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For THE CANADIAN ENGINEER.

STEAM ENGINE ECONOMY.

BY P. BATTY.

Steam engine economy in a broad sense involves considerations of construction and design, as well as everything that enters into cost and maintenance and operation. With the engineer in charge of engines and boilers, however, the problem is ordinarily that of getting the best possible results from machinery already constructed and placed in his charge. An important part of his education is in the direction of how best to accomplish this end, and the value of his services is largely dependent upon his ability in this direction. Economy to him means keeping down the fuel account, having small bills for repairs, little or no loss from enforced stoppages, maintaining regular speed, and having the least possible loss from deterioration.

The cost of fuel is always an important matter, but sometimes it is of more importance that there be no enforced stoppages, or that the speed be very regular. The engineer must study this in any particular instance, and govern himself according to circumstances.

So far as the use of fuel goes, an engineer often finds himself confronted with conditions that render the attaining of good economy impossible. The only course then is to make the best of bad surroundings. The condition unfavorable to fuel economy most likely to be met with is an engine too large for its work. In a non-condensing engine the useless work of moving the piston against the pressure of the atmosphere must always be done. The resistance the piston meets with from the atmosphere being, in round numbers, 15 lbs. per sq. inch, if the mean effective pressure required to do the work is but 15 pounds, then as much work is done in overcoming the atmospheric resistance as is done in overcoming the friction of the parts and doing the useful work. If the load is increased so that the mean effective pressure is 45 lbs., only one-third as much work is done against the atmosphere as against the other resistances. One reason, then, and a very important one, why an underloaded engine works with poor economy, is that the useless work is too large a fraction of the total work done by the steam. So far only the useless work of overcoming the resistance of the atmosphere has been referred to There will be, besides this, some further back pressure which will not increase in proportion as the mean effective pressure is increased, and this, so far as it goes, strengthens the reason just given. In a condensing engine the piston has always to be moved against the pressure due to imperfect vacuum, and some back pressure besides, so the same reason holds good, but not to the same extent.

Another reason why poor economy and light loads go together is that part of the work done in the cylinder of a steam engine is done to overcome friction of moving parts, and this friction does not increase as fast as the load is increased. It is sometimes nearly as great with no load as with the engine fairly loaded.

A third reason is condensation of steam in the cylinder. When ordinary dry steam from the boiler enters the cylinder, cooled by the low temperature during expansion and exhaust, a very material portion of it is condensed, parting with latent heat to bring up the temperature of the exposed surfaces. In an engine lightly loaded the steam thus condensed is a larger fraction of the total steam used than in one more heavily loaded. The exact loss from condensation cannot from present knowledge of the subject be calculated, or very closely approximated, so that it cannot be told by calculation just what the mean effective pressure on an engine should be for the best economy in fuel consumption. Experimentally it has been found that with steam from 70 to 90 pounds, by gauge, the best economy in a non-condensing engine obtains when the load is such that cut-off will be not much, if any, earlier than one-quarter stroke. With this cut off the terminal pressure will be from 5 to 10 pounds above the atmosphere. At lower steam pressure than named the cut-off should be still later. With condensing engines the cut-off may be such that the terminal pressure will be at atmosphere, or a little below.

But the engineer has to do with the engine underloaded—too large for the work—and must consider how he can keep the coal consumption down, or loss in some other direction. When the cut-off is materially before quarter-stroke, so much so that the terminal pressure in a non-condensing engine is below atmosphere, it is in the interest of economy to reduce the speed. This is not, however, always practicable. Sometimes the construction of the engine is such that a change of speed will disarrange the governor to such an extent that the regulation will be poor; in other instances it is merely a matter, so far as the governor is concerned, of a change of a pulley.

Another important consideration in a proposed reduction is the weight of the fly-wheel. Good regulation cannot be had with a flywheel too light for the work.

If the fly-wheel is only of sufficient weight for the speed as it is, if the speed is reduced, it will be too light. The momentum of a fly-wheel varies as the diameter, and as the square of its revolutions; hence, reducing the speed decreases its capacity rapidly. There are several rules for determining the proper weight of a fly-wheel, and I think the following rule is as simple as any. Rule for finding the weight of the rim of a fly-wheel for an automatic engine: Multiply 6,000,000 by the indicated horse-power of the engine, and divide the product by the diameter of the wheel in feet, multiplied by the square of its number of revolutions per minute. Take, for example, an engine developing 75 indicated horse-power, having a fly-wheel pulley 14 feet diameter, running 80 revolutions per minute. What should be the weight of metal in the rim of the wheel? 6,000,000 × 75 = 450,000,000; the square of 80 is 80 × 80 = 6,400, and 6,400 × 14 = 89,600. Then 450,000,00 ÷ 89,600 = 5,022 pounds for the weight of the rim of the wheel.

Some builders use a larger constant than 6,000,000, which gives greater weight of wheel, but more use a smaller constant. Cast-iron weighs about .26 pound per cubic inch, so by finding the cubic inches in the rim of the wheel, and multiplying by this decimal, .26, the weight will be found with reasonable exactness; then finding by the use of the indicator the horse-power developed, it can be told whether the speed can be decreased with satisfactory results without increasing the weight of wheel.

Reducing the speed is usually the only practical means of increasing the economy of fuel consumption in an under-loaded, non-condensing engine. By this means the useless work done against the pressure of the atmosphere is diminished—the inevitable loss from filling the clearance space with steam at every stroke is less, and friction is generally reduced. A slight saving may sometimes be effected by working with reduced steam pressure, but what it will amount to, if anything can only be told by trial. It will depend upon the steaming qualities of the boiler under the higher and lower pressures; upon the construction of the engine, particularly as to whether the valves work under full pressure or are wholly or partly balanced; upon whether leakage will be less at low pressure, and upon a variety of conditions that cannot well be enumerated. Usually in a well-constructed boiler—unless expansion is considerable—say 2 or 3 pounds at least below the atmosphere, working with lower boiler-pressure will not decrease the coal consumption. If advisable to reduce the initial pressure, better results will usually follow a small amount of throttling, keeping the boiler pressure as it is. Reducing the boiler pressure in the instance of an under-loaded condensing engine is much more likely to save fuel than in one working non-condensing. In any case the effect can only be known by trial. Weighing the coal used running both ways will settle the matter conclusively. If an engine is overloaded the remedy that most naturally suggests itself is to increase the speed. The diagram will show, by the freedom with which the steam gets into and out of the cylinder, whether in this respect higher speed is advisable, or will accomplish the end sought. If initial-pressure is nearly equal to boiler-pressure, with only a pound or two of back-pressure, then there will be no trouble in increasing the speed from 10 to 20 per cent., if the wearing or moving parts can be run faster without danger or inconvenience. Increasing the speed of an engine ought to improve the regulation, because it increases the capacity of the fly-wheel. Frequently the very best remedy for an overloaded engine is increasing the steam-pressure. Doing this, of course, involves previous consideration of strength of boiler, and of various parts of the engine, as well as the amplitude of the wearing surfaces to resist the higher pressure. When there are no objections to increasing the pressure, doing so generally increases economy.

Another plan for helping out an overloaded non-condensing engine is to add a condenser. Where fairly high pressure of steam is carried—say, not less than 75 pounds gauge pressure—and the cut-off is from one-quarter to one-third stroke, a condenser will, by adding from 9 to 11 pounds pressure below atmosphere, shorten the cut-off and the economy will be increased. Adding a condenser to a lightly loaded engine working with high steam pressure in the expectation of saving coal, as is frequently done, will generally end in disappointment. Condensation in the cylinder will be increased and colder feed must be used, the two frequently neutralizing all that is otherwise gained by the use of the condenser.

When, from any cause, it is necessary to materially reduce the steam pressure carried, thus in effect making the engine small for the work, then a condenser is a valuable addition.

In a non-condensing engine advantage should always be taken of heating the feed-water by the exhaust steam; in this way a saving of coal equal to from 10 to 15 per cent. will be effected, besides which it is much better for the boiler to feed hot water. With a condensing engine there is very little gain from the use of a heater, provided the temperature of the hot well is not unnecessarily low.

For THE CANADIAN ENGINEER.

WATER IN THE BOILERS.

BY W. SUTTON.

All waters used in steam boilers contain, in solution or suspension, more or less mineral and organic matter, acquired by contact with the earth's surface, or by percolation through its alluvium and rocks. Of this river and lake water contain from 5 to 20 grains to the gallon in solution, and a varying quantity in suspension. Well and spring hold but little in suspension, but, in solution, a quantity varying from 10 to 650 grains. This matter consists of a variety of substances, namely, carbonates lime, magnesia, iron; chlorides of lime magnesium, potassium; sulphates lime, magnesia, soda and potash; phosphate lime, bromides and iodides of calcium and magnesium, alumina and silica. Besides these substances, certain gases are more or less present. These are oxygen, hydrogen, carbonic acid and sulphuretted hydrogen—the three first being always found. All of the above substances are not uniformly present. The quantity and character of the matter in any particular water depends much on the constitution of the earths and rocks over or through which it has passed, and upon the condition of location, and motion, and exposure to light, heat and air which it has undergone. Consequently, there is much variety in the constitution of various waters with reference to their adventitious ingredients.

EVAPORATION.

All water, on being evaporated by boiling in an open pan, leaves a residue composed of all the elements contained in it; the deposits of the residue take place

in the following manner: As soon as ebullition begins, the contained free gases are driven off, since they are not soluble in hot water, and, as the presence of carbonic acid is necessary to the solution of the carbonates of lime, magnesia, iron, these salts, which are found in all waters, are precipitated in a finely crystalline form, tenaciously adherent to whatever they fall upon. Sulphate of lime, which is commonly present, is soluble in 400 parts of cold water, but scarcely at all in boiling water; therefore as the evaporation proceeds supersaturation occurs, and this salts is thrown down in the same form and possessing the same adherence as the carbonates. The other contained elements, which are more soluble, are precipitated in the same way by super-saturation. As the quantity of water is lessened the suspended matter gradually subsides and agglutinates with the other deposits. In a steam boiler the deposits from the evaporated water tend to take place in the same manner, but the constant supply of fresh portions and the occasional emptying out of the saturated water prevents the precipitation of the more soluble salts; these are retained in solution. Practically, it is found that the deposits from all kinds of boiler waters consist almost entirely of carbonates of lime, magnesia and iron, and the sulphate of lime. Scarcely more than 5 per cent. of other salts are found.

It is important both for the safety and efficiency of a boiler that the tubes and sheets are kept free from scale. The evil effects of scale are due to the fact that it is relatively a non-conductor of heat. Its conducting power, compared with that of iron (according to Desprety), is as 1 to 37.5 or thereabout; accordingly more fuel is required to heat water through the shell and flues of an incrusted boiler than would be required if the boiler were clear of scale. It is readily demonstrated that a scale one-sixteenth of an inch thick will demand the extra expenditure of about 15 per cent. more fuel. This ratio increases as the scale grows thicker. If a boiler be perfectly clean, the contained water may be raised to any given temperature by heating the external fire surface to a temperature a few degrees higher, but if any scale be present it will be necessary to heat it still higher, according to the thickness of the scale, in an increasing ratio. To illustrate: To raise steam to a pressure of 90 lbs., the water must be heated to 320° Fahrenheit. If the boiler be clean, this may be done by heating the fire surface to about 325°; but if one-half inch of scale intervene between the shell and the water, such is its non-conduction that it will be necessary to raise the fire surface to a temperature of about 700°—almost low red heat. Now, the higher the temperature at which iron is kept, the more rapidly it oxidizes or carbonizes, and undergoes molecular change. At any temperature above 600°, it soon loses the fibrous nature of the wrought iron, and becomes granular like cast iron (which it has really become) by carbonization. In this condition it is brittle, thin, and, under high heats, liable to bulge or even give way to the great pressure upon it. Weakness of boilers thus produced predisposes them to explosion, and causes necessarily expensive repairs.

To obviate these evils, namely, danger from explosion, expense of repairs, loss of time and waste of fuel, very many methods have been devised, having in view the prevention and removal of scale. For this purpose, picking, scraping, chaining, etc., are generally resorted to periodically. Such is its toughness and tenacity, however, that mechanical force only succeeds in removing a portion of it, and is generally unsatisfactory, since in addition it is necessary to empty the boiler and to allow it to get cool enough to enter, which, with the operation itself, generally requires a whole working day.

Various mechanical contrivances have been and are now used to intercept the precipitated saline matter from the supply water on its passage through the heating apparatus. They consist essentially of obstructions to the flow of the water. This latter being heated to boiling by being intermingled with the exhaust steam in the heater, the carbonic acid is driven off, and a precipitation of the carbonate takes place, the deposits accumulating on the shelves, straw, or other obstructions, over or through which the water slowly flows. In this way large accumulations of the matter in suspension, and of the precipitated carbonates, are prevented from going into the boiler, and being retained in the heater, may be removed very conveniently when opportunity is afforded. This plan, however, only partially remedies the difficulty, since it is only the precipitated carbonates and the matter in suspension that are retained by this apparatus. The soluble salts all pass on to the boiler and also a great portion of the earthy carbonates which cannot be precipitated during the short passage through the heater, therefore the scale in the boiler forms more slowly.

Another variety of mechanical device for preventing scale is the sediment pan. This, of which there are many forms, consists essentially of a shallow vessel which is placed in the bottom of the boiler, with the view of catching the precipitate and preventing its deposition on the inner portion of the shell. This plan succeeds in gathering much of the sediment, but much necessarily fastens itself to the boiler, and the scale, as before, continues to form.

For a long time, simple chemical agents have been used in an empirical way, or applied without science, with a certain success. Some of these are molasses, fruits, slops, vinegar, cane-juice, and a variety of vegetable substances containing more or less acetic acid, which when placed in a boiler, at regular intervals, will remove and prevent the incrustation to certain extent. The acetic acid decomposes carbonates, forming acetates, which are kept in solution and hence cannot become increments of scale. The sulphate of lime and other salts are not affected by it, and from this the scale will gradually be formed. Moreover, the iron of the boiler being open to the attacks of the free acid, will be gradually corroded, and after a time rendered useless, if not dangerous.

This fact alone ought to forbid the use of these agents.

Starchy matters, in various shapes, such as potatoes, corn, oil cake, etc., have been much used. These prevent scale only by enveloping the precipitates with gelatinous matter, which lessens their weight and prevents their agglutination into a solid mass. Starch, as well as nearly all other organic matters, has a tendency to produce foaming or frothing of the water in the boiler. In this case the exact quantity present cannot be determined by the gauge cocks. This is a source of great danger, and ought to prevent the use of such agents.

