, and applications for space were so numerous that all locations have been appropriated several weeks earlier than usual The machinery department will have the following gentlemen acting as a committee:—G. W. Sadler, chairman, H. R. Ives, G. Esplin, W Perry. E. O. Champagne, R. Gardner, H. Carrier and Wm. Bellingham.

THE Chanteloup Manufacturing Co., of Montreal, has been incorporated. The company is now composed of D. Yuile, merchant; J. C King, merchant; W. Robinson, merchant; D. W. Ross, jr, merchant, J. Watson, machinist, all of the city and district of Montreal, in the Province of Quebec. The company will carry on the business of contractors, and may own, sell or lease, or otherwise dispose of, all or any patent rights applicable to the business of the petitioners, and to carry on the general business of merchants, manufacturers, plumbers, finishers of iron and brass goods, and kindred metals The capital stock is $10,000. The Chanteloup Manufacturing Co is a long established and flourishing firm, highly regarded for reliability, and it is to be expected that under its new incorporation its business will be much increased.

CHAS. ALGER, of Hudson, N Y, who is promoting the new blast furnace scheme at Kingston, Ont., says the cost of a modern equipped blast furnace would be $130,000. The following resolution has been submitted for the approval of the Kingston aldermen: "That in the event of any company with a capital of not less than $200,000, establishing and operating a blast furnace with a capacity of 125 tons a day, in this city, we agree to allow them a free site, freedom from taxation for ten years and ten cents per ton for each gross ton of iron manufactured, for a term of five years from the time the furnace is manufacturing 125 tons a day." It is said that Mr. Alger, who thinks highly of the iron of Central Ontario, will have little trouble in forming a company.

Railway and Marine News.

THE G.T.R. have discontinued their belt line service around Toronto this month.

THE T., H. & B Railway has paid $1,000 to the family of T Davis, Hamilton, who was killed by an explosion while working on the road.

MONDAY, September 9th, has been fixed for the opening of the Canadian canal at the Soo The opening will be made without any formality.

THE schooner "Alice," of and for Liverpool, N.S, from Boston, Hutt, master, was totally wrecked on Seal Island, August 23rd The crew was saved.

J OWEN, proprietor of the Station Hotel, Oakville, Ont., fell from the Oakville train on August 29 and was killed. Deceased was 65 years of age.

THE C P R Railway car shops at Perth are just now endeavoring to cope with an order for 100 new box cars of a new design. The cars are to bring the wheat down from Manitoba.

THE ninth Railroad Men's Convention in the maritime provinces was held in Moncton, August 23 to 25 There was a very large attendance at all the religious services Montreal will be the place of meeting next year.

THE "Gypsum Prince," a four-masted schooner owned by the Gypsum Packet Company, of Windsor, N.S, was wrecked off Grand Manan a few days ago. The "Gypsum Prince" cost about $30,000, and is insured for $28,000.

THE Railways Securities Company, Montreal, is applying for incorporation. The petitioners are: A. Allan, H. M. Allan, H. A. Allan, and A. Allan, steamship agents, of Montreal, and B. J. Allan, steamship agent, of Boston.

THE Ontario & Parry Sound Railway is making good progress, and the twenty miles west of Whitney will be ready for rail laying on September 1st The contract for this section of the road was secured by E. J. Fauquier, of Toronto

A YEARLY subsidy has been promised by the Dominion Government to the Colombo Belgium Steamship Navigation Company. The subsidy amounts to $50,000 and is for a fortnightly steamship service between Canada, a French port and Antwerp. The first steamer will leave Montreal May 1st, 1896

A MEETING was held at Renfrew, Ont., on August 14th, to discuss the projected railway between Portage du Fort and Renfrew. It was announced that a subsidy of $3,200, granted for a railway in 1890, but since allowed to lapse, could be obtained by this road, and that the local government would make an additional subsidy of 10,000 acres per mile.

THE railway systems of Pennsylvania, Ohio, and Ontario have been brought into connection by the launching of the new "Shenango, No. 1"—a fine vessel 300 feet in length, with a beam of 52 feet. The "Shenango, No. 1" will ply over Lake Erie, and has a capacity for 22 loaded cars. When necessary 953 excursionists may be carried.

A PHILADELPHIA paper says that a number of capitalists in that city have purchased the rights of a power company recently formed to develop the Sault Ste Marie canal, and have organized the Lake Superior Power Co, with a capital of $2,000,000 This company has two large mills and expect to operate one on the Canadian side within a month.

THE construction of the Central Counties Railway was temporally suspended last month, 147 men having struck work until they were paid their arrears of wages. The men, it is stated, are five or six months behind in their wages, and have received scarcely any remuneration for their whole summer's work on the line. The line from Rockland to South Indian, Ont., is almost completed.

THE *Globe* says that the Georgian Bay Canal and Power Co. is about to begin operations. The present intention is to convert the Humber River basin, from its mouth as far as Weston, into a large reservoir of over six miles area, the fall at the head being 140 feet. The head of water obtained is expected to develop 10,000 horsepower of electric energy sufficient to supply the demands of Toronto and more.

THE hull of the burnt out steamer "Cibola" has been towed over to Toronto from the Niagara.

SIR CHARLES RIVERS WILSON, president of the G.T.R. Co., will sail for England from New York September 20.

A SCHEME for a canal along the watercourses from the head of Lake Winnipeg to Hudson Bay is being promoted.

THE C.P.R. tug "Siskiwit" was burned at Fort William. The tug is probably a total loss. Value about $3,000.

THE keel for a new lake barge to carry 50,000 bushels of grain was laid last month at Kingston. The craft will be ready for the season of 1896.

AT a meeting of the Ottawa and Gatineau Railway Company, this month, the following directors were appointed: J. P. Mullarky, H. J. Beemer, M. S. Lonergan, Montreal; W. Wall Harris, J. M. W. Currie, Ottawa; E. A. Hoare and H. G. Beemer, Quebec.