Oak, hemlock and other barks and woods are operative in the prevention of incrustations, on account of the tannic acid which they contain.

Various extracts, such as catechu, logwood, etc., rich in tannin, are also used. Tannic acid

decomposes the carbonates, forming tannates, which are insoluble; but their specific gravity being light, they do not subside, but remain continually floating in the boiling currents; and, moreover, being amorphous, they have no tendency whatever to agglutination, and therefore do not incrustate on those surfaces with which they come in contact. The sulphate of lime, however, is not decomposed by tannin, and will form a scale, notwithstanding its presence. The same objection holds against tannin, in its free state, as offered in the above named agents, as it does against free acetic acid—it will attack the iron of the boiler; though, as the tannate of iron is insoluble, the corrosion will not be as rapid as with the acetic acid, which forms a soluble acetate with iron.

THE PETERBOROUGH WATERWORKS.

BY A. C. M'CALLUM, M.E.

The pumping plant of Peterborough Water Company, recently placed in position by the Wm. Hamilton Manufacturing Co., Ltd., of Peterborough, is one well worthy of being described, as the capacity of the pumps are such as to suit the requirements of many of our larger as well as smaller towns throughout the Dominion where water power can be utilized.

The pumping plant is a water power one, and consists of two sets of triplex single acting power pumps. The plant is of the direct pumping system, requiring no stand pipe or reservoir, and is employed for fire purposes, as well as for domestic use.

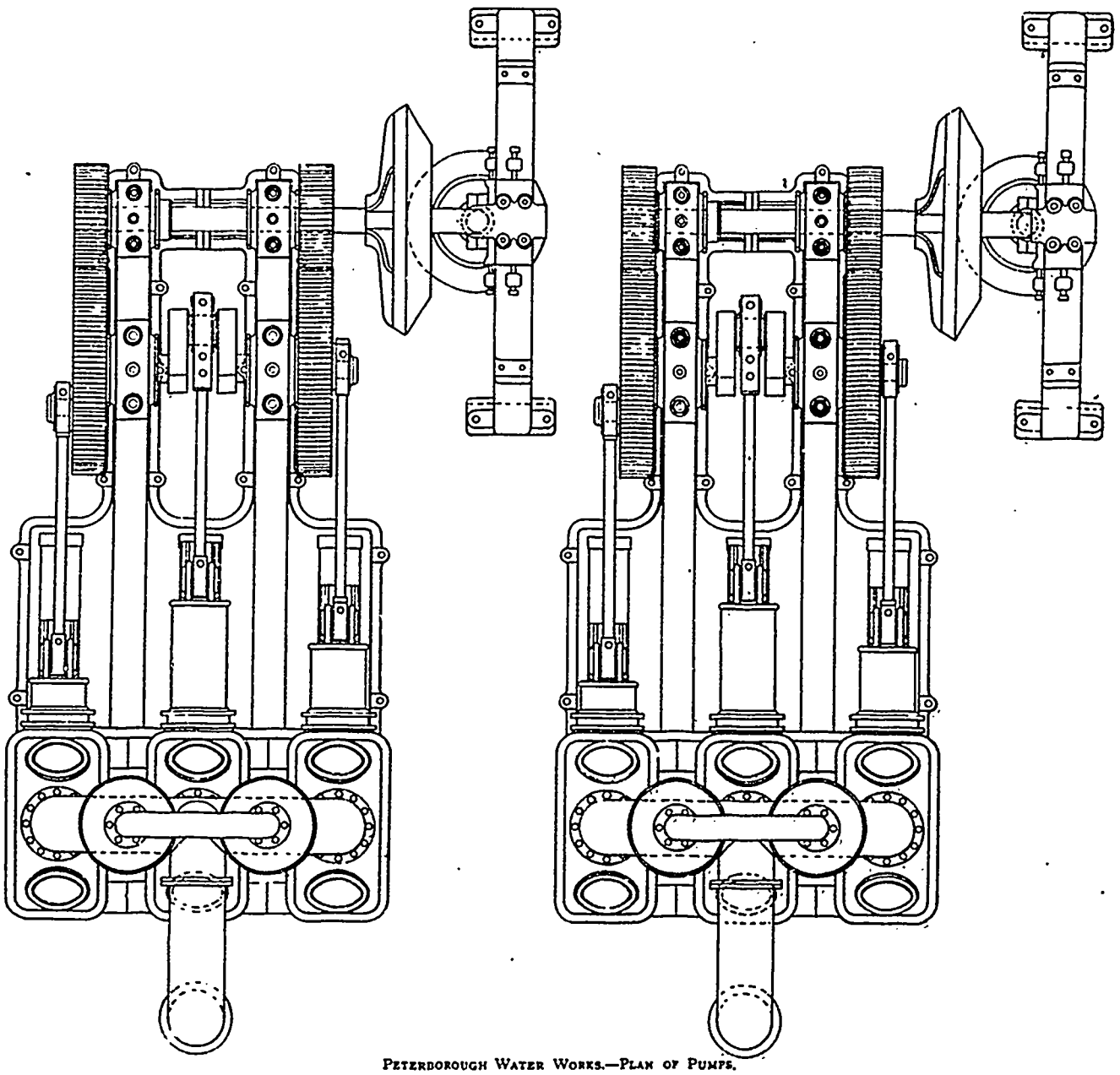
The demand for fire purposes is met by increased speed of the pumps; notwithstanding this, the pumps will not be called upon at any time to exceed the average working space of reciprocal pumps.

The pumping station is situated about 2½ miles north of the centre of the town upon the bank of the Otonabee River, which forms part of the now famous Trent Valley Canal route.

The pump house is built upon the west end of the new timber dam recently constructed, and presents a very pleasing appearance from the roadway running up the river side.

The foundations of the pumping station and wheel pits, together with the foundation for the machinery, are carried up from the bed rock of the river to machinery floor and are entirely built of rubble masonry.

The walls of pump house are built frost proof. The outside walls are built of red brick, relieved in panel. An air space is made between the outside and inside walls; the inside walls are built of white brick.



PETERBOROUGH WATER WORKS.—PLAN OF PUMPS.

The pumping station is well lighted, having four large gothic windows, and, together with the several smaller windows, makes the interior, with its white brick walls and panelled hardwood ceiling, present a very pleasing appearance.

The grounds around the pump house have not yet been put into the shape they will afterwards take; it is intended to have the grounds neatly laid out, with sloping bank to the river's edge, and the walk to roadway from pump house laid out and levelled, and, together with the harmonious surroundings, the water company may feel well pleased with their property.

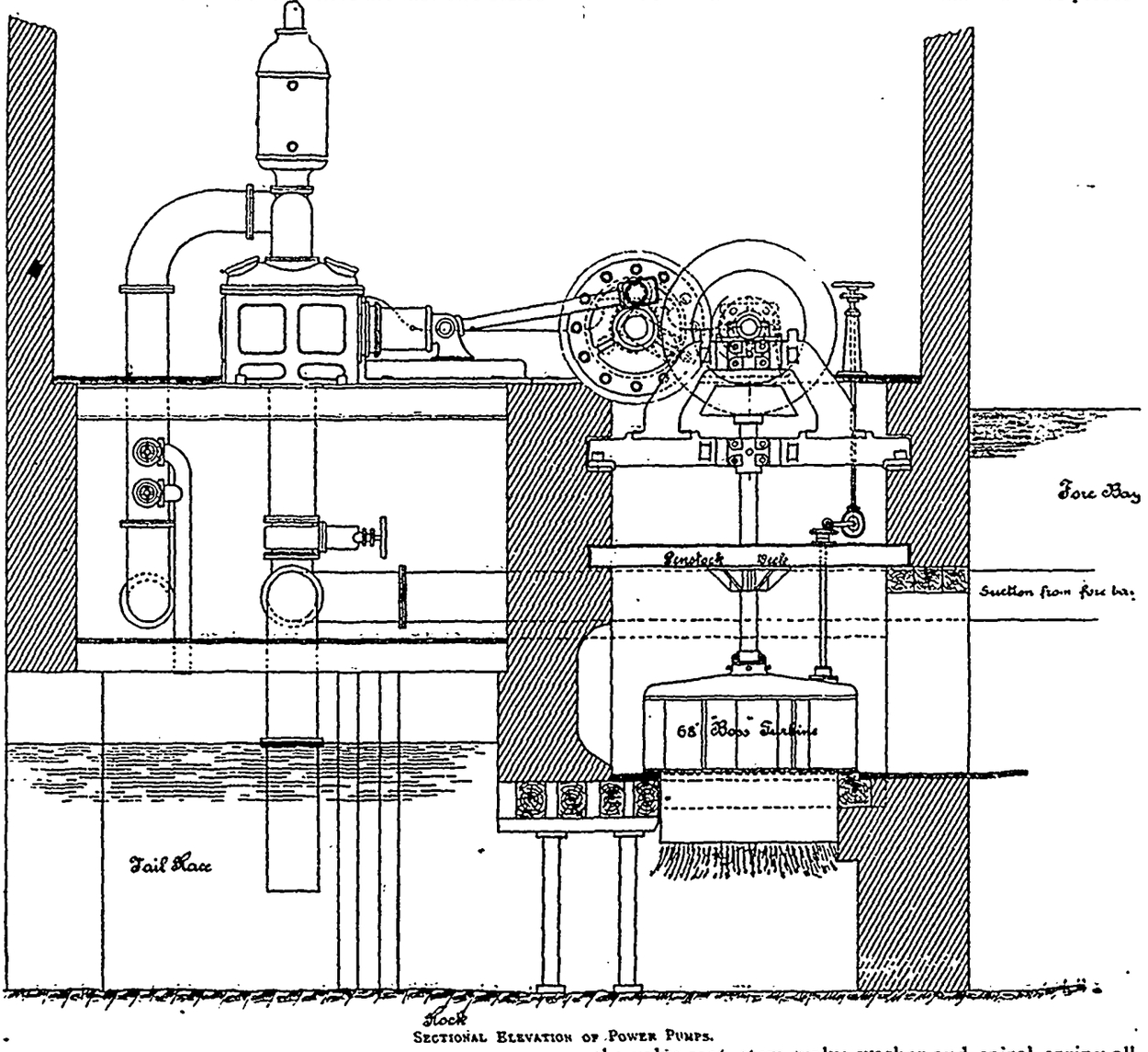
The dam which was recently constructed is an overflow one, built of stone and timber; it is about 600 feet long and has an overflow of 220 feet. There is a power opening upon the last end of the dam 30 feet 6 inches wide. Provision is also made for the running of logs through. As many thousand feet of lumber are driven down the river, a timber slide of 32 feet 6 inches wide was made in the dam. There are also two sluice-ways built in the dam, through which the surplus in the reach above is passed. The dam is composed principally of timber, the crib work being filled in with stones.

The pumps are of the three-throw single acting type, or, perhaps, better known as Triple Single Acting Power Pumps. Each set of pumps has three cylinders, each 18 inches diameter, with a stroke of 30 inches, and a capacity of 2,250,000 imperial gallons per diem and a working pressure of 130 lbs.

The side elevation shows in outline the external appearance of the pumps. The cylinders present a massive and pleasing appearance. The stays or ribs supporting the sides of the cylinders are internal, leaving a smooth exterior surface, which is neatly panelled.

The cylinders are bolted securely to each other, and each to the main frame, the whole being firmly bolted to the splendid foundations prepared for them. The front end of pumps are carried upon a stone foundation; the back part and cylinders are carried upon deep beams, securely built into the walls.

Each cylinder, with its front head, is one casting throughout, well braced and ribbed internally, to withstand the heavy duties assigned to them; the lower part of the cylinder joins the suction chamber. The pump valves are placed on horizontal plates above and below the line of plunger travel. There are 36 valves on top plate to delivery chamber, which forms top part of cylinder, and 36 valves on lower plate forming top of suction chamber. The valves are made in four pieces



Sectional Elevation of Power Pumps.

the valve seat, stem, valve washer and spiral spring all of brass. The valve proper is 3½ inches in diameter, one half-inch thick, and made of rubber by the Gutta Percha and Rubber Co. of Toronto. The amount of lift allowed is just sufficient to make the area through the valves uniform, so that the water will pass with uniform velocity. The low lift of the valves, and with their elastic faces, make them noiseless in action at all speeds and pressures. Access to the suction valves can easily be had by taking off the back end cover of the cylinders, there being ample room for the engineer to get inside of the cylinders when the plungers are drawn up.

Through the hand holes back and front of delivery chamber cover, the delivery valves can be easily reached. In fact all the details of the entire plant were so de-

signed that they can be examined at any time with the least possible trouble.

The main frame of the pumps is made in two halves, and bolted together. The frame is built of the inverted U section, thoroughly ribbed and stayed; the crosshead guides or bearings are of liberal dimensions, truly planed and finished, having pockets at either end for the reception of oil or grease to lubricate crossheads; the bearings of the crank and lying shaft are of the type peculiar to the Corliss engine, built up entirely of brass, and provided with wedges to take up wear or loose motion. Some idea of the massiveness of the frames can be formed when it is known that their weight alone is over 18,000 pounds each.

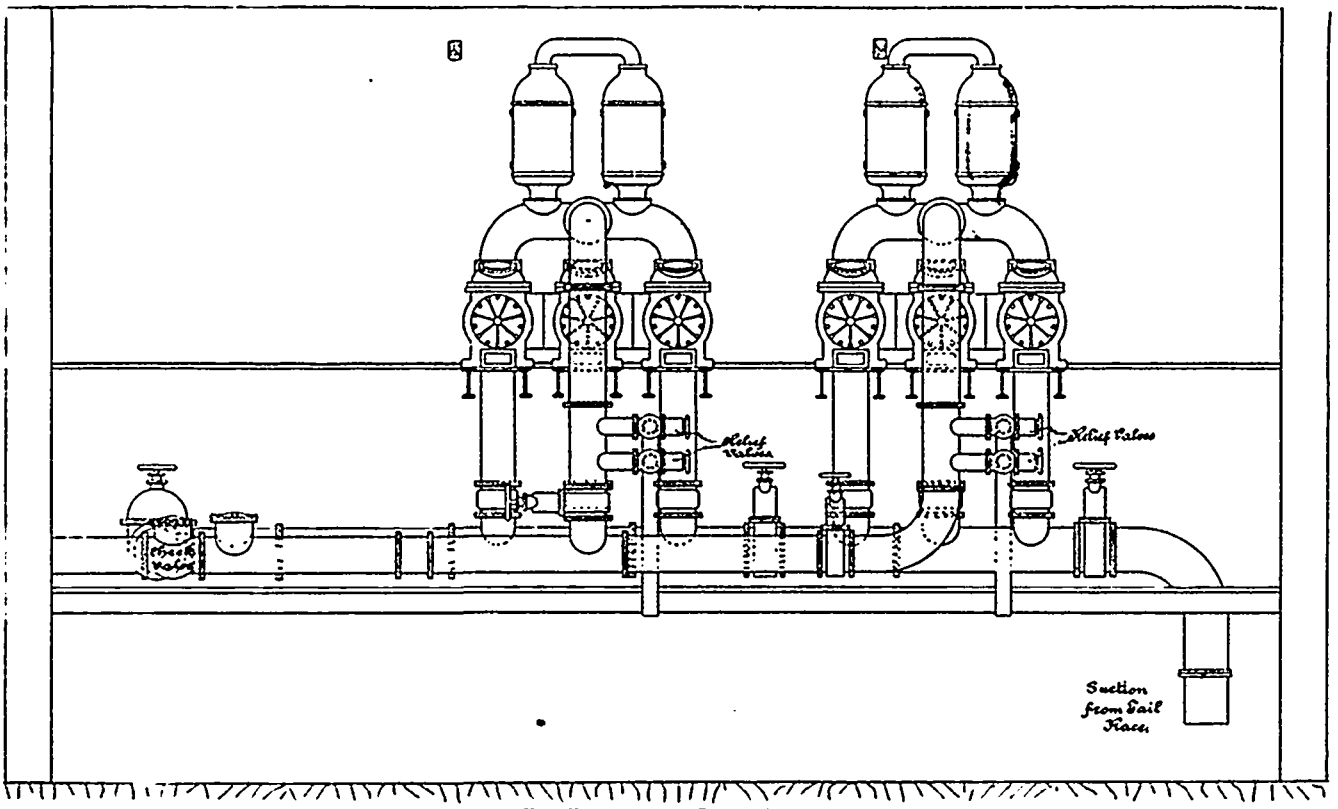
The plungers are made of cast iron working in a brass-lined cast iron stuffing gland, which can be readily packed from the outside, and are carried in the stuffing box, which is securely bolted to front end of cylinder.

The plungers are cast hollow with spherical ends, and are made as light as possible, so as to "float," and thus reduce their weight on their horizontal bearings; they are secured directly to the crossheads.

internal circular flange and securely bolted to the cast iron crank disc, in which the crank pins for the outside cylinders are placed. The crank pins on discs are ground in and fitted in a taper hole, and securely held by key on inside of disc.

The discs were pressed on to the crank shaft and provided with steel keys. The crank shaft is 10 inches in diameter, of hammered steel made by the Nova Scotia Steel Company; the centre crank pin is formed upon the crank shaft, of the same diameter as the crank shaft; the outer crank pins are 7 inches diameter and 7 inches long. The entire weight of the crank shaft, with discs and spur wheels, is about 13,700 lbs., the heaviest single piece to be handled. The connecting rods are of forged steel of rectangular section, with a ratio of 6 to 1 of the crank; they are all provided with brass boxes, wedges for taking up loose motion, and are finished bright all over.

The crossheads are of cast iron of massive design, and in keeping with the rest of the pumps, they are provided with adjustable slippers for taking up any wear. The bearing part of slipper against guide is



End Elevation of Power Pumps.

The crossheads have a bearing only on underside, as the plungers do no work upon their forward motion, there being no thrust upward; all the thrust takes place upon the backward motion of the pumps.

The cylinders are securely bolted by the back end of main frame, at the front end of which is the lying shaft operated by the water wheel shaft, as seen by the illustrations; between the lying shaft and the cylinders is placed the crank shaft, from which motion is imparted to the plungers. The lying shaft is driven from water wheel shaft by bevel gearing, and motion is imparted to the crank shaft through the spur pinions on lying shafts in gear with large spur wheels on crank shaft.

The spur gears are 2 to 1, the pinions are 33 inches diameter, 11-inch fall, and 4-inch pitch; the spur wheels are 64 inches diameter, 11 inches faces, and 4-inch pitch. The spur gearing teeth are all machine cut, thus insuring accuracy of motion.

The large spur wheels are simply a rim with an

formed of babbitt metal run up into the recess made for same in slipper; the babbitt is then well hammered when cold, and afterwards neatly planed off, thus forming an excellent rubbing surface with the cast iron guide on frame. The crosshead pins are of steel, 5 inches diameter by 5½ inches long.

Each set of pumps is provided with two air chambers of large capacity made of cast iron, weighing over 2,000 lbs. each, of neat external design; the air chambers are connected to each other by a 4 inch pipe, thus ensuring an equal volume of air in each. The air chambers are wholly supplied by the "snifting valves" placed on top of pump barrels, and having the necessary glass gauges. The usual piping for priming and draining off the cylinders is provided, and so placed between the cylinders as to be easily operated when required. The delivery pipe from each set of pumps to the pumping main is 16 inches diameter, and is supplied with a 16-inch gate valve so that each set of pumps can be entirely shut off from the mains. The

suction pipe from the fore-bay to the pipe vault under machinery floor is 20 inches in diameter. A 16-inch branch is led up from suction pipe to each pump cylinder, and provided with a gate valve 16 inches diameter to each branch, to permit of pumps being entirely shut off from suction.

The suction pipe is laid out to the intake house, situated 200 feet above the pumping station in the river, and ends in a well in the river crib; where suction pipe enters vault a 20-inch gate valve is placed so that suction may entirely be shut off from river crib if so desired. The end of suction pipe in pipe vault is turned down at right angles into the tail-race provided for the wheels, as the illustrations clearly show, and can be utilized to supply the pumps in the event of a heavy demand for fire or other purposes, or in the event of accident to the crib from ice or other cause; a 20-inch gate valve is also placed in pipe vault to close off this end of suction when not in use. The pumps have a lift of four feet, and from indicator cards already taken of them by the writer, the action of the suction is all that could be desired. The delivery main in vault is 16 inches in diameter, provided with a 16-inch check valve and bye-pass just inside the pipe vault. From the delivery pipe of each set of pumps are two 6 inch branches, just below machinery floor line, on which are placed six inch relief valves discharging into an 8-inch pipe leading through floor of vault into tail race.

The pipe vault is worthy of comment; there is over 9 feet of head room, and ample room around the pipes and valves, and is well lighted and easy access to the roadway. The pipes are laid close to the floor upon cast iron crutches laid upon hardwood blocks, and all pipes were tested by hydrostatic pressure before being put into place.

The machinery floor supporting frame and lying shafts is formed of rubble masonry, resting upon the rock which formed the bed of the river. The holding-down bolts of the frame of pumps are encased in pipe or tubing, which was built into the foundations when they were building; the bolts can be taken out at any time, they not being run up with cement.

The penstock for the wheels is practically an extension of the fore-bay through the dam and wall of pump house; the openings to penstock are 9 feet square in the clear; the admission of water to the penstock is regulated by means of stop logs placed in front of opening in building and also in front of dam. The penstock is decked over with steel plating having castiron girders 10 inches deep of I section, the ends of which are built into the walls; provision is made so that they can be removed at any time, if desired, without damaging the walls in any way, and permit the removal of the entire deck. The deck plating around walls is securely held to L pieces of cast iron checked into walls, and held in place by bolts let into the masonry and run up in lead. The L pieces on wall are run up with lead between casting and wall, and when cold were carefully caulked, thus ensuring a tight joint between wall and casting.

A stuffing box for water wheel shaft is formed in two halves around the water wheel shaft, and made very strong to successfully resist the greatest pressure due head. Water tight joints between plates and castings are formed by means of rubber, the plates being securely bolted to girders, stuffing box and L pieces, thus making a thoroughly water tight deck. A manhole is provided upon the deck to give access to the penstock and wheel when water is drawn off.

A 4-inch drain pipe from the deck, extending down through penstock floor, is also provided to drain off any leakage and sweating that may take place. A 2-inch pipe is tapped into the deck plating, and is formed goose-neck, led into drain pipe, and by means of globe valve on this pipe the air in penstock can be drawn off.

The water wheels are of the well-known make of the Wm. Hamilton Co., "Boss" turbines of 68 inches in diameter, having a vent of 1,300 square inches, and discharging, under a calculated head of 12 feet, 15,000 cubic feet per minute, developing 270 h.p., making 55 revolutions per minute. The depth of the pit under the wheels is 8 feet, and allows a perfectly free discharge of the water.

The wheel shaft is 7 inches in diameter, of forged steel, with an enlargement through the stuffing box and where it passes through the hub of cast iron pinion. This shaft is over 15 feet long; the entire weight of water wheel, runner, shaft and pinion rests upon the step carried upon bridge-tree in draft tube of wheel. The upper end of shaft runs in a bearing of liberal dimensions, placed upon side of bridge-tree placed above penstock deck.

The penstock timbers are of oak securely built into the masonry, and are sheathed over with planking 3 inches thick, and perfectly watertight; hard-wood skirting is placed between wheel case and deck.

The wheels are operated from the machinery floor with large hand wheels and suitable gearing; a neat cast iron column fastened to the floor carries the gate stem shaft, upon which is placed the hand wheel; there is also upon the stand an indicating device, by means of which the position or opening of the wheel gate may be known.

The cast iron girder carrying tail end of lying shaft and upper end of water wheel shaft, is of massive design, of inverted U section, resting upon plates built into the walls, and is securely held to the masonry by strong bolts. Provision has been made to enable aligning the girders at any time, if required. The pressure gauges and revolution counters are placed upon the wall above hand wheels, and can be readily seen from any part of the building.

The entire weight of the pumps and piping is over 160,000 pounds, and was placed in position by the William Hamilton Company, under the superintendence of Mr. Wm. Kennedy, jr., C.E., of Montreal, who had entire charge of the works.

The illustrations are copied from the designs of the plant, prepared by the writer.

The present distribution system comprises about fifteen and one-half miles of mains, varying in size from 5 to 16 inches, there being one mile of 16-inch, one and one-half miles of 12-inch, four miles of 8 and 10-inch; the balance of distribution is practically 5 inches.

There are placed 115 stop valves on the system. The mains supply 114 fire hydrants. The total cost of the works is over $200,000. They are owned and controlled entirely by the Peterborough Water Company, composed of local gentlemen: John Burnham, Esq., M.P., president; G. W. Hatton, Esq., sec.-treas, and Wilson Henderson, superintendent.

MINING ASSOCIATION OF QUEBEC.—The annual convention of the association took place in Montreal on the 9th, 10th and 11th of January. A paper by T. J. Drummond, read on that occasion, appears in this issue. A general report of what took place is unavoidably held over.

CHARCOAL AND ITS BEARING ON THE UTILIZATION OF OUR FORESTS.*

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

To a very large extent, the value of a forest tree is the value received for the labor expended in hewing it into square timber, sawing it into boards, or turning it into an article of furniture. As with our soft or merchantable woods, so with the unmerchantable or hard woods. If we burn these woods to clear the land, it means dead loss, or if we use them for domestic fuel, the return is small, and if we turn them into charcoal and export the charcoal in that shape, the value to the country will not be very great; but if we use these woods in such a manner as to develop an industry that must otherwise be non-existent, then we have obtained something worth while, and so I hold that by burning into charcoal and using that coal for the smelting of iron, the value of the cord of wood to the country becomes the value of the labor expended in producing the amount of pig iron that quantity of wood will smelt; in other words, the value of a cord of wood for domestic purposes to the farmer would be, say, $1.50 to $2, and would yield nothing beyond that to the country. But if that cord of wood is burnt into charcoal, and by that fact an iron industry becomes possible, then as it takes from two to two and one-half cords of wood to obtain sufficient charcoal to produce one ton of iron, so it must be plain that a cord of wood utilized in this way brings through the labor consequent on raising the ore, flux, etc., and smelting, say, from $6 to $9 per cord, according to the class of ore smelted and wood used. In making this statement, I am, of course, dealing principally with our Province of Quebec, where the conditions are such that without charcoal an iron industry cannot be commercially established, and where, with proper attention, consideration, protection and encouragement towards the utilization of what are known as merchantable and waste woods, insuring a long and regular supply of charcoal, a charcoal iron industry can be developed as great and as important to the province and the Dominion as that industry has been and is to Sweden and the United States.

Now that I have given in a general way my ideas as to the utilization of our forests, and the bearing those forests have on the iron industry in this province, I will, in as few words as possible, explain the different systems of manufacture of charcoal generally followed, giving particularly the practice adopted at the works with which I am identified.

In cutting wood for pit burning, the custom in Sweden is to cut the logs in about nine foot lengths, but in our own experience we have found it better to cut to shorter lengths for reasons hereafter given.

For kiln burning the general practice in the United States is to cut to four foot lengths. Formerly the cutting to lengths, as well as the felling, was done with the axe, but latterly the saw has been brought into general use, with a view not only to quicker work, but to prevent waste. The value of the saw in cutting the cordwood to length is considerable, for the axe chips represent a very material loss. The axe seldom makes a cut at an angle less than 45 degrees, so that in practice as much wood is cut away as remains in the two adjacent points, and the loss of chips in cutting to four foot lengths with the axe amounts to fully from 8 per cent. to 10 per cent., according to the size of wood cut.

In the Province of Quebec, when we first took up the charcoal industry, we found that the practice was to work wholly with the axe, and to cut to three foot lengths, and we saw that this must be changed, as the loss was considerable in labor through cutting to such short lengths, and as already pointed out, the loss in chips also was naturally very great. We had a great deal of prejudice to overcome, but we are now making, for kiln purposes solely, 4 ft. wood, and our men are using the saw for cutting to length. And we find that not only do we effect economy for reasons given, but our men are able to earn, working in pairs with the saw, better wages than they formerly could, working singly, with the axe.

In burning into coal two systems are generally followed, viz., pit or meiler burning and kiln burning, and in the United States "retort" burning has been attempted. This is carried on, I believe, on a small scale at present, but I do not think it has ever proven to be a commercial success, although, perhaps, if given full trial, it might be found to be more economical than it has so far proven to be.

KILN BURNING.