W. IVEY, engineer, for twenty-five years in the employ of the G T R., was accidentally drowned at Collingwood, Ont., on August 26th. Deceased leaves a wife and five children He was insured in the Grand Trunk Railway Benevolent Society and in the Brotherhood of Locomotive Engineers.

THE plans for the John street bridge, Toronto, have been accepted by the Grand Trunk and Canadian Pacific railways. An arrangement has been made by which the Canadian Pacific railway will complete the Grand Trunk's part of the work. An agreement between the two railways will shortly be drawn up.

A SPECIAL general meeting of the St. Lawrence and Adirondack Railway Company will be held at the office of the company in Montreal, on September 12, for the purpose of considering a proposition for the amalgamation of the company with the Malone and St. Lawrence Railway Company.

A DECISION of some interest to Canadian marine men has been rendered by the Supreme Court of the United States. In a case of a man indicted for an offence committed on the high seas, the defendant questioned the jurisdiction of the court on the ground that the lake on which the offence was committed was not the "high seas." The court held that the great lakes, and the rivers connecting them, were "high seas," as they were waters over which no particular state had jurisdiction.

WE are pleased to note that under the present excellent management additional improvements in the service of the R. & O Nav. Co. are the order of the day, and the passenger traffic has considerably increased. We understand further improvements are contemplated, one being that the sounding of the steam whistles at the different landing places is to be done away with. This will add greatly to the comfort of the passengers and tend to make the line still more popular with the travelling public.

THE G.T.R. have lately been trying a new style of locomotive fitted with patented devices, the most important of which are two cylinders, one 19 and the other 29 inches, and so arranged that the steam is used in the larger one after it has done its work in the smaller. When tested, the engine drew 46 loaded cars from Brockville to Montreal, with a consumption of four and a-half tons of coal. An ordinary engine hauling half that number of cars the same distance uses five tons of coal.

THE C.P.R. has just completed two special military or war trains, which comprise fourteen cars for the men, two cooking cars, two Pullman cars for the officers, two cars for wines and stores, and two dining cars. The officers' cars are fitted up in luxurious style, and contain state-rooms, lavatory, smoking rooms, etc. Each train consists of eleven cars and engine, and has ample accommodation for nearly four hundred. With these fast war trains, the C.P.R. expects to be able to cover the distance from the Atlantic to the Pacific in five and a half days.

THE report on the Montreal harbor improvements, which has been made public, recommends appropriations as follows:—(*a*) $2,000,000 for the execution of the plan known as No. 6, which has already received the formal sanction of the Government, as far as the provisions of chapter 92 of the Revised Statutes of Canada are concerned; (*b*) $1,000,000 to build an island basin at such place in the eastern end of the city as may, upon examination, be found most advantageous, and (*c*) $1,000,000 to complete the basin at Windmill Point and other parts of the harbor not included in plan No. 6. The Harbor Commissioners point out that no public funds have hitherto been appropriated to the port of Montreal, as at other ports, although the business transacted at Montreal consists very largely of goods shipped to or from the west. They, therefore, consider that any expenditure which cannot be met by their own revenue should be a charge on the Dominion. About half the guard pier is completed and considerable dredging of the basin is done. The work on the wharves has not yet begun. The report was signed by Thomas Monro, Louis Coste and W. P. Anderson. A supplementary report signed by Louis Coste and W. P. Anderson was sent in to the Harbor Commissioners. This advised that in the event of the Government adopting the report and making or guaranteeing a loan, such a loan should not exceed $2,000,000. The report then outlines the work that could be done for this amount.

A NEW tug, the "Aberdeen," has been built by the Sincennes-McNaughton Co., of Montreal, and was launched on August 28. The new tug is 77 feet long, 17½ feet beam, and will draw 8½ feet of water, with a solid steel hull. Her engines, of 500 horse power, were constructed by Beauchemin & Co., Sorel. These are of the compound high-pressure type. The boilers were built by Messrs, Weir & Malloy, of Montreal.

THE Brotherhood of Locomotive Engineers held their bi-annual session in Montreal, the last week in August. The proceedings were secret. The following delegates were present:—A. Kennedy chairman, Winnipeg; J. Scott, Toronto, vice-chairman; C. Pope, Rat Portage, secretary; D. Lincham, Sherbrooke; J. Tallon, North Bay, A. McLaren, Chapleau, Ont., E. E. Austin, Kamloops, B.C., H. E. Currie, Woodstock, N.B., W. B. Ritchey, Havelock, Ont.; A. Gariepy, St. Roche, Que.; T. C. Cottrell, London, Ont., W King, Ottawa, Ont., R. J. Armstrong, Fort William, Ont., R. D. Smith, Medicine Hat, N.W.T., T. McKenna, St. John, N.B.

ON the night of the 5th inst. the warehouse of A. W. Muir, ship and dry dock owner, Port Dalhousie, Ont., was totally destroyed by fire. The steamer "St Magnus," lying in dry dock for repairs, was burned to the water's edge. Captain Becker, of Cleveland, aged 72, was sleeping on board the boat and narrowly escaped cremation. He had to break through the window of his room and slide down a line from the top deck, and was badly burned about the head, hands, arms, feet and legs. He has since died. Muir's building and stock, valued at $40,000, are a total loss. The "St. Magnus," owned by R. O and A B. MacKay, of Hamilton, is also a total loss. No insurance on either warehouse or boat. The fire was the work of an incendiary.

DURING the Industrial Exhibition at Toronto, the Royal Electric Co. had in operation in the Machinery Hall the "S. K. C." Two-Phase Alternating Current System, as manufactured and sold by them exclusively in the Dominion of Canada. From the one Two-Phase Alternating Dynamo current was supplied at the same time for lighting incandescent lamps, arc lamps and operating motors. This is an entirely new departure for Canada, but it is coming into general use and must command the attention and approval of everyone having power that can be thus profitably utilized. For efficiency, regulation, solidity, beauty of mechanical design, it is said that there is nothing in the market to equal it. The exhibit attracted a good deal of attention from electrical people.

Mining Matters.

THE Massut mine at Trail Creek has been sold for $8,000.

J. C. HAAS, assayer and mining engineer, Midway, B.C., has disposed of his business to J. A. Guess.

THE dividends paid since last December by the Trail Creek War Eagle Mines have amounted to $83,000.

LE ROI mine, at Rossland, B.C., has been fitted with new machinery, and is now producing 100 tons of ore per day.

THE owners of the Iron Horse mine at Rossland, B.C., are calling for tenders for the sinking of a shaft 100 feet deep.

OIL has been struck in Athabaska. The landing is at a depth of 1,500 feet, and the well is flowing at the rate of sixteen barrels a day.

THE Columbia Hydraulic Mining Company has been registered for business in British Columbia. The company has a capital of $100,000.

THE total value of the output of gold, silver and copper from Trail Creek, B.C., during the last twelve months was worth $468,375.

D. MANN, of Mann & Holt, railway contractors, has a silver mine at St. Mary's River, East Kootenay, which is giving a gross return of $68.70 per ton.

UPWARDS of 1,200 locations have been recorded at Rossland, B.C., this season.

THE Hall Mines Co., of Nelson, B.C., has placed an order for the machinery for 100-ton smelter.

MACHINERY has been sent to the gold mine on Willard Brook, near East Angus, Que., owned by a Montreal firm.

THE Edmonton *Bulletin* reports that over a hundred prospectors have gone hunting for gold on the Athabaska river.

THE Cauonto Mica and Mineral Co., Ltd., has been incorporated in Ontario to carry on mica mining, headquarters, Toronto. Capital stock, $22,000.

THE Idaho Gold Mining and Smelting Co. and the Centre Star Mining and Smelting Co., both of Butte, Mont., have registered to carry on business in British Columbia.

THE American Trust and Loan Co has brought suit for $700,000 in the Supreme Court against the Eastern Development Co., owners of the Coxheath Copper Mine, at Sydney, B.C.

THE Custer mine, at Wallace, B.C., owned by Finch & Campbell, started up this week, after being idle over two years. Half a dozen men are at work with M. Foley as foreman.

GEO. J. GOODHUE, who has bonded several claims for a New York company, has returned to British Columbia to bring an increased force of men for development work on Lost Creek.

MUCH interest is taken in new locations on Slocan Lake, south of New Denver. At 8 mile, 12 mile, and Springer Creeks dry ores are being found carrying gold, some of which is free milling.—*Midway Advance.*

THE *Eastern Chronicle* reports that the "Crow's Nest" mine, owned by R. P. Fraser, of Pictou, N.S., has been sold to a Boston syndicate. The new company have appointed E. R. Ray, mining engineer, as manager, and are to put in a new stamp mill.

A FEW days ago Franklin S. Riley arrived at Port Arthur, from the Lake Harold gold mine, with the first gold brick produced in the Port Arthur gold district. It weighs 47½ ounces and is valued at $950, the product of seven tons of ore run through a five-stamp mill in 117 hours.

THE Kootenay Gold, Silver and Copper Mining Co., which is operating on Sable Creek, have completed the trail to their properties and are now at work on the claims. A contract has been let for a tunnel on the claim located on the south side of the creek. They intend putting in a concentrator this fall.—*Kootenay Mail.*

A. P. Low, of the geological department, has returned from his trip to Labrador. He started from the coast about opposite Anticosti and went north about 500 miles. Mr. Low states there is an abundance of iron ore everywhere and good beds of copper. Indications of silver were seen. In places there were forests, but the timber is small.

THE value, as declared at the customs, of all the ore shipped from the Kootenay mines during the twelve months ending May 31st 1895, is as follows Gold, $225,866, silver, $181,856; copper, $55,952, lead, $79,937 Total, $543,611. The greater part of this, as our readers are aware, was shipped during the last five months of the above period.

THE idea that gold in the Lake Wahnapitae district was only in surface deposits or pockets, is exploded. For some months work has been going on quietly and steadily at the Crystal Gold Mine. At the surface the vein was only a small one, but a few days ago a cross cut run from the 100 foot perpendicular tapped a continuation of the vein, which had gained four feet in width, or six feet altogether, displaying a veritable California bonanza. People will hardly be prepared to believe its richness, the fact however exists, as from tests made from the ore it is found to run $60 to $5,000 per ton.—*Sudbury Journal.*

OF the ore at the Long Lake Camp (Boundary Creek), B.C., the Midway *Advance* says —"The character of the ore is mostly free-milling quartz, carrying from a few to many hundred dollars gold per ton, while in some of the claims a notable quantity of silver is found, occurring as argentite or silver glance. The width of the veins is from one to five or six feet; the strike of those on the east side of the lake being a little east of north, and all dip to the east. On the west side of the lake, while some of the veins strike in the same direction as those on the east, others strike in a north-westerly direction. The formation is a mica schist, while off to the north a quartzite belt is found, and then the granite rocks appear. The belt of schists and quartzite is probably very extensive, and it has been traced to the west and northwest, a distance of several miles. Here undoubtedly is a great field for exploration.

THE War Eagle mine at Rossland, B.C., has temporarily stopped shipping ore, and will put in new and improved machinery.

C. L. THOMET recently brought down samples of ore from his claim at Long Lake, B.C., which gave on an assay the enormous return of $6,000 per ton.

J. BURBAU, Canadian Government explorer, has been sent to visit Anticosti and value its resources in view of its proposed sale to Menier, the great chocolate manufacturer.

THE Delora mining property in Marmora, Ont., has been secured by Americans, who claim to be able to cope with the hitherto existing difficulty of extracting the gold.

A COMPANY is about to be organized at Gay's River, N.S., to grind gypsum. The largest quarries in the Province are to be found there, and the shipping facilities are excellent.

THE town council of Leamington, Ont., has bought the Leamington Natural Gas Company's plant. The price paid was $14,000 cash. This includes the real estate, plant and stock.