Two styles of kilns are generally used, the "rectangular" and the "beehive." The latter has been found to be the most satisfactory, and has practically superseded the "rectangular" kiln. In our own experience, the "rectangular" kilns have given us good results both as to durability and the making of coal, but we have found them more difficult to keep air-tight than the "beehive," and that they also require more experience and care in handling, being more subject to cracking and opening through being affected to a greater extent by expansion and contraction. They have also to be well bound with heavy frames of wood, which are affected by weather and time, and require replacing.

Our present battery of "rectangular" kilns is, however, in first-class condition, although it has been in operation about twenty-four or twenty-five years. This is, perhaps, mostly due to the fact that they have been carefully looked after, and repairs promptly made when necessary.

When in operation, it is necessary that the burner watch the "rectangular" kilns very closely, owing to there being a greater liability to burn down to the centre than in the "beehive" kilns, the form of the latter giving solidity, while the action of expansion and contraction from heat and cold is not so great; and the "beehive" kiln is therefore easier to keep air-tight, and for these reasons the coal produced in the "beehive" is more uniform.

Apart from the question of coal, the "beehive" kiln is much easier to keep in repair, as it is not necessary to have any wood frames or binding. The wood can also be handled somewhat cheaper and faster in the "beehive" than in the "rectangular," and owing to their greater liability to straining from expansion and contraction already referred to, the "rectangular" kilns require about two or three days longer to cool, and therefore cannot be "turned over" as often as the "beehive," and for general results the latter has been found to be the most suitable.

PRINCIPLE OF MANUFACTURING IN KILNS.

In our "rectangular" kilns, an opening is left from the front door to the centre of the kiln. This is made by piling the cordwood in such a manner that a canal

*Read before the General Mining Association of Quebec, in Montreal, January 10th.

of say 12 in. square is left in the middle of the kiln leading from the door to the centre. At this point a sort of crib-work is built, known as a "chimney," leading to the top of the kiln. On all sides of this dry wood, or brands, are piled so as to fire easily. A small quantity of split brands are then placed in the hole in the centre. The wood on all sides is ranked in the same manner as cordwood and is piled as closely as possible. Along the top of the kiln the lighter wood is laid, and this for two reasons. First, it is easier to handle, and secondly, the fire will run through it quicker than through the heavy timber which is left in the centre of the kiln; then a fair quantity of light wood for brands is placed along the bottom and at the ends. When the kiln is closed and ready for firing, the top door is opened, and a piece of oily waste is inserted by means of a long pole to the centre of the "chimney." The draft to the top of the kiln carries the fire upward and along the top, and once fairly started, the top door is closed and the air is allowed to draw down to the lower vents, three rows of which are opened around the base of kiln. These vents are operated by a burner in such a manner as to draw the heat from point to point of the kiln, and thus to "cook" the whole mass. The direction and force of the wind have a large bearing on the manipulating of the heat, and will drive it from one side of the kiln to the other—hence the holes have to be closed and the windward side protected to prevent combustion, as otherwise the wood would become overheated and be reduced to ashes. The condition of the coal in the kiln when approaching the finishing point is generally determined by the color of the smoke, and sometimes by the insertion of an iron rod at various points to ascertain by feeling the condition of the wood or coal. This latter mode is only occasionally resorted to.

Beehive Kilns.—The same mode of piling and firing applies to the "beehive" kilns, as described in regard to the "rectangular." The fire is started at the bottom and allowed to burn upwards. Once fairly started among the light or dry wood, the kiln is closed, and as the gases escape from the wood they practically supply sufficient heat to "cook" the entire mass. Care must be taken at all times to prevent too great a supply of air to the kiln and thus cause combustion.

The properly cooked kiln should contain only the ashes made by the wood that surrounds the "chimney," with a little from the dry or light wood on the top, the combustion of which has supplied sufficient fuel to heat the mass and cause the drying and evaporation of water and gas in the whole.

What a charcoal burner must keep before him all the time is that the wood is to be "cooked" and not burned, so that every care must be taken to prevent combustion, and sufficient heat must be introduced into the kiln or the "chimney," or canal leading to it, or by the combustion of a small quantity of light or dry wood on top, to "cook" the whole mass. The light wood, of course, will be consumed, but in the meantime it should have imparted sufficient heat to the rest to draw off the water and the lighter gases.

The burning of charcoal is more or less a process which distills or throws out the undesirable gas, leaving the mass of wood charred to the centre. If this could be carried out to perfection, the coal should be solid without any breaks or cracks, or tendency to fall to pieces.

Both our "beehive" and "rectangular" kilns have a capacity of about 55 cords, and they generally take from ten to fourteen hours to fill, according to the class of wood handled, and from five to six days to burn, which is again largely governed by the class of wood. The "beehive" kilns take about eight days to cool and can be easily discharged in one day. The "rectangular" kilns generally take two or three days longer to cool, as already stated, owing to their being more affected by expansion and contraction. In our kiln work we use cord wood all the way from a limb 2½ inch in diameter up to the trunk of the heaviest tree that is too solid or knotty to be split with the axe, so that in our practice there is practically no waste wood, as we use tops, lops and everything.

(To be continued.)

"THE INDICATOR AND ITS USE."*

BY K. C. M'CALLUM, PETERBORO.

The indicator is an instrument by means of which the pressure of steam in the cylinder at each point of the piston's stroke can be recorded, in form of a diagram drawn on paper, and which shall accurately represent the various changes of pressure on one side of the piston of the steam engine during both forward and return stroke.

Engineers are becoming educated in its use; it reveals to them many things which they *thought* they knew, but find they *didn't*. It claims the attention of engine builders, and by its means the speed of the engine has been increased, the immense ponderous mass of matter formerly set in motion is largely reduced, space is economized, compounding is shown to be a success and a necessity, coal and water bills are being reduced to a minimum. By its use we are enabled to determine

(1) The arrangement of valves, for admission, cut-off, release, and compression.

(2) The adequacy of ports or passages for admission of steam, and exhaust of same, and, when applied to the steam chest, the adequacy of steam pipes.

(3) The suitableness of valve motion in point of rapidity at the right time.

(4) The power developed in the cylinder, that lost in various ways, such as by wire drawing, back pressure, mal-adjustment of valves, leakage, etc.

(5) It is useful to designers in showing the rotative effect around the path of the crank-pin.

(6) Taken in combination with measurements of feed water, and the condensation and measurement of the exhaust steam with the amount of fuel used, the indicator furnishes many other items of interest and importance.

It is pleasing to record that the indicator is making its way into the engine room; by its use engineers are being led into the "deep and hidden mysteries of steam engineering," and by its use they are encouraged to prosecute researches therein.

A history of the indicator may not be uninteresting. To the inventor of the steam engine must we ascribe the honor of being the inventor also of the indicator, James Watt, an honored name among the noble ones of earth. According to some there is doubt about his being the inventor of the indicator, but in referring to his memoirs, written by Muirhead, I find, page 247: "The barometer being adapted only to ascertain the degree of exhaustion in the condenser where its variations were small, the vibrations of the mercury render

*Presented at the meeting of Branch 14, C.A.S.E., Peterboro, 24th October, 1894.

it very difficult, if not impracticable, to ascertain the exhaustion of the cylinder at the different periods of the stroke of the engine; it became, therefore, necessary to contrive an instrument for that purpose that should be less subject to vibration, and should show nearly the degree of exhaustion in the cylinder at all periods. The following instrument, called the indicator, is found to answer the end sufficiently. A cylinder about one inch in diameter, and six inches long, exceedingly truly bored, has a solid piston accurately fitted to it, so as to slide easily by the help of some oil; the stem of the piston is guided in the direction of the axis of the cylinder so that it may not be subject to jam, or cause friction in any part of its motion. The bottom of the cylinder has a cock and small pipe joined to it, which, having a conical end, may be inserted in a hole drilled in the cylinder of the engine, near one of the ends, so that by opening the small cock a communication may be effected between the inside of the cylinder and the indicator."

The cylinder of the indicator is fastened upon a wooden or metal frame more than twice its own length; one end of a spiral steel spring like that of a spring steel yard is attached to the upper part of the frame, and the end of the spring is attached to the upper end of the piston rod of the indicator. The spring is made of such a strength that when the cylinder of the indicator is perfectly exhausted, the pressure of the atmosphere may force its piston down within an inch of its bottom. An index being fixed to the top of the piston rod, the point where it stands, when quite exhausted, is marked from an observation of a barometer communicating with the same exhausted vessel, and the scale divided accordingly.

The end of piston rod carried a pencil, and was made to press against sheet of paper D D, which was moved backward and forward in conformity to the motion of the piston. By this means Watt was enabled to take off indicator cards, thus enabling him to perfect his engine.

McNaught, an engineer of Glasgow, improved upon Watt's indicator, principally in the use of a vertical cylinder, instead of the sliding panel, which was turned backwards and forwards on a vertical axis, in conformity to the motion of the piston; in using the pencil to make the diagram upon the paper the hand had to travel with the motion of piston; the chances to make a poor card were very great, because if any weight was placed upon the piston it would certainly have the effect of reducing the height of the admission and expansion lines; great care had to be exercised in manipulating the instrument.

Later another indicator was brought out by one Gooch, but had its serious faults. Not until about 1860 can the indicator be said to have arrived at any degree of fineness both as regards its work and make up. At this time Mr. C. B. Richards, of Hartford, Conn., invented what we know as the Richards' indicator; it contained the essential features of the others before it, together with many marked improvements, which combined go to make it a perfect instrument. Indicators which have been made in recent times cannot be said to have improved to any great extent upon the instrument of Richards' make, and it may be truly considered the prototype from which all others differ simply in detail of workmanship, form and size of parts.

Those most commonly known to us are Thompson, Crosby, Tabor, Calkins, Straight Line, Arc, Bachelder.

The construction of the indicator is well known to nearly all engineers, but for the benefit of the brethren present who have not handled the indicator, I take pleasure in showing the Thompson Improved, and by means of it, what otherwise would require some time to explain, is made an easy matter, and the construction of an indicator made plain to all.

But the mere fact of being the possessor of an indicator would not make us in any way an adept in its use unless we apply it to the cylinder of our engine. A few suggestions with regard to the place where to put up our piping for indicator may not be amiss.

The cylinder should be drilled and tapped for ¼ inch pipe, gas pipe thread; the hole should be into the clearance, and great care must be taken that the hole is not in any way covered by the piston. Sometimes the heads are tapped instead of the cylinder shell, but once having an acquaintance with the indicator and the methods of taking cards, the placing of piping will become an easy matter if we keep in view the fact that our piping be as short as convenient and with as few turns and bends as possible, for where through length of pipe condensation takes place, water in the pipe will have the effect of making wavy lines upon the card.

Nearly all modern engine cylinders are drilled and tapped, ready for the indicator. Still upon many engines of early form no such provision was made for the indicator, yet with a little skill we can easily rig up the cylinder to receive the piping to indicate.

As to whether in a horizontal engine the top or bottom should be chosen, is determined by the position of the steam chest, form of crosshead, and the device we make for catching hold of crosshead, the position of eccentric rods and connections.

In drilling holes for piping, place your engine upon the centre, so that the piston may be at the end in which you are to drill. You can then see how much clearance there is between piston and cylinder head, and can then be guided in the drilling of hole.

If steam chest is on top, pipe on side, preferably in front. Should the steam chest be upon either side, pipe on top or on opposite side to chest? To pipe into heads is preferable where the cylinder lagging is too thick, or where there is a steam jacket, or where we cannot have side or top attachments made to cylinders.

In the Corliss and modern type of automatic engine, connections are generally made upon the front side of cylinder or upon top.

When the heads cannot be removed to enable the operation of drilling to take place, it is well to admit a little steam to the cylinder, after the drill has commenced to enter the bore, so that the drillings may be blown outwards, and prevented falling into the cylinder, care being exercised by the operator that he be not scalded by the steam.

In making connections to the crosshead sometimes one experiences difficulty in doing so. If your crosshead be of Corliss pattern, an easy way to make connections, where the oil cup is placed in centre of crosshead pin, is to take off oil cup, and by means of a cap screw placed in oil hole we can readily attach our reducing rig. Or we may drill and tap the cheek of the crosshead for half studs at any point convenient, and at right angles to the centre of the piston rod, where you have to make connections to a crosshead running horizontal.

(To be continued.)

For THE CANADIAN ENGINEER.

VELOCITY AND PRESSURE OF THE WIND.

NOTES ON THE STORM OF 28TH DEC. AT QUEBEC.

BY CHARLES BAILLAIRGÉ, C.E., CITY ENGINEER OF QUEBEC.

The velocity and force of wind is still a much debatable quantity among engineers, due probably to the want of precise data on which to predicate results.

The pressure is said to increase as the square of the velocity, and is given as such in tables of "wind pressure" as at page 49 of the "Handbook of Useful Information," by C. H. Mortimer, publisher of the *Canadian Architect and Builder*, Toronto.

The force exerted by the wind in overthrowing a chimney (several such of 80 to 120 feet in height having been blown down in this city during the late hurricane) depends upon the height and consequent leverage, as also on the greater or less adhesion of the mortar or cementing material—a factor difficult to ascertain and base any close calculation on.

In like manner, the blowing away of a roof, or upsetting of a barn or such other wooden structure, to be reduced to computation, implies a knowledge of the weight transported, the area acted on, and the may be more or less rotten or decayed and loose condition of the tenons of its component frame-work. But when the weight is known, and the resistances can be calculated, a somewhat reliable result may be arrived at, as, when, at page 113 of the *New York Engineering Record* for January, 1894, in an article by the writer, he discussed the question of the overthrow by wind of one of the 1,000 ton, 500-feet spans of the iron bridge between Louisville and Jeffersonville, United States.

During the storm alluded to in the heading to this article, the roof of the westernmost kiosk of Dufferin Terrace, of this city, was bodily wrenched from its understructure of cast iron columns, girders, supporting brackets, spandril pieces, etc., and blown to a distance of a hundred feet or more, and half way up the cliff intervening between the terrace, which is at 180 feet above river level and the citadel, at about double that elevation.

Its weight I have estimated in detail at some two-and-a-half tons, including cast-iron rafters, iron purlins, galvanized sheet-iron covering, wrought-iron tie rods and the like. Taking the resistance of ordinary bar iron at only 25,000 lbs. to the square inch, or 12½ tons, and, as the roof was held in place by light wrought iron screw bolts and nuts of ⅝ inch diam., to break each of which a strain of 3¾ tons must have been exerted together, including weight of roof, some 27½ tons, the area acted on by the wind being say 640 ft. sup.—the conclusion is arrived at that a force of not less than 86 lbs. must have been brought to bear per square ft. of area to produce the effect recorded; and if the pressure be assumed as the square of the velocity, this velocity at that particular point or portion of the terrace must have been 130 miles an hour.