FISHING for pearls is a new industry at River Hebert, N.S. A large number of pearls have already been obtained, but it has not yet been decided whether the work will be profitable or not.

A FINE seam of coal has been discovered in Cedar district, Vancouver Island, by a man named Hodgson. The seam is on the property of the Dunsmuir family, by whom it will be worked.

SPECIMENS of gold quartz from the Renfrew mines recently shown in Halifax would, it is estimated, yield over 120 ounces to the ton The July crushing from the Renfrew mine yielded 150 ounces.

THE North Star, on St. Mary's River, East Kootenay, B.C., owned by Montreal capitalists, is about to be opened, and $10,000 has already been spent on a road to connect the mine with Jennings' Station.

A VERY rich vein of gold was opened last month on the Brown property in Bannockburn, Ont., and suitable machinery will be purchased to push forward the development of the mine with all possible despatch.

THERE is a big mining boom in Alberni, B.C. Free gold is said to be dislodged at every stroke of the pick Government geologist Sutton says that the Starlight claim in that district is the best he has ever seen.

THE Slocan, B.C., smelter has not been found of sufficient capacity for roasting the amount of ore sent to it. More furnaces will be purchased and the capacity of the smelter increased to double its present size.

THE Lucky Coon Mine, on the Seine River, B.C., which was attached by the Canadian Government for non-payment of customs on stamp mill machinery, has been purchased by T. H. Hillyers & Son, who will at once resume operations on it.

THE *Financial News*, London, advises the British public to look to West Kootenay, and to invest there in mining property, instead of South America and elsewhere in foreign lands, where investments so made have to be shadowed by one of H. M. gunboats.

THE Van Winkle Consolidated Hydraulic Mining Co., Ltd., will hold a general meeting of shareholders in Vancouver on September 23, to authorize the company to dispose of the whole of their assets to another company, for the purpose of working their mining claims conjointly.

A. BUDDEN, vice-president of the Intercolonial Coal Company, says that Canadian coal miners are a much better class of men than those engaged in the Pennsylvania and other American mining regions. And the wages in Nova Scotia mines are 14 cents per ton higher than in the mines in the States.

W. P. RICE, engineer, and B. Davis, contractor, Cleveland, O. visited Thorold, Ont., a few days ago, with a view of making arrangements for the working of the Campbell quarry. If the quarry is opened up by them the stone will be exported in large quantities for the purpose of paving.

J. H. CHEWETT, mining engineer, Toronto, has recently returned from Nova Scotia, where he has been examining and reporting upon gold properties in the Wine Harbor and Goldenville districts, in the interests of a syndicate negotiating their purchase. Among the properties examined were the "Eureka" and "Stellarton." Mr. Chewett is well pleased with the appearance of these mines, and expresses the opinion that with reasonable capital and proper management good returns may safely be expected. Hitherto neither self feeders nor concentrators have been used in the majority of the stamp mills, thus lessening the capacity on the one hand and wasting 25 per cent. to 40 per cent. in the tailings on the other.

THE Kootenay Gold, Silver and Copper Co., Ltd., have made a good strike on their Agnes claim. The ore appears of much higher grade than any previously obtained (altogether former tests show the concentrates worth over $400 in gold, silver and copper); at present there are three feet in width of this ore in sight, with good promise of as much more behind.

THE Stellarton, N.S., *Trades Journal* reports that Mr. Evans' manager of the Dominion Coal Company's mine, at Port Morien, occasionally undertook to run the locomotive on the Dominion Coal Company's Railway. While he was practising on August 20th, something went wrong, and the brakeman, Hector McLean, was killed. A coroner's jury returned a verdict of manslaughter, and now manager Evans is in jail.

THE Lindsay *Post* gives the following as an instance of the profit in Canadian mines: Twelve years ago Mr. O'Grady, of Peterboro, went to British Columbia, and engaged in gold mining in the Kootenay district. He returned last week, but before doing so sold an interest in the mine for $120,000. In addition he still retains a large interest in this mine, which yields ore that assays a large percentage of the yellow metal. Since returning Mr. O'Grady has purchased his father's homestead in Otonabee.

THE list of foreign and home companies, heavily capitalized and having for their mission the development of British Columbia's mineral resources, has received five important additions during the past few weeks. The companies are the Iron Horse Mining and Milling Company and the Kootenay Mining and Milling Company, both of Spokane, and each capitalized at $100,000; the Crown Point Mining and Milling Company, also of Spokane, with capital of $500,000, the Western Prospecting and Promoting Company, of Vancouver, $100,000; and the Kootenay Consolidation Mining Company, of the same city, $500,000.—*Colonist*.

A. BLUE, Director of the Ontario Mining Bureau, in his annual report, says that the number of mining locations sold in the province during the past year was 40, extending to 3,271 acres, the price being $7,646. The number leased was 66, of 7,080 acres in extent, the receipts from rents of locations being $10,296. The total value of the product in 1894 was $6,085,758, and number of persons employed in producing it was 6,076, who received $1,840,289 in wages. In 1893 the product was valued at but $46,000 less than in 1894, while 1,087 more men were employed in 1893 than in 1894, and $95,301 more was paid in wages. In the petroleum industry 486 employees turn out products to the value of $2,146,937, and get $279,930 in wages, or roughly speaking, about an eighth of the value produced. The work done in the gold fields of the province is in development, and preparing for the erection of mills. During 1894 the amount of gold produced in Ontario was 2,022½ ounces, valued at $32,766 To the 92 men engaged in gold mining, $38,032 were paid in wages.

REPORTS this month from the Okanagan district, state that as rich a field of gold, copper and silver ore has there been discovered on Kruger's Mountain, near Osoyoos, as that which is now being worked by nearly 3,000 miners at Rossland, in West Kootenay, where the output, though the camp is only four months old, already reaches a value of $140,000 a month and is rapidly increasing. The North Star Mine, on St. Mary's River, East Kootenay, owned by Montreal capitalists, is about to be opened. The company has built a road costing $10,000 to connect the mine with Jennings' Station, on the Great Northern Railway, on the other side of the International boundary, the point at which a large portion of the ore will probably be delivered, though some will, as British Columbians hope, also be shipped up the Columbia River for smelting at Golden, where a large smelter has too long remained unused. Two sample car loads of ore from the mine, recently shipped to the smelter at Everett, Wash., showed a gross return per ton of $68.70, at which rate a mine where a hundred thousand tons of ore are said to be already exposed, should yield a splendid return to its owners.

DR. OKTON is heading an exploratory and surveying party on a trip to Hudson Bay from Winnipeg. The idea of the party is that a barge route can be established between Winnipeg and Hudson Bay *via* Lake Winnipeg and the Nelson and Hayes rivers. They will make surveys of the falls which impede navigation, so that an estimate may be got of the cost of canals and locks that will be required to overcome these natural obstacles. One of the gentlemen of the party has gathered a great deal of information on the subject, and he calculates that all the necessary locks can be built and the route opened up for a much less amount than it will take to build and equip the Hudson Bay Railway. The Saskatchewan river with its one thousand miles of navigable water, would do for a western branch of the route.

Electric Flashes.

THE Port Arthur Electric Light Co.'s plant has been purchased by the town for $7,000.

THE Milton Electric Light and Power Co., Milton, Ont., has been incorporated. Capital stock $15,000.

A RADIAL electric railway between Sarnia and Florence, to run through Petrolia, Ont., is being discussed.

J. F. PAYZANT has been elected president and W. B. Ross secretary of the Halifax Electric Railway Co.

THE shareholders of the London street railway have authorized the issue of $250,000 in bonds for the purpose of changing the system to an electric power road.

NEARLY $4,000 has been collected in fees by the electric light inspection branch of the Inland Revenue Department. The branch is thus found to be self-sustaining.

ST. MARY'S, Ont., is to be lighted by thirty-two arc lights of 1,000 candle power each. It is believed arc lights will be cheaper and more effective than incandescent.

IT is proposed to organize a company to operate a system of electric railways between Port Hope and Rice Lake, and also to connect with the C.P.R. at Pontypool, Ont.

WORK of construction will not be begun on the Quebec electric street railway until next spring. The delay is caused by the unusual engineering difficulties which the city presents.

AN order for $30,000 worth of curves, side tracks, etc., and a thousand tons of rails for the Halifax street railway, has been placed with the Johnston Steel Co., of Louraine, Ohio.

ALL negotiations of the Selkirk Electric Railway scheme have been broken off. It is said that the reason for this is that some of the promoters are showing a disposition to make money out of the scheme.

INCORPORATION is being applied for by the Central Light and Power Company, Montreal, with a capital stock of $50,000, to supply electric light and heat to provincial towns, and also to manufacture electrical machinery.

A COMPANY, called the Co-operative Telephone Co., of the counties of Lake St. John and Chicoutimi, Que., with headquarters at Hebertville, has been formed to build and operate a telephone line. Capital stock, $10,000.

F. BOIVIN, an employee of the Ottawa Electric Light Company, at Ottawa, while at the top of a pole accidentally touched a live wire. His hands were burned to the bone and he fell 30 feet to the ground. He may not recover.

P. MCLAUGHLIN, postmaster at Summerville, Ont., was killed by an electric car on Aug. 23rd. Deceased was walking on the track of the Toronto & Mimico Electric Railway, and was not seen by the motorman until the car was almost upon him.

THE Belt Line Electric Railway from Montreal to Point aux Trembles, is now being graded; work is being carried on in both directions. The contractors for grading work are Leamy, Mills & Murphy, who will finish their work in November.

LONDON, Ont., Street Railway Co. are about to increase their rolling stock by 10 new electric motor cars. The car bodies are being manufactured in St. Catharines, the wheels at St Thomas, the motors at Peterboro and the trucks at Montreal.

THE Western Electric Light, Heating and Power Co., of Vancouver, have made an offer to light that city for 10 years for 27½c. per lamp 2,000 candle power, if 200 lights are used. The incandescent lights to be furnished at ½c. per ampere per hour.

AT Windsor, Ont., C. McLeod, a lineman employed by the Windsor, Sandwich & Amherstburg Street Railway, came in contact with a loose trolley wire on August the 22nd. He received a current of 500 volts, and though badly injured he will recover.

THE annual meeting of the stock-holders of the New Brunswick Electric Telegraph Company was held at Rothsay on August 12, the old board of directors were re-elected. They are: C. W. Weldon, president; D. C. Dawson, secretary-treasurer; L. J. Almon, J. J. Tucker and D. M. Sutherland.

E. F. CLEMENTS, manager for Canada of the Standard Telephone Company, New York, visited Charlottetown, P.E.I., a few days ago. He is trying to get permission to construct a telephone system on the Island. This granted, he will land a cable at Cape Traverse and begin operations next spring.

THE Galt and Preston Electric Railway will be extended into the village of Hespeler in a few weeks

THE Bell Telephone Co.'s long distance telephone between Montreal and Toronto will soon be completed

THE Ladies' College at Whitby is putting in an electric light ing plant. The engine is a 50 horse-power Robb-Armstrong.

ASHCROFT, B C., purposes putting in an electric light plant and a waterworks system. Steam will be used to generate power.

THE Laurie Engine Co., of Montreal, is shipping the large new engine for the power-house of the Winnipeg Street Railway.

OTTAWA, with 45,000 population, has 50,000 electric lights. This makes Ottawa the most extensive user of electricity in the Dominion.

THE Star Manufacturing Co, of Listowel, Ont., has offered to build and operate a lighting and power plant at Listowel, if an exclusive franchise is granted.

THE new works of the Welland, Ont., Electric Light Co are now in operation They are operated by a 100 horse power engine The company will supply both light and power

THE Halifax Electric Railway Company has ordered two 300 horse-power Robb-Armstrong engines in addition to two of the same kind now under construction for them.