The anemometer at the Quebec observatory broke, or was rendered useless, at a recorded velocity of 90 miles per hour, so Mr. Smith is reported to have declared, the wind at that time still increasing in velocity until, as Mr. Smith thinks, it may have reached and gone beyond 100 miles per hour.

Now it seems beyond the possibility of doubt that, as I stated in my correspondence in the *New York Engineering Record*, above alluded to, while the general velocity of the wind or air in motion may not have exceeded from 80 to 100 miles, there may have been within the general current a local one of greater speed, as with the "Gulf Stream" flowing from the Gulf of Mexico into and across the Atlantic ocean. Or the increased velocity and force at that particular point may have been and was likely due to some cyclonic or gyratory action, where the peripheral velocity, to keep pace with the velocity of translation, must or may have been so much the greater than at the centre of gyration, as often observed in cyclones, and as we have all been witness to, when on a windy day, and while the air in motion along a street takes the dust with it and thus becomes visible to the senses, a tiny cyclonic action may be observed here and there, where streams of wind rotate as they advance with the general air current in which their motion forward or of translation is involved.

Another argument favoring this conclusion is that along the 1,500 feet of terrace, every portion of which is equally exposed to the fury of the wind, there are four other kiosks of exactly the same construction as the one unroofed by the storm, and while one of these only suffered to the extent of having a small portion of the roof sheathing torn and blown away, the others stood the fury of the gale unscathed.

BRIBERY IN BUSINESS.

Undoubtedly the evil which above all others is undermining the very foundations of legitimate trade is bribery, from which our manufacturing concerns—whose business is done so largely by formal contracts—are pre-eminently the sufferers. In some cases, we regret to say, contractors and manufacturers are pre-eminently the sinners. The spectacle which Judge Macdougall's special tribunal has exposed in Toronto is enough to make the angels of commerce weep. But is Toronto any worse than many other centres of the Dominion? The very fact that such a tribunal under a courageous man like Judge Macdougall has been so effective in exposing the current rascality, gives us ground to hope for better things in the Queen City. But Montreal is so much worse than Toronto in this respect that such a tribunal would be an impossibility. Public exposure is there laughed at, and the scathing denunciations of the daily press seem like the voice of one crying in the wilderness. If a Judge Macdougall should arise in Montreal and begin his investigation, the public robbers who invest the highway of this Samaria would stand together like one man. They might be attacked from any other quarter but that which would deprive them of their right to public plunder. Here they are united in one bond. At the session of the Quebec legislature just closed, Geo. W. Stephens recited the recent history of civic corruption in Montreal. He told how in the street railway franchise the city's interests were so traitorously dealt with, that, so far from the city deriving an income from the company's operations, it has had to disburse about $27,000 more than it received from the company, and this in the face of another offer that would have given the city a handsome revenue. He told the shameful story of the Royal Electric Company's deal by which that company got a ten years' contract, from which it will have drawn thousands upon thousands of dollars more than would have satisfied other firms; and this in the face of the strenuous protests of the city press and the exposure beforehand of the jobbery. He told the history of the recent gas deal by which the Coates Co. sold out for $400,000 a franchise intended

for the protection of the public, and left the city at the mercy of a monopoly. He told of the street paving contracts, by which money has been poured out to the extent of millions, while the improvements in the water-works system, so urgently needed for the safety and sanitation of the city, and so strongly urged nearly two years ago by Thomas C. Keefer, C.E., in a report that has not yet seen the light, are ignored. He told of other smaller but no less corrupt jobs log-rolled through the council, of the vicious expropriation system, and other means by which the city's debt has been increased over $12,000,000 in less than a dozen years. The human maggots who are fattening upon our cities as upon a carcase, are developing a mass of corruption that is tainting the common air of all business, and the stench thereof will before long wake up the people to the dangers of their surroundings. Retribution is already at hand in the case of Montreal, for the people, after permitting all these years the plundering of their own treasury and the disgrace of their good name, now find hundreds of fellow citizens out of work, and themselves face to face with increased taxation—or still worse, more public borrowing. With the money that has been squandered and stolen plenty of useful work could have been provided for the present unemployed. They may now see the kind of carrion birds they have invited to their nest. No city in Canada has been more bountifully assisted by nature and circumstances than Montreal; it remains for her citizens to see what they will do to destroy or restore its position. The same alternative is before many other leading cities and towns of Canada. They must either purify their civic politics or sink to disrepute. It will not do to say that we are no worse than our neighbors, and that boodling has been an American or foreign importation. It may be true that H. A. Everett, the arch boodler in the Toronto revelations, came from the United States, but is it not also true that Guelich & Co., who so manfully resisted the blood-sucking demands of the civic leeches, and who were so cruelly wronged in the matter of the paving contract, were also Americans? But even if it were true that others were worse, such an excuse for public crime is only worthy of a school boy in the infant class.

The naked truth is that obtaining trade by bribery is a crime of unspeakable meanness, and one which works immeasurable outrage against the principles of commerce, which should be founded in equity, and which, when so maintained, carry comfort and happiness over the world. The giver of a bribe is criminal, because to just the extent of the bribe given to an intermediary is he defrauding the purchaser of his goods; the amount of the bribe could and should have been put in the value of his goods, while the precedent the briber sets bears an inevitable train of evil consequences. The contractor who supplied slop-work saddles to the British army in South Africa did not think that the Prince Imperial would ride in one of them, and that his scamped work would cost a Prince's life; but so it happened, and many a boiler has blown up, many a machine broken down, and many a life lost thereby, because men will give bribes and then turn out indifferent work in order to squeeze out a profit on it. But if this is the case with the giver of a bribe, how much worse is the man who is the seeker of the bribe; such a man does a wrong to his own moral character and a most positive wrong to the employer who trusts in him, and who has a rightful claim to the honest service of each of his employés. The seeker of a bribe is of necessity worse morally than the common thief. Perhaps four out of five bribe-takers never think of themselves as being in the same category as those who live by picking pockets, but let the bribe-seeker think the thing out and see what the logical conclusion must be.

The most lamentable feature of the recent exposures is that firms and companies whose financial standing is supposed to be such as to place them above the temptation to such unprincipled methods, have submitted most to the solicitations of these corrupt men. We would not wish to add further to the humiliation of these firms by repeating their names, but we say all honor to those other firms who have chosen rather to submit to the loss of trade that they may preserve an untarnished business reputation and do full justice to such work as they may get by honest means. We are among those who believe that somehow, in the end, Providence will maintain and stand by those firms who keep their integrity and do a straight and honest trade. Honesty is in truth the best policy. Let him that stole steal no more, and even a blemished name may be restored.

THE RESISTANCE OF PILES.

In a paper recently presented before the Canadian Society of Civil Engineers, Montreal, Henry F. Perley gave much useful information concerning the "Resistance of Piles," and stated that there was no end to the wonderful calculations and still more wonderful formulæ which were to be found in the literature on the subject. These formulæ perplexed the brain of the practical man and did much to worry him needlessly with their purely theoretical assumptions, complex forms, and variable constants, especially as those which might apply in one case often would not apply in other cases.

Piles are used under varying circumstances:—(1) to form a foundation where the soil is of such a nature as to preclude the super-imposing of a structure on it, but which, by the use of piles, is compacted to such an extent as to afford sufficient resistance to a sinking or settlement of the piles which carry the load; (2) as a ready means of obtaining a foundation where a loose or soft stratum overlies a firm and compact material, to or into which the piles are driven and derive their support; (3) to serve as columns of support, as in the case when driven in clusters, or singly, as in pile-bridging and wharfing, where the piles are capped and carry only the superstructure, and a dead or a live load, but are subjected, it may be, to the lifting power or action of ice; (4) where they are driven to form a coffer-dam, and are not subjected to any vertical pressure, their object being to provide a water-tight structure, strong enough to resist the unequal side pressures to which they may be subjected; and (5) to form a retaining or revetment wall.

The resistance to which a pile is subjected is of a two-fold nature—(1) that which it meets with whilst being driven, and (2) that which it offers in sustaining either a vertical load or a lateral pressure.

With regard to the resistance a pile offers in sustaining a load, a complication ensues, as it may be so placed that *two* different resistances have to be borne by it. In a foundation pile, whose head is on a level with the surface of the ground, and thus is supported throughout its whole length, the resistance experienced in driving is, in some degree, a measure of the resistance to settlement, and a greater load per square inch can be imposed on it, because it is a column supported at all points in its length against flexure and rupture,

both of which actions are modified, and, it may be said, greatly modified by the nature of the ground or soil into which the pile is driven; for it stands to reason that a pile which has passed through a comparatively soft stratum, and then penetrated a hard stratum, cannot support the same load that it would were it driven into a stratum solid throughout. Then again—take the case of a pile in a bent of a pile-bridge. Here we have a pile which is to be driven x feet into the earth, and to stand y feet above its surface, unsupported, except in so far as it may be tied to other piles by walings, braces or caps. The resistance of the y portion of the pile is its ability to support as a pillar or column the dead and live load imposed on it, and to transmit such pressure to the x portion, to be met by the resistance afforded by the ground or soil into which it is driven.

The resistance to the downward movement of a pile is (1) that which is opposed by the displacement of a mass or quantity of earth equivalent to the cubic contents of the driven portion of the pile; (2) the frictional resistance which exists between the ground and the pile, such resistance varying with the nature of the soil or ground, the depth driven, and the superficial area of the pile in contact with the earth; and (3) the ability of the pile to withstand crushing, rupture, or deformation of any kind whilst being driven, or at any time during its use.

During the driving of a pile, the earth surrounding it is in a state of motion or vibration, and if the blows of the ram follow in quick succession, as in the case of a steam pile-driver, the particles of earth are kept vibrating and the tendency to settle is prevented, and thus the pile may be driven deeper and more quickly than by the usual machine worked by hand power, by which the blows are rendered at comparatively long intervals. It is well known that a bolt can be driven more quickly into a hole smaller in diameter than itself in timber, when *two* hammers instead of *one* are used, because the fibres of the timber are prevented from "setting" or hugging the bolt by the rapid succession of blows to the same extent they otherwise would do. A heavy ram falling from a small height will do better and quicker work than a lighter ram falling from a greater height, and a greater number of blows per unit of time can be given; and besides this, the chances of brooming or crushing the head of the pile are reduced to a minimum, hence the successful use of the steam pile-driver.

CONVERSION OF STEAM RAILWAYS TO ELECTRIC ROADS.

Those at the head of the steam railways, especially the mechanical heads and traffic managers, see very clearly that in traffic between cities and suburban towns the electric roads are in the field to stay. Some managers of steam roads are inclined to attempt to kill or choke off this development, but where nature and science combine to favor the change, such attempts must fail ultimately, even when backed by superior capital. What the steam railway people will have to do is simply to adopt the electric railway and take it into their own hands. There is the present difficulty of combining the equipment to suit both short local lines and trunk lines, but this difficulty can be adjusted as the science of electric railway building advances. The New York, New Haven and Hartford Railroad Company appear to be the first to face this problem on the lines we have suggested; and it may be that their experiments mean the first great step to the operation of trunk lines by electricity. At all events that company are now equipping with electric cars two branches of their road, namely, the Nantucket Beach line and the Warren and Bristol line, from which the steam locomotives will be taken off. Not only will this be done, but John M. Hall, the president of the company, hinted at the early prospect of this conversion being applied to the four-track system between New York and New Haven itself. It may be noted that the Warren and Bristol line is 35 miles in length—a stretch of road sufficient to make it one of great importance in the solution of this problem.

In Canada an experiment has been in contemplation by the Canadian Pacific Railway, not to apply electricity to a trunk line, but to surmount the special difficulties of transportation in the Rocky Mountains. Here extra engines are required to haul trains over some of the steep mountain grades, and it has been proposed to use some of the water falls of these great canyons to develop electricity to run electric engines over these passes. Surveys have recently been made and a member of the firm of Siemens & Halske, of Germany, has been over the ground, but the questions of the cost of conversion and of operating such a road have not yet been settled. Though this scheme, if carried out, would have no bearing on the general application of electricity to steam roads, it is a fact that our leading Canadian railway managers fully realize that in regard to the competition of the suburban electric roads that have already been built near their lines, electricity is itself the agent by which that competition must now be met—unless, indeed, the new process of making gas and the new improvements of the gas motor give the latter a still further advantage over steam in the neighborhood of large towns.

THE forthcoming convention of the American Electrical Association, which is to be held on the 19th, 20th and 21st of this month, at Cleveland, O., bids fair to be one of the most successful gatherings of this progressive organization, which is now considered the most important body of electricians in the world. It is probable that there will be from 300 to 400 members in attendance. One of the features, as usual, will be an exhibition of electrical appliances.

LAST year J. H. Birkett, proprietor of the Kingston planing mills, started the plan of profit sharing, and is very well satisfied with the results of the first year. At the end of the year, after deducting interest on capital at the rate of 8 per cent., and the cost of operating the mills, the net surplus is divided equally between the mill and the men. Mr. Birkett finds that the men are more attentive to their work, more careful in avoiding losses and accidents, while the product of their labor is greater. Mr. Birkett considers that the principle of giving workmen a participation in the profit of a business is one of the best solutions of the difficulties existing between capital and labor.

THOSE who read our article last month on the disastrous effects of carelessness in connection with the storage of explosives, will be glad to know that, in one city, at any rate, the regulations are to be enforced more stringently. In Montreal the building inspector and the secretary of the fire department have been looking up the law regarding the storage of gunpowder and other explosives, and they find that statute 1004, article 88 of the statutes of Quebec Province, reads to the

effect that every person who wants to sell powder or other explosives must get a license so to do; that not more than twenty-five pounds of any such explosive shall be kept by any storekeeper in the city; that a fine of five hundred dollars may be imposed upon any one who is found keeping more than this amount; that no more than ten pounds of powder shall be kept by any one in the city for private use, and that those who sell such explosives shall expose over their places of business a sign to that effect. Nothing is said in the statutes on the question of causing these regulations to be attended to, and the city council is to be asked therefore to pass a by-law for the appointment of inspectors. Nor does the statute in question mention any regulation as to the storage of explosives by contractors in the street, which was the direct cause of the two disasters referred to last month, but we presume that the inspectors will have the requisite power given them for dealing with the whole matter to the satisfaction of the public.