THE Brantford Electric and Power Company has applied for an injunction to restrain Wood Bros from using the canal water for their mill on the Power Company s waterway

A COMPANY to be called the Brockville Electric Railway Co. is being organized in that town to build a street railway in Brockville and Elizabethtown. It will have a capital of $200,000.

THE Parry Sound Electric Light, Heat and Power Co, Parry Sound, Ont., is applying for incorporation with a capital stock of $20,000 to supply light, heat and power to that town

THE North Sydney Electric Company has decided to enlarge their plant, and have ordered two dynamos and an engine. The latter is a 100 horse-power Robb-Armstrong engine, supplied by a Monarch Economic boiler from the Robb Engineering Company.

AT the annual meeting of the North-West Electric Company, held in Winnipeg, the following board of directors was elected for the ensuing year G H. Strevel, president; J. M Graham, G. A. Simpson, J A. McArthur, and H. Cameron, manager and secretary.

THE Welland Power Supply Canal Co is now fully incorporated, and when their channel is completed will give an unlimited supply of the cheapest power in the world, with its headquarters at Thorold The giving of this charter is exciting alarm among our American neighbors, who have discovered that it gives the promoters power to divert the Niagara River as a whole over the escarpment at Thorold.—*Thorold Post*

THE International Radial Railway Company is asking Hamilton for a subsidy large enough to warrant them entering that city with their electric railway The company will include the following places in their route. Millgrove, Carlisle, Freelton, Morriston and Aberfoyle, and the townships of East and West Flamboro, Beverly, Puslinch, Guelph and Waterloo, giving the residents of these places rapid and cheap communication with the markets of Hamilton and Guelph, and connection with the C.P.R system at Shaw Station.

THE first electric vessel seen in the upper Rigaud Lakes is owned by O Higman, chief electrician in the Inland Revenue Department at Ottawa The launch is called the "Minosee" She is thirty-seven feet in length with a beam of seven feet, carrying fifty-two storage batteries, with a four horse-power motor, and when charged will run about seventy-five miles. The wheel and rudder are both attached to the same shaft, and so arranged that one man can manage the motor and steer Her average speed is eight miles an hour She will accommodate thirty persons comfortably.

JULES BEHM, a popular employé of the Montmorency Electric Power Co., met with a painful accident last month, reports the Quebec *Telegraph*, while working at the new switchboard in the distributing house of the company in St. Roch s. There happened to be a live wire close at hand at the time, and this was accidentally touched by the end of the pincers which Mr. Behm was using. The electric current, with a power of 2,000 volts, was thus transferred through the medium of the pincers to the switchboard, which instantly burst into flames, and was extinguished with the greatest difficulty. Mr. Behm's hands were badly burned, and the gold ring on one of his fingers was partially melted, while the end of the steel pincers where the current made connection with the switchboard was completely fused He was taken to the hospital, and is recovering.

BY a recent decree the Roman Catholic Congregation of Rites has declared that electric light cannot be used for the purposes of worship proper, but can be used for the illumination of churches.

MR. FRASER, engineer and manager of the Toronto and Suburban Electric Railways, has inspected the route of a proposed electric line between Welland and Fonthill, Ont., and states that much freight would be moved by the line.

A LITTLE seven-year-old girl, named E. Blanchard, was run down by an electric car in Montreal a few days ago. The child's legs were completely severed from her body, and she died within ten minutes of being admitted into the hospital.

THE Toronto and Suburban Railway Company's extension of their electric line to Weston, a distance of about seven miles, was opened for traffic on the 2nd inst. An agreement between the same company and the county council of York is being discussed for an extension along Dundas street from Toronto Junction to Islington.

THE CANADIAN ENGINEER thanks the Eugene F. Phillips Electrical Works, of Providence, R.I., for a second invitation to their annual clam bake, which was held on the 17th ult. For over a year we looked forward to the delights of that clam bake, and regret that press of business at home has again interfered. They say that the Eugene Phillips Co. do this function up in grand shape, and we hope to see it if a third invitation comes this way

WORK on the Lachine Rapids Hydraulic and Improvement Company's scheme is now making rapid progress. As regards frazil ice, a report of Dr. Robert Bell, of the Geological Survey, states that they will have to contend with no anchor ice except that formed in the river and lake above their works; for, "although water may remain open beneath bridges or overhanging rocks or large fir trees, frazil is not observed to form in such situations."

THE Grand Valley Railway, to connect with the Canadian Pacific system, is to run, if built, from Brantford to Berlin, *via* Galt, thence to Waterloo, and then on through Wellesley to Listowel. The provisional directors have chosen the following officers: President, E. Carl Breithaupt; vice-president, Fred. Colquhoun; secretary, Herbert J. Bowman; treasurer, J. E. Skidmore; Messrs. Burt, of Waterloo, and Bouteiller, of Berlin, together with the officers, were elected an executive committee.

Personal.

MAJOR H A. GRAY, C.E., returned to Toronto by the steamer "Vancouver," after an enjoyable sojourn of three months in England.

F J POPE, science master in the Collegiate Institute, Stratford, has resigned, to become assistant to Prof. Goodwin of the School of Mines, Kingston.

DR McMASTER has been appointed principal of the Toronto Technical School in succession to Mr. Merrill, the late principal, who has gone to Pittsburg, Pa.

A. W. SNIDER, who was in the employ of Alexander Kelly & Co., Brandon, has formed a co-partnership with D. N. Russell, also of Brandon, to carry on a milling business at Wawanesa, where a new mill is being erected.

PRESIDENT J. J. YORK, of the C.A.S.E., in company with Secretary-Treasurer T. Ryan and Trustee J. G Robertson, are enjoying a few weeks vacation at Portland, Me., and will also make an extended tour in Massachusetts.