THE Toronto Electric Light Co. has issued a circular letter addressed to the citizens of Toronto, accompanied by an analysis of the different estimates that have been made for the electric lighting of the city. The question is a decidedly "live issue," and one of interest, not only to every taxpayer of the Queen City, but to citizens of all places where electric lighting is in use. The analysis shows detail of cost of running a 1,300-light plant, staff required, material, interest on investment. fuel, running expenses, etc., with the following as a result:

City engineer's estimate.....	$ 81 78	cost of lamp per year.
R. J. McGowan's "	103 85	" " "
Bertram's "	59 66	" " "
Chicago municipal plant. (1,110 light.)	96 64*	" " "
Toronto Elec. Light Co. offer...	74 82	" " "

The statement also gives the following table of cost per lamp per year of light produced by municipal corporations in England, sent by *The Telegram's* special correspondent, Nov. 15th, 1894:

Derby.....	$121 67
Dundee.....	121 67
Brighton.....	146 00
Blackpool.....	107 07
Manchester.....	131 40

The council's decision in the matter will be watched with interest.

* Without interest or depreciation.

THE death is announced of James M. Mackenzie, an American electrician and inventor of some note, who was well known in Canada. Born in Scotland in 1837, the early part of his life was spent in Canada. He lived for some time at Niagara Falls and was eighteen years in the service of the Grand Trunk railway. It was during this period that he met Edison, who was then a boy selling fruit on the trains. Little Edison saved Mr. Mackenzie's child from being run over by a train, and out of gratitude he taught young Edison how to telegraph. The story of Edison's cleverness as an operator and his subsequent fame as an electrician is well known, but we see what vast results flowed from this act of gratitude of Mr. Mackenzie, and how Edison's own fate and fame were determined by the impulse of self-sacrifice which saved the little child. The two simple facts are eloquent of suggestion not only to all beginners in life, but to all who are inclined to doubt whether a good deed "counts" for good to the doer. Some years ago Mr. Mackenzie visited Canada in the interests of the Edison Company, having endeavored unsuccessfully to form a company in Toronto. He was a nephew of Sir David McPherson. He was a man of fine physique, standing over six feet. He took out quite a number of patents on his own inventions, a well known one being the "A.B.C. Puzzle." Mr. Mackenzie's life has furnished a rather curious case in the annals of surgery. When a young man he had a leg broken, and in the setting the broken limb shortened 1¾ inches, leaving him lame. Four years after this, while crossing the Hudson River on the ice, the stage coach capsized and his other leg was broken in eight places. When that leg had healed it was found that it contracted just to match the other one, so that afterwards he walked without any lameness whatever.

IT appears by reports from Hornellsville and Canisteo, in New York State, that the Canisteo Fuel Gas Co. have succeeded in so altering and improving the Harris process of making gas as to make its working a practical success, and that while starting out to make a fuel gas, they have succeeded in making a good illuminating gas which can be sold at a profit of 25 to 30c. per 1,000 feet against $1 to $1.50 now commonly charged. It is stated on behalf of the new company that it has not been able to extend its operations outside its own locality, or even in the city of Hornellsville, owing to the bitter opposition of the old companies whose monopolies it threatens. In spite of these difficulties, however, the Canisteo company have piped their gas seven miles to Hornellsville and there sold it at 25cts. per 1,000 for illuminating purposes and 12½c. for heating and power purposes. Reports given by the users of the new gas appear to be favorable, and Col. Speers, the engineer in charge of the works, makes the following claims for the new product: "We are now making what has so long been sought, that is, an absolutely fixed gas. All gases now in use will shrink under certain conditions, the same as water will expand or condense by heat or cold, but practically in our gas there is no stratification or condensation. This fact and the further fact that in all the seven miles of piping there is no drip prove it to be a fixed gas." It is stated that 1,000 feet of gas is made with 10 lbs. of coal. A recent chemical discovery in the treatment of the nitrogen of the air is made use of, and the other elements in its production are crude oil, hydro-carbons and steam. The process, however, is kept a secret.

METAL IMPORTS FROM GREAT BRITAIN.

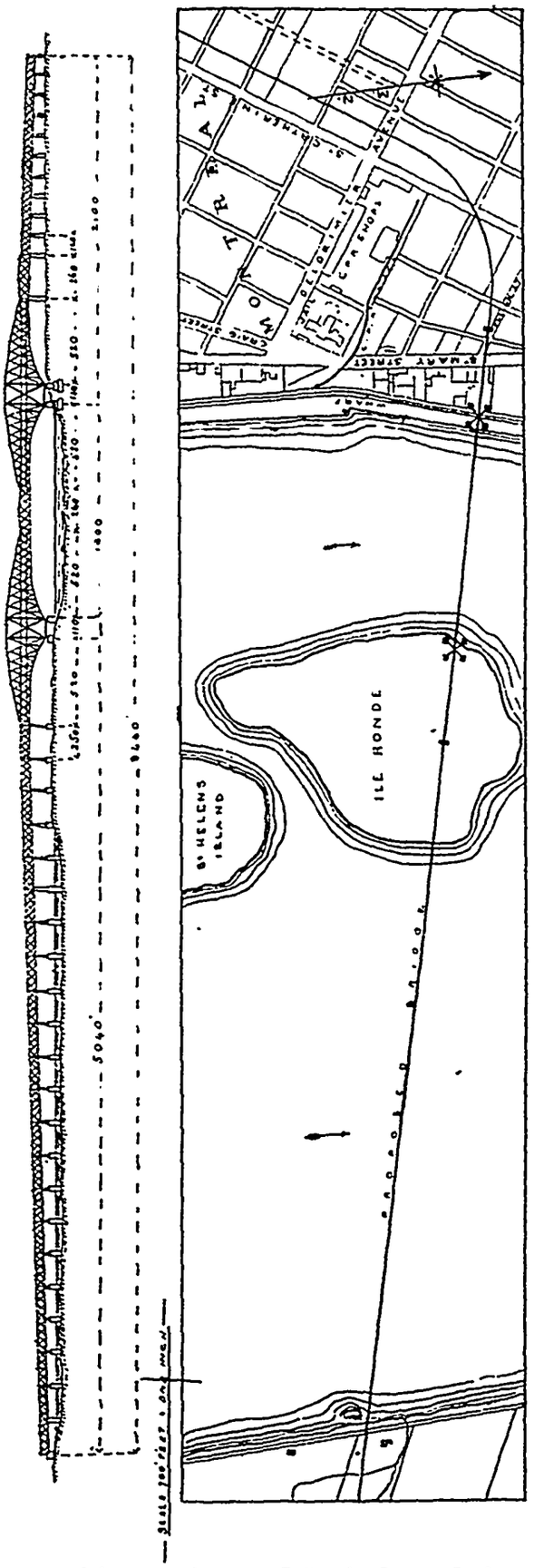
The following are the values in pounds sterling of shipments of metals, etc., from Great Britain to Canada, as shown by the British Board of Trade returns for December, and for the previous twelve months, compared with the same periods of last year:

	December.		Twelve months ended December.	
	1893.	1894.	1893.	1894.
Hardware and Cutlery ....£	5,202	£ 3,366	£93,830	£66,140
Pig iron.....	932	1,052	56,817	27,888
Bar, etc.....	2,289	1,268	28,556	19,530
Railroad	7,390	96	503,656	229,657
Hoops, sheets, etc.....	2,005	1,778	67,514	83,905
Galvanized sheets	1,203	666	71,170	55,672
Tin plates	17,464	14,632	226,323	207,402
Cast, wrought, etc., iron ..	5,076	4,810	120,025	68,742
Old (for re-manufacture)..	.....	.....	103,883	19,594
Steel	5,390	3,128	130,360	88,335
Lead	560	380	16,362	12,098
Tin, unwrought	4,923	1,145	35,408	25,099
Cement.....	163	458	53,250	36,057

Of the imports into Great Britain from Canada, copper to the amount of £2,393 was sent, against £5,250 for the same month of the previous year.

THE PROPOSED NEW BRIDGE AT MONTREAL.

he Montreal Bridge Company are rushing preparations for the construction of their new bridge across the St. Lawrence. As will be seen from their advertisement in this issue, they invite engineers and bridge builders to send in plans and estimates for its steel superstructure. The bridge is to cross the St



Lawrence] from a point near Dalhousie Square Station to Isle Ronde, and thence to the southern shore. Its length is to be about two miles, divided as follows: One cantilever span of 1,250 feet, two side spans of 500 feet each, 15 viaduct spans on south side of 250 feet each, and 18 viaduct spans on the Montreal side of about 250 feet each. The height of the carriage road on the large cantilever span above the water level will be about 150 feet, a higher altitude than that of the great Brooklyn bridge. The bridge will be so constructed as to allow of a double line of railway track, a double track for electric tram-cars, two roadways for carriage vehicles, and footpaths for passenger traffic. The cost of the structure is estimated at about $6,000,000, besides the terminal facilities, which will increase it by about $200,000. It is expected that all the railways converging at Montreal will make use of the bridge. Thus, as will be seen, it will be second in size only to the great Victoria Bridge, while its importance will be even greater. It is being pushed in connection with the Atlantic and Lake Superior Railway, and is in such forward shape that Senator Thibaudeau and Mr. C. N. Armstrong have left for London to conclude the necessary financial arrangements. Prizes of $1,000 and $500 are offered for the best two plans, and the first will have a chance of obtaining the managership of construction work, so the competition will no doubt be of the keenest. The roadways are to be on the same level on the cantilever spans, but on the approach viaducts the four rail tracks are to be on the top, and the wagon road and foot-walks below, and so adjusted as to slope easily down from the level of the cantilever deck to that of the lower chords of the trusses. Plans, etc., will be received up to May 15, addressed to the secretary of the Montreal Bridge Co., 17 St. James street, Montreal.

CANADIAN SOCIETY OF CIVIL ENGINEERS.

A meeting of the Canadian Society of Civil Engineers took place in their rooms at Montreal, on the 17th January. The chief subject of discussion was H. F. Perley's paper on the "Resistance of Piles."

Mr Gray (by correspondence) referred to an improvement in the method of driving piles, which he had seen in use at Owen Sound. In this case the soil was sandy, and the superintendent used a water jet alongside the pile, boring a hole with the machine, and then putting in the pile before it filled up. This proved to be very satisfactory in its results, and a great saving of time and energy was effected.

Mr. J. G. Kerry thought that Mr. Perley had covered the subject when he said that the question of resistance depended on the amount of friction between the pile and the ground. The bearing power of a pile depended on the crushing resistance of the soil under its end, and on the friction between the sides of the pile and the surrounding earth. He suggested that a series of constants might be calculated from experiments giving the friction co efficient of the various soils. Two piles driven in side by side would have a bearing power equal to that of the double length of pile, even if it were successfully driven, while all the cost of iron and splicing and all danger of complete loss of the first pile would be obviated.

Mr. Wallbank related some experiences in pile-driving.

Mr. Cecil B. Smith gave some formulæ for calculating the strength of piles and pillars, and criticised Mr. Perley's use of formulæ.

Mr. Sproule said he did not see the use for so many formulæ: young students of civil engineering would be frightened. He instanced a case of driving piles in a harbor bottom, a work in which he had been engaged, and stated that the workmen had simply rammed them down until they would go no further, the result being quite satisfactory.

Mr. Cecil Smith thought that the previous speaker had been somewhat flippant in his remarks on formulæ. Even if the piles could be treated in the manner spoken of, yet the question might come up—how many piles ought to be put in? And even if the formulæ were not perfect, yet their tendency was certainly in the direction of accuracy

Mr. Sproule said there was one question he did not understand, namely, why it was that the strength of a pile did not depend at all upon the nature of the soil immediately underneath its bottom end.

Mr. Wallbank gave instances to show how the soil differed under different piles in close proximity to one another. He had known cases in which a pile had been driven in, and remained perfectly firm, when another pile only a few feet away, and under apparently similar conditions, had suddenly sunk deep down.

Mr. Cecil Smith said that sometimes the point of the pile did support the larger portion of the load. He wished he had paid more attention, instead of less, to formulæ in some cases. In his younger days he had put in too many piles in some cases, and in other cases which he could remember he was afraid he had not

put in enough This would have been prevented in a large measure if he had employed formulæ.

Mr Kennedy explained more fully the use of the jet in driving piles.

A paper by Henry A Gray on "The Great Lakes—their Commerce and Physical Features," was taken as read.

Mr P W St George said the great argument against their becoming a close corporation was that it was not the case in England But in that country young men paid premiums to the engineers for the privilege of assisting them, and it was not likely that they would give up this source of income.

Mr. E P Hannaford thought that although, of course, some surveyors and architects were certainly very able men, yet they (the engineers) did not want to come down, so to speak, to the general level of the backwoods land surveyors of this country. He preferred that the civil engineers of the Dominion should go their way independently. The idea was to get power as a body, just as trades unions had power This might not be acknowledged outwardly, but it was the case nevertheless

Mr. Sproule said his idea was to bring in the best of the men, not those of the backwoods type referred to by Mr. Hannaford. The best of them were quite equal, both in capabilities and education, to themselves.

Mr Webster (in a letter read by the secretary) regretted he had to return the draft of the report unsigned. (This referred to one of the earlier drafts sent out by the committee.) It did not fully represent his views Something more definite and practical was needed He gave instances to show how civil engineers were ousted from their proper work and province by the land surveyors, especially in the case of the Northwest irrigation scheme. He suggested that the committee be continued, with instructions to draw up a bill for the establishment of the society as a close corporation, to be presented to Parliament at the next session, and that the society should put aside a sum of money needed for carrying on the work. He thought the present time was just as good as the future was likely to prove for the success of definite action on their part.

Prof. Bovey observed that although no doubt it was true that the land surveyors wanted to do engineers' work as well, yet it should at the same time not be forgotten that the civil engineers were precisely in the same position—they wanted to add land surveying to their province He thought it would be possible to join the professions of engineering, architecture, and surveying more closely together, with benefit to all, but at the same time he was of the opinion that the best plan for the engineers to act upon was to adopt a thoroughly independent course The English Engineers' Society, although not so called, was in reality a close corporation, and it was a very strong body of men, just as the architects were.

Mr. Wallbank said that the land surveyors' examinations were about as difficult as any examinations held in this country. The average land surveyor at the present day knew quite as much as the average member of the Civil Engineers' Society.

Mr. Shanly, senr., wondered what was to prevent a body of men, who wanted to build a railroad, from employing what was called a "practical man." It was impossible—absolutely impossible—for Parliament to prevent this. The Dominion land surveyors had the Government at their back and it was the duty of the civil engineers to reach a similar position.

Mr. Dodwell said that he had discussed the question as to whether they could obtain power to establish themselves as a close corporation, with two or three legal friends But he would like to know whether the committee should be empowered to obtain such advice and to pay for it in the ordinary way.

Mr Shanly did not think they ought to employ counsel until they had discussed the question more fully amongst themselves and had arrived at a fairly close idea as to what they really wanted. After that, it would be well to put the case into legal hands.

Prof Bovey said he thought they ought to obtain legal advice on this question: Can the Dominion Government give a charter such as they needed, or can they not?

Mr. Peterson agreed with what Mr. Shanly had said. Make a report as to what they wanted—with the idea of becoming as close a corporation as possible—and then take advice. It seemed to him that everybody was almost sure that the Dominion Government had *not* the power, and it would be waste of money to take legal advice on a question upon which they were sure beforehand.

Prof. Bovey moved that the council be authorized to obtain legal counsel as to the best procedure to adopt for the purpose of becoming established as a close corporation.

Mr. St George thought the question ought to be kept in committee and not sent to council. He knew what it would be if they relegated the matter to council—nothing would come of it. He seconded the motion of Mr. Dodwell, that the committee be given full powers.

Mr. Alan Macdougall (by correspondence) said that the Ontario Association of Surveyors were to meet in February, in Toronto, and perhaps it would be well to obtain the views of this powerful body.

Moved by Mr. Shanly, senr., and seconded by Mr. Dodwell, that the report on professional status be received and adopted.

Mr. Sproule thought that the opinion of the society at large ought to be known as to whether they wanted a close corporation. It would be ridiculous, when the proposed bill should have been brought before the House, for some one to get up and say, "Why, half or one-third of your own members don't want a close corporation at all." He moved that the question of professional status be put to the membership. Carried.

The report of a committee which had been appointed on a previous occasion to enquire into the habit of the councils of some small municipalities of accepting the gratuitous services of engineers, was then read.

This was adopted, and will be published in the "Proceedings of the Annual Meeting."

The report of the Committee on "Professional Ethics" was read by Mr. Sproule, and will be embodied in the annual report.

FRIDAY AFTERNOON.

The report of the committee which had been appointed to prepare some tests for cement was read.

Mr E. P Hannaford moved that it be printed.

Mr. St. George seconded the motion, and said he thought it should be printed at an early date, and then brought up at some ordinary meeting for discussion

The chairman of the Gzowski Medal Committee read his report, and the president, P.A. Peterson, handed the award to Mr. H. F Perley for his paper on "A Cubic Yard of Concrete." His address on the occasion was as follows:

PRESIDENT'S ADDRESS.

It affords me great pleasure to hand you the Gzowski medal, which has been awarded to you for your paper entitled "A Cubic Yard of Concrete." The medal is given to the member of the society who has presented the best paper during the past year. I cannot tell you how pleased I am that it has fallen to my lot to present this medal, nor what pleasure it has given me to see you here today after your long and serious illness, during which it may be some satisfaction for you to know that you have had the sympathy of the members of the society. I know that Sir Casimir will be more than gratified to learn that his medal has fallen into such worthy hands, and that you have so far recovered your health as to be able to be here in person to receive it.

Mr. Perley replied with much emotion. He said that the award of the medal had for him a two-fold signification: firstly, because it showed that his paper had been valued, and, secondly, because he had been under a cloud, and it showed that this made no difference to the manner in which the Society of Civil Engineers regarded him. If he might be allowed to say it, he was afraid some of the members were more lax in the number of papers prepared by them than they should be.

Mr. St. George brought before the meeting the question of accommodation for the society. He thought the present time of depression a good one in which to buy a building, which would go on increasing in value with every year. It would be a good plan to obtain such a building, with enough rooms in it to provide practically the accommodation of a club.

President Peterson thought it better to buy a corner lot in a convenient part of the city, and then for them to build upon it according to their needs.

Mr. St. George moved, seconded by Mr. Duggan, that the council should be authorized to purchase or rent a house suitable for club rooms, and to report what they had done at the next ordinary meeting.

Mr. E. P. Hannaford moved an amendment to the effect that the council should find out the best mode of providing accommodation for the society, according to its means and requirements. Seconded by Prof. Bovey.

Mr. Duggan said that the real point was that the present rooms were unsuited to the society's requirements.

After some further discussion, in which Messrs. Wallbank, Duggan, St. George, Peterson and Sproule took part, the question was put to the vote, with the result that the amendment was carried.

It was decided to send the minutes of each council meeting to non-resident members, so that they might know what was going on.

Mr. Wallbank asked concerning a grant from Parliament for the purpose of making tests on building materials.

The secretary stated that the Government had been memorialized on the matter, but nothing had come of it.

Mr. Perley related his own experience in the same line His efforts with the Government had met with utter failure, and he was afraid that it would be the same in this case.

Mr. Munro stated that he had spent over $1,500 public money in making tests on cements at one place, and he thought that to give a regular grant for the purpose of keeping up a regular testing bureau would be a saving of money in the end.

Mr. Wallbank said it was not so much the formation of a testing bureau which he wanted, as the increased usefulness of such testing apparatus as was already in operation, which the grant of a permanent subsidy would bring about.

The report of the scrutineers on ballots for officers was then made known, the result being as follows: Thos. Monro, president; H. Wallis, M. Murphy, W. T. Jennings, vice-presidents; R. W. Blackwell, treasurer; W. McNab, librarian; C. H. McLeod, secretary.

Council.—H. D Lumsden, D Macpherson, D. Barnett, H. T. Bovey, R. Surters, P. S. Archibald, H. B. Smith, L. A. Vallée, H. N Ruttan, W. J. Sproule, G. C Cunningham, J. M. Shanly, J. Galbraith, W. G. Thompson and C. W. Dodwell.

The newly elected president, Mr. Monro, was then installed in the chair, and gave his address.

Past-President P. A. Peterson delivered his retiring address on the "C.P.R., and the Work of Reconstruction on its Lines."

Mr. E. P. Hannaford moved a vote of thanks for Mr. Peterson's useful and interesting address, and for his valuable services to the Canadian Society of Civil Engineers during the year.

After the usual votes of thanks, etc., had been passed, the meeting came to a close.

THE ANNUAL MEETING.

The ninth annual meeting of the society took place in Montreal, on Thursday and Friday, the 24th and 25th ult.

The meeting was called to order at 10 a.m. on Thursday, President P. Alex. Peterson in the chair, and after appointing scrutineers for the ballots immediately adjourned. The members then visited the sheds and power-house of the Montreal Street Railway Co, who courteously placed cars at their disposal. They then visited the waterworks, where they partook of luncheon, provided by the chairman and superintendent of the works. Parties of the members also visited the works of the Dominion Bridge Co, Dominion Wire Manufacturing Co., Dominion Wire Rope Co. and the Montreal Wheel and Pipe Foundries Co. A cold luncheon was served at the Dominion Bridge Co.'s works at 1 p.m.

Thursday evening was devoted to a dinner at the Windsor Hotel.

On Friday morning the members met for the transaction of business at the society's rooms, at 10 o'clock, Pres. Peterson being in the chair.

Letters of regret at being unable to attend were read by the secretary from Mr. H. Wallis and Mr. H. A. Gray.

The report of the council for the past year was then brought forward.

The attendance list of members of the council, of which there had been eleven meetings during the year, was read.

H F. Perley moved that at future annual meetings such a statement should be omitted It was all very well for the secretary to have such a report, but it was hardly fair, he thought, to make it public.

This was seconded by Mr. Hannaford, and carried.

The report of council showed that the elections during the year had comprised seven members, six associate members, one associate, and twenty-six students. Four associate members had been transferred to the class of members, and seven students to the class of associate members. Resignations had been received from six members, ten associates, and one student. Four members had died, one associate, and two students. At the present date, the total membership of the society stood at 657, against 632 for the same time last year.

The thanks of the society were given to the Dominion Government, which had granted free transmission by post to the reports, etc., of the society. This applied to all parts of the country except Montreal.

The council's report stated that, at the request of the American Society of Mechanical Engineers, they had appointed a special committee to assist in the establishment of an international standard for rounds and flats.

The society's income for the year was reported as being $4,243.70, and the expenditure $3,352.16, leaving a balance of $891.54, and a total balance to carry forward to the general fund of $6,817.44. The amount to the credit of the building fund was $3,604.57, being an increase of $214.01.

The report of the committee on professional status read as follows:

1. That the desire for full and proper recognition of professional status, especially through the Canadian Society of Civil Engineers, is gaining ground strongly in the profession.

2. That the practice of engineering by many persons not properly qualified by education and special training, is injurious and detrimental to the best interests of the profession in many parts of the Dominion.

3. That it is incumbent upon the society to maintain, by all legitimate means, the highest standard of qualification amongst its members, and to discipline members guilty of unprofessional or improper conduct towards each other or towards the public.

4 That every member should give his earnest thought, and aim at the establishment of a high standing for the profession through the society; and whilst it appears that there is no immediate prospect of forming a close corporation, yet the society should use every means to have its members recognized.

5. And it appears to your committee that our efforts to promote its advancement ought not to be relaxed, and that the council should be asked to receive the statement, and give notice that the matter will be a subject for discussion at the annual meeting.

(Signed) ALAN MACDOUGALL, Chairman.
WM. T JENNINGS.
W. SHANLY,
C. E. W. DODWELL,
GEO. H. WEBSTER
ALBERT J HILL.

Prof. Bovey moved, and Mr. Thos. Monro seconded, the adoption of the report.

Mr. W. Shanly said he regretted very much the absence of Mr. Alan Macdougall, who had taken a large amount of interest in the work of the committee. He thought the report was somewhat general in character, but this could not be helped

Mr. Dodwell made a few remarks in explanation of the conclusions arrived at by the committee, and then read a letter addressed by himself to its chairman, in which he stated his differences from some of the members. So far as he could see, he thought the future would not prove more propitious than the past had been for the establishment of the civil engineers as a close corporation, and this was the whole basis of a true system of professional ethics and a real professional status. He stated the reasons for the comparative lameness of the report, which was no doubt chiefly due to the difficulty of calling the committee together, it being composed of members residing, some of them, two or three thousand miles away. He thought the council should be asked to draft a bill for the purpose of presentation to Parliament. Probably this plan would fail—at any rate for some time - but in any case no harm would be done, and it would at least draw the attention of the country to their desires. The efforts of the civil engineers to become recognized as a corporate body ought not to be relaxed.

Mr W. Shanly thought the civil engineers ought to take high legal authority first, to see whether it was possible for the Dominion Government to give them a charter. He had great doubts as to whether the Government had the requisite power to do so.

Mr. Dodwell said he had not forgotten this point. He would advise that the committee be granted full authority to consult legal opinion.

Prof. Bovey thought that the committee ought to add to its membership two or three persons who were resident in Montreal or in some other one place. This would much facilitate their consultations.

Mr. Sproule thought that until the committee were given power to obtain legal opinion, very little benefit would come from their consultations. No doubt the society would eventually be able to get a charter in one way or another. For instance, they might probably get a charter from each of the Provincial Governments. He himself would recommend the taking of a plebiscite on the question, and then for them to be guided by the result. He thought they ought not to antagonize other bodies, such as the land surveyors, who were an able body of men, and it would be a very good thing for them to endeavor to get into closer connection with them Perhaps even the architects also might be brought

into closer connection with the society. One party would always be enemies to their aspirations in this direction, namely, the people who wanted to get their services for nothing. These, for their own ends, would always adopt warfare against their obtaining a charter.

Mr. Wallbank said it was impossible for the Dominion Government to grant them a charter including all the provinces. The thing to do was for them to obtain a charter from each of the Provincial Governments, then to get it ratified by the Dominion Government, and for all the charters to come into operation on a certain day. The land surveyors were not opposed to the civil engineers, but they would oppose any infringement on their rights.

Another assemblage of the members took place in the evening in the testing laboratory of the Faculty of Applied Science, McGill University.

The Governor-General, Lord Aberdeen, having signified his intention to be present, the occasion was taken advantage of to present a short address to His Excellency.

Prof Bovey read a paper on "The Strength of Douglas Fir, Red Pine, White Pine and Spruce," giving illustrations of the testing methods employed in the laboratory.

CANADIAN ASSOCIATION OF STATIONARY ENGINEERS.

Editor Canadian Engineer.

Dear Sir,—I send you a few lines on No. 16 C.A S.E. We met Saturday evening, Jan. 5th, and had an interesting meeting, there being three applications for membership, and questions asked, making the meeting very helpful to all. A special meeting was held January 19th to consider the renting of a room to be open all the time The association is going to start a reading and class room, to be always open, the room to be furnished with papers and reading matter pertaining to engineers' work. This association is doing well under the circumstances, and hopes to have a good show made by spring Wishing the sister branches success and the compliments of the season,

A. M. Schofield,
Rec Sec. C.A.S.E., Branch No. 16.

Kingston Branch, No 10, held a very successful open meeting on the 16th ult in Fraser's Hall. On the platform were Pres Robt King, Past Pres. Wickens, of Toronto, and Jas Devlin, executive secretary. Those who read papers were Pres King on "Local Association"; Mr. Devlin on "The Aims and Objects, and Present Standing of the Association"; Bro. Davis on "Water Tube Boilers"; Bro Breck on "The Dynamo and its Care"; Bros. S. Donnelly and Robt Charlton on "The Duties of an Engineer"; and Bro H. Hoppins on "Pumps." A very amusing and interesting paper on what an engineer should be was read by Bro. J Gilmore. Bro. Chief Youlden, of the city fire department, took the blackboard and very minutely explained the principles and uses of the engine indicator. Brd. A. Asselstine read a paper on "Belts for Transmission of Power," whilst Bro A. Strong read a short paper on "Shafting." Bro Fred Simmons explained very concisely and interestingly the arc lamp, giving practical illustrations from an arc lamp such as those in use in this city, which he took apart and explained. Past Pres. Wickens delivered a stirring address on the necessity of organization for mutual improvement, and also for the passage of a law by the legislature to compel all engineers in charge of steam plants to pass an examination and secure a certificate of competency. Ira Breck and B. W. Folger, two large steam users of the city, were proposed as honorary members of the association. The latter suggested to the meeting the advisability of appointing a committee to wait upon J. L. Haycock, M.P P., and request his support for the purpose of securing a law such as had been referred to. Mr Folger's suggestion will be acted upon

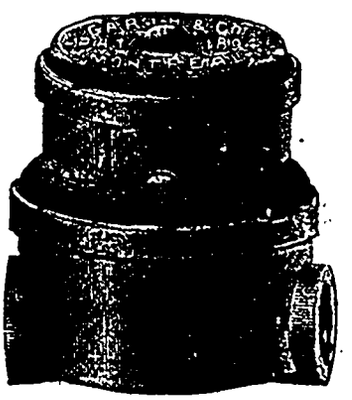
Montreal No. 1 branch has been going along the even tenor of its way, steadily progressing in usefulness. The committee have been busy making preparations for the annual dinner, held in Engineers' Hall on the 2nd inst.