GEO. A. GOODWIN, member of Inst. C.E., and past president of the Society of Civil Engineers of England, is now in Johannesburg, South Africa, superintending some mining plants in that great gold field. Mr Goodwin is a Canadian.

AMONG the numerous honors and presentations showered upon Private Hayhurst, winner of the Queen's Prize at Bisley, John Bertram, of the Canada Tool Works, Dundas, gave him a costly diamond ring on behalf of personal friends, chiefly belonging to the firm.

THE late Warden King, the well-known manufacturer of Montreal, left about half a million, and made many charitable bequests. He left the Manitoba Theological College $5,000, and home and foreign missions $2,000 each. To these and kindred societies he leaves a total of $45,000.

J. H. HOUSSER, manager of the Massey-Harris Co.'s Works, of Brantford, Ont., was presented with an address and a gold headed cane by the employees of the firm. Mr. Housser is about to move to Toronto.

It is reported that the general managership of the Inter-Oceanic Railway may be given to Walter Morcom, at present general manager of the Mexican Southern. He is a Canadian, and known in railway circles all over the United States and Canada.

The Patent Review.

48,036 R. McWilliam, West Newton, Penn., dust collector.
48,037 E. B. Repp, Washington, Columbia, U.S.A., metallic roofing tile.
48,038 E. S. Merrill, Portland, Me., transom fastener.
48,040 W. T. Coggeshall, Melrose, Mass., steam boiler flue cleaner
48,041 L. L. Smith, Toronto, cinder sifter.
48,042 C. Frost, New York, N.Y., car coupler
48,043 F. L. Street, Neodesha, Kan., low pressure alarm for air brakes.
48,044 A. S. Hodge and J. H. Hodge, both of Boston, automatic relief valve for radiators.
48,045 D. F. Allen, Richburg, New York, N.Y., rotary engine.
48,048 S. Salter, Wal Wal, Victoria, Australia, mould board for ploughs.
48,046 J. H. King, Piqua, Ohio, and W. J. Dean, Minneapolis, Minn., grinding machine.
48,051 N. Lampman, Woodstock, Ont., car brake attachment.
48,052 C. C. Young, Ellsworth, Me., lubricator.
48,053 J. Weldon, Elmore, Ohio, sash holder.
48,057 M. D. Luehrs, Cleveland, Ohio, machine for threading bolts
48,060 W. Clark, Galt, Ont., planing machine.
48,063 J. G. Wilson, Fort Washington, N.Y., wood block flooring.
48,066 F. X. Guay, St. Maurice, Three Rivers, Que., Monocycle.
48,070 S J. Johnston, Leesburg, Virginia, U.S.A., combination tool.
48,071 H. G Hicks, Walpole, N.H., welding compound.
48,073 M. Walker, Port Huron, Mich., ball and socket joint
48,076 C. E. P. Hobart, Cherokee, Iowa, seed planter.
48,080 J. Shank, St. Katherine's Works, Scienns, Edinburgh, Scotland, rag or beating engine.
48,081 P. Lord, Iberville, and P. Amesse, Montreal, both in Quebec, hay press.
48,082 F. K. Caswell, Hartford, Conn., hot water heater.
48,083 J. J. Malley and H. J. Brinkenkamp, both of St. Louis, Mo., range tank.
48,088 J. E. Dalrymple, Chicago, Ill., telephone signalling device,
48,089 J. E. Dalrymple, Chicago, Ill., telephone.
48,092 J. H. Fitzgerald, Neapolis, Virginia, railway gate.
48,094 J. Player, Topeka, Kan., car wheel.
48,101 J. and E. Hall, London, England, apparatus for producing cold.
48,104 The Plenkharp Barrell Machine Company, Columbus, Ohio, hoop-making machine.
48,124 L. Epstein, London, Eng., storage voltaic battery
48,127 J. McAllister and A. C. Hubbell, both of South Manistique, Mich., off-setting device for sawmill carriages.
48,131 T. Keene, Birkenhead, Eng., packing for piston rods.
48,133 B. H. Tindal, Amsterdam, Holland, manufacture of secondary transformer coils.
48,135 G. E. Hibbard, Chicago, Ill., automatic fire extinguisher.
48,142 The Gould Coupler Company, New York, locomotive buffer.
48,153 H. Boyd and E. Frantz, both of Copley, Penn., car coupler.
48,157 E. A. Bryant, Marshfield, Wis., rod packing.
48,171 Consolidated Car Heating Company, Albany, N.Y., electric heater.
48,179 C E. Parks, Waterton, Wis., slat and wire fabric loom.
48,195 W. H. Beal, Anson, Kan., wire stretcher.
48,197 S. O. Jones and G. H. Atwood, both of Stillwater, Minn., piston valve.
48,200 E. C. Davis, Crookston, Minn., and E Davis, Hyde Park, Mass., tie and fastening for railway rails.
48,217 H. L. Sulman, London, Eng., treatment of precious ores.
48,221 J. R. Penberthy, Buffalo, N.Y., apparatus for repairing asphalt pavements.
48,237 N. Sampson, Riviere du Loup, Que., rachet drill
48,244 W. H. Walsh, Albany, N.Y., railway signal
48,246 D. D. Wilson, Toronto, Ont., chemical fire engine.
48,248 H. J. Combes, New York, multiple cylinder steam engine

AMERICAN PATENTS.

The following is a list of patents recently granted in the United States to Canadians. This list is specially furnished to The Canadian Engineer by Hanbury A. Budden, patent solicitor, Montreal.

543,469 R. Drury, assignor of one-half to J O. Thorn, Toronto, bath.
543,727 William Duffield, London, Ont., pencil sharpener.
543,488 Richard Kinsman, Galt, Ont., quoin.
543,492 S. J. Laughlin and J. Hough, Toronto, Ont., drawing, sketching and designing table.
543,535 Thomas Mounce, Toronto, Ont., hasp-lock.
543,842 Henry C. Biette, Toronto, Ont., autographic register.
543,158 John Cox, Victoria, B.C., edger.
543,855 Francis N. Denison, Toronto, Ont., short-circuiting device for stopping dental motors.
544,100 George Hurst, Canso, N.S., lobster-trap.
544,964 Henry C. Mitchell, Toronto, Ont., boiler-covering.
544,146 Horace A Wortman, Sydenham, Ont., fence-post.
544,461 Hugh Cotter, Burlington, Ont., bag supporting device.
544,295 A. I. Farnam, Dunham, Ont., fly catcher for use on animals.
544,619 John Hazlett, Kingston, Ont., steam boiler.
544,586 Frank S. Meade, Montreal, Que., gas or oil engine.
544,375 George Philips, Victoria, B.C., sanitary grate.
544,490 G. H. Smith, assignor to A Mathews, Toronto, Ont., child's safety skate
544,493 Jedithun N Wigle, Ruthven, Ont., magazine camera.
545,338 G. H. Bowie, assignor of one-half to J. C. Rogers, Ottawa, Ont., automatic vending machine.
545,122 Adolphus Davis, Montreal, Que., filter.
545,971 Dieudonné J. Grondin, Yamachiche, Que., evaporator.
545,328 Earnest A Le Sueur, Ottawa, Ont., means for counter balancing end-pressure in steam turbines.
545,126 Florian Lebel, Montreal, Que., hub-attaching device.
545,167 H. C. Malsness, Stratford, Ont., automatic dust-collector.
545,086 John D. Mantion, Hull, Que., and E. G. Shepard, said Mantion assignor, and said Shepard assignor of two-thirds to El. Leetham and C. D. Chitty, Ottawa, Ont., match-racking machine.
545,372 John MacFarland, Austin, Ont., car-moving bar.
545,130 James H. McKechnie, Granby, Ont., foot-wear.
545,241 Robert Menaugh, Victoria, B.C., means for obtaining power by rise and fall of tide
545,141 Thomas Walsh, Montreal, Que., fire-alarm box.
545,143 A. White, assignor of two-thirds to C. R. Sutherland, Toronto, and A. S. King, Ottawa, Ont., skeleton lettering.
545,184 J. Wright, assignor of one-half to F. Wright, Montreal, Canada, steam engine indicator reducing gear.
545,579 R. Bustin, assignor of two-thirds to W. Vanwart, Fredericton, and J. R. McConnell, Marysville, Canada, car fender.
545,771 R. Bustin, assignor of two-thirds to W. Vanwart, Fredericton, and J. R. McConnell, Marysville, safety attachment or fender for cable, electric or other cars.
545,456 W. B. Cowan, Guelph, Ont., triturating and emulsifying machine.
545,793 William O. Gottwals, Ottawa, Ont., perforating machine.
545,587 Charles S. Jackson, Bridgeburg, railway switch.
545,510 Matthias Larner, Milltown, yarn protector attachment for spinning machines.

The preliminary report of the American commission to enquire into the effect of the Chicago drainage canal on the levels of the great lakes, shows that there is very little reliable data to go upon; but it is probable that the abstraction of 10,000 ft. per second by this canal might cause a lowering of the lakes by six inches. Such a change would seriously affect not only all the American, but the Canadian harbors. Under the laws of the United States these changes cannot be made without federal authority; and, what is *more important to us, they are an infraction of international law.* The report further says that while the channels and harbors of the great lakes below St. Mary's Falls will be injuriously affected by a diminution in depth, the inner harbor of Chicago will be diminished also by the introduction of a current, which in the present condition of the river, with the minimum flow of 5,000 cubic feet per second, is entirely inadmissible. The board of trustees have not yet determined upon a plan of treatment of this navigable channel, and their plans may, the report suggests, be such as to improve, impair, or destroy its utility as a navigable river.

An Anglo-American company has been organized in Egypt to build an electric road from Cairo to the Pyramids.

A discovery of yellow cedar was made some time ago in the northern part of British Columbia. This wood takes on a beautiful polish, and is particularly suitable for cabinet work. Fifteen thousand acres of these trees were acquired by a Vancouver company who have sold out to an English syndicate for $40,000 cash and $250,000 stock in the new company. It is estimated that there are over 100,000,000 feet of this lumber available for commercial purposes, and it is valued at $80 a thousand.

The performances of the Ronald engine at the recent test made in Toronto were most creditable, and considering that the conditions were against the Canadian engine and in favor of the Merryweather, the makers of which made special efforts in this case, we think the Toronto City Council should have bought the Canadian engine. Mr Ronald has not had generous—perhaps not even fair—treatment in this instance, but the work of his engine will bring him credit in other quarters if it does not effect a sale of his engine in Toronto.

The amendments to the Ontario Factory Act passed at the last session provide that where two or more persons occupy the same room or premises, and employ in the aggregate six or more persons, each of the employers shall be responsible for the proper sanitation of the place. This is to provide for those cases where several work-rooms are situated in the same building, and where each one shifts the responsibility on the other. Another clause prohibits the employment of children under fourteen years in any factory except a canning or desiccated fruit factory. Another clause is designed to provide for more secure guarding of dangerous parts of machinery, flumes, doors, bridges, etc., but leaves a large discretion in the hands of the factory inspector. In regard to fire escapes, a rope is ordered for every window in any factory having more than a ground floor flat. When an explosion occurs the inspector must be notified of the same within twenty-four hours under a penalty of $30. The new Act authorizes the appointment of a female inspector of factories.

Capt. J. Murray, the well-known contractor and vessel owner, died suddenly at his home in St. Catharines on August 27th. Deceased was president of the Castleman Lumber Co., and vice-president of the North-West Central Railway. He did work on the Welland Canal and other public works.

Subscribers changing their residences are reminded to notify us, giving both old and new addresses, so that delivery of their CANADIAN ENGINEER may be uninterrupted. The date on address slip shows when subscription is paid to. Those in arrears will oblige by an early remittance. Montreal City subscribers may pay at our Montreal office, 43 St. Sacrament Street.