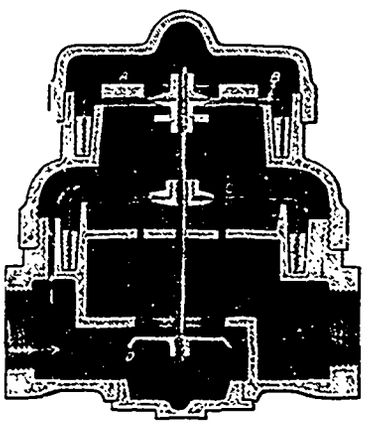
Halifax.—In reply to a Halifax, N.S., correspondent, we would say that the makers of the Luhrig Gas Motor are "Gasmotoren Fabrik," Deutz, near Cologne, Germany.

Erratum.—In our article in last issue entitled "Modern Measuring Instruments," we incorrectly stated the price of E. G. Smith's caliper. It should have been stated that the cost of the No 5 calipers, 4-inch pocket size, was only $2 50, the price of a large 10-inch one being $5.

A NEW GAS GOVERNOR.

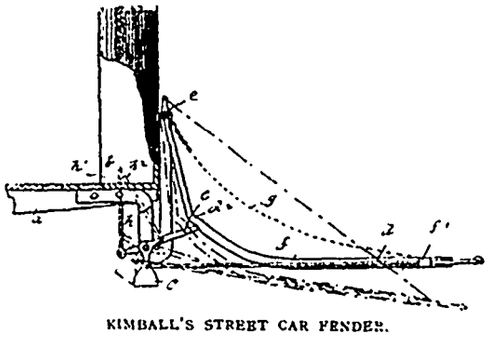
Garth & Co, Montreal, have recently placed on the market a new gas governor, called the "Imperial," which seems to present some striking advantages. It has only been put on the market after the most thorough tests, and the verdict of those who have tried it is highly satisfactory. It is a small automatic device placed near the gas meter, its object being to maintain the gas at a constant pressure after it leaves the meter A steady and uniform light is thus produced, and the gas being prevented from leaving the meter at a great pressure, the user does not have to pay for unconsumed gas and broken globes. It may be attached also to gas cooking stoves, etc., and will maintain a regular, constant heat, and prevent the unpleasant odor arising from the escape of unconsumed gas By the use of the governor, it is claimed that a saving is effected of from 15 to 40 per cent, according to the nature of the room illuminated, and whether it be in a factory or in a private residence. The main feature consists of two sealed inverted diaphragms free to move in a cup of mercury, both permanently attached to a stem carrying the valve D that controls the inlet of gas. As the gas varies in pressure from the city main, it becomes necessary that a gas-governor should be so constructed that the variation should not affect the working of the governor, but that it should always maintain a constant pressure, according to that at which it may be set The initial gas, entering at the left hand side of governor, exerts an upward force on the under side of valve D, and has a tendency to close it. This is balanced or counteracted by the initial gas ascending through a small passage into upper chamber, and exerting an upward and downward force between the two inverted diaphragms B C. If the diaphragms B C were both of equal diameter, the force exerted would be nil. But it is not so; the lower diaphragm C is made just so much larger in diameter, that its difference in area between the upper one B is equal to the area of the diameter of opening of valve D. This being so, it matters not at what pressure the initial gas may be, the valve D is always in equilibrium and free to move either way, with the least variation of pressure on the under side of diaphragm C. The weight A being adjustable is made heavier or lighter, according to the pressure required to burn the gas. This pressure varies through the present pipes having been laid to suit a high pressure gas. It being reasonable to suppose that larger pipes are required for low pressure gas, to overcome the loss of pressure due to friction, this, where necessary, can be remedied by running auxiliary mains or feeders to the system. In this governor there are two opposing forces both in equilibrium, and when one is disturbed it balances itself without any disturbance to the other, the high-pressure gas maintaining one, and the low-pressure the other. The low-pressure equilibrium is formed by the weight A on top of the diaphragm exerting a force proportionately downwards, to the upward pressure on the underside of the lower diaphragm C, which equilibrium is not disturbed until the gas jets are lit or turned off, as the case may be, this disturbance being really what actuates the governor. The high-pressure equilibrium is formed by the incoming gas ascending through a small passage into the upper chamber and exerting a force between the two diaphragms B C, the differential area of which maintains a downward pressure equal to the upward pressure on the underside of the valve D. Thus there are two equilibriums, each acting independent of the other. The prices of this useful little device are as follows. Half-inch, $10, three-quarter inch, $15, one inch, $20, two inch, $40, three inch, $65, four inch, $85. The makers will be pleased to send to any person interested sketches descriptive of its action.





A NEW CAR FENDER.

Annexed is an illustration of a new street railway car fender recently patented by Stephen S. Kimball, of Montreal, which introduces what appear to be some extremely useful improvements. The guard is composed of wire mesh or other material, with its inner end pivoted to standards at the end of the car, and its outer end held normally elevated by movable supports so adapted as to



KIMBALL'S STREET CAR FENDER.

be operated automatically through a projecting feeler extending in front of the guard. The most striking feature of the invention is that the guard, in the event of its meeting with any obstruction, such as a human being standing on the track, falls automatically to a lower position. This means for automatic falling of the fender, however, is only provided in the event of the motorman not seeing the obstruction in front of the car. Means are also provided whereby, by merely pressing his foot downwards on a pin, he can lower or raise the guard at will. Thus it will be seen that if the motorman has but a moment's warning of a possible accident—which will usually be the case—he can cause the fender to drop to the ground and it will then immediately take up the obstacle without doing any injury. But even if he should not be aware of it, the automatic drop arrangement would prevent anything serious happening. It should be mentioned that the front part of the feeler is covered with rubber cushioning to lighten the shock. A better understanding of the invention will be gained by glancing at the accompanying cut, it being only necessary to mention that the guard, as shown in dotted outline, immediately on meeting with an obstacle, falls *backward* as well as downward This is not made very clear in the sketch; it should not project quite so far outward. The chief drawback to the fenders at present in use is that they are necessarily in a position so far above the level of the ground, that should they happen to come in contact with a person crossing the track of the car, the force of the concussion would probably break his leg, even if no further injury ensued In Mr. Kimball's invention this disadvantage is overcome, the slightest resistance being sufficient to drive the front part of the fender inwards, and, simultaneously, to cause the latter to fall to the level of the ground.

THE HAMILTON WATER POWER AND CANAL SCHEME.

Editor CANADIAN ENGINEER:

SIR,—I have read with renewed interest Mr. Golding's article in your January number on the proposed aqueduct for power and freight transport purposes, from the mouth of the Grand River at Lake Erie, five miles below the Dunnville dam, to Hamilton from Caledonia.

The writer would be pleased if Mr. Golding would demonstrate its practicability from an engineering and financial point of view, by aid of profiles showing the bottom of the canal and the rise of its banks in its course to Hamilton, giving an estimate of the number of cubic yards to be removed to bring the canal to its required depth. I have endeavored to do this approximately on the Grand River section.

Mr Golding states that the bed of the river at Caledonia is very little, if any, above the level of Lake Erie. In this he is mistaken or misinformed, as I will show him. The dam at Dunnville is from nine to eleven feet above the level of Lake Erie, according to the condition of the lake. If this dam were taken down, the water of the lake would flow up the river about half way to Cayuga, where there is now about 7 feet of water through being backed up by the Dunnville dam.

The dams above Cayuga, when the navigation of the river was in order, were Mount Healy, with a fall of 7 feet; Sims' dam, fall 5 feet; York do., 4 feet 6 inches, Seneca, 5 feet, or 21 feet 6 inches of rise in the bed of the river from Cayuga to Caledonia. The fall to the lake level from Cayuga would not be less than 4 feet, or a rise in the river bed to Caledonia of 25 feet 6 inches. If the canal were constructed for a navigable depth of 10 feet, it would have to be 14 feet at Cayuga, and not less than 39 feet to 40 feet at Caledonia below the level of the present bed of the river. The land above the river bank at Caledonia to the railway track is about 20 feet above the river, rendering an excavation to carry the canal at a right angle to the river 60 foot deep, without a position could be found of less elevation. I do not see, however, that this would be an advantage. The city engineer of Hamilton, a gentleman of high standing in his profession, states that the top of the high land above the city is 53 ft. above the Lake Erie level I do not propose to say any more in this on the route from Caledonia to Hamilton, but will direct your attention to the probable cost of deepening the Grand River to the requisite depth and width to do the proposed work. Captain Mitchell, well-known in this city, formerly of Caledonia, has navigated steamers on the river when it was in a navigable state, and states that the bottom of the river is all rock near Dunnville. I assume that for the purpose of navigation and the requisite flow of water for power purposes, at a velocity of 200 feet per minute—I do not mean a surface velocity, which is very much above the average, fully 25 per cent., but an average velocity—the canal should be not less than 3 yards deep and 33 yards wide. The average excavation required from three miles above Dunnville to Caledonia would not be less than 6 yards by 33, or 198 yards of gross sectional area; this multiplied by 1,760 gives 348,480 yards per mile, and multiplied by 18, the number of miles in which there is rock in the river, or 6,272,640 cubic yards to be excavated or quarried out of the bed of the river. The cost per yard on the Croton viaduct, for New York water supply, where the best and most modern appliances were at work, was or is $1.16 per cubic yard, without a flow of water such as is in the Grand River, to encounter, the excavations being made in dry rock. It is therefore evident from this that deepening of the river to the proposed depth would cost more than $6,000,000. Please give your version of this with the quantity worked out. I have endeavored to state the matter as fairly as I could get data for.

There is another phase of this scheme that has not been touched upon. If it turns out as Mr. Golding has laid out, a very large number of steam engines and boilers now in successful operation, driving cotton mills, rolling mills, street cars, electric lights, foundries, factories and pumping engines, will become dead stock, and be relegated to the scrap heap, and numbers of men now in charge of these will be out of employment. The engine and boiler works may also close down, as the steam engine will be superseded by a simple turbine running a dynamo. The coal trade would be also injuriously affected, as the electric cars are reducing the value of horses in the States to the price of the hides; so would electric power affect injuriously many of our present businesses. However, these are matters that time might rectify by transferring business in another direction.

I have purposely made but a few remarks on the Caledonia & Hamilton section of the proposed canal, as without borings and a profile nothing can be known about it. However, for the Grand River section I have got approximate data from which I have made the calculation given here.

Yours, respectfully,

J. H. KILLEY.

Hamilton, January 28th, 1895.

NO UNCERTAIN SOUND.

CANADIAN ENGINEER, Montreal:

DEAR SIRS,—I regard your paper as the very best medium for advertising in my line. I have received enquiries, *which invariably resulted in orders*, from every province in Canada, some as far away as British Columbia. Yours truly,

W. H. STIRLING,

Manufacturer of the Niagara Injector.

St. John, N.B., Jan. 28th, 1895.

Messrs. Biggar, Samuel & Co.,

GENTLEMEN,—I have received the December, 1894, and January, 1895, issues of THE CANADIAN ENGINEER, and I am delighted with it. I am glad I have subscribed and I am sorry that I did not do it before. Wishing you success, I remain, yours truly,

(Signed), J. ALCIDE CHAUSSE, Architect.

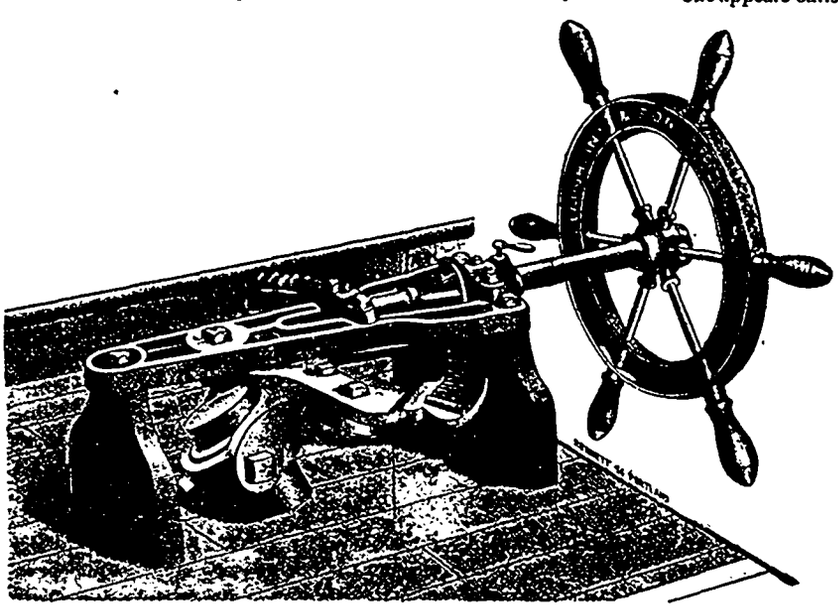
Montreal, Jan. 24th, 1895.

AN admirable publication of its class is THE CANADIAN ENGINEER, issued simultaneously at Toronto and Montreal. It is a well printed, judiciously edited and amply illustrated monthly. The contents are such as should be indispensable to any engineer wishing to keep posted on the improvements and leading events in his important calling. In fact, besides its value to all classes of engineers, it is of value to manufacturers, contractors and those in the metal trades.—*Goderich Star.*

STEERING GEAR FOR YACHTS.

We give herewith an illustration of one of several styles of steering wheels recently introduced by the Thomas Laughlin Co., of Portland, Maine, one of the oldest and best-known firms in ship chandlery and ship specialties on the Atlantic seaboard. The steering wheels are more especially suited for yachts and small vessels, and the one shown in our engraving is one of three styles of quadrant steerers which the makers claim to be the best yet put on the market It is strong, simple and effective.

It can be put in a boat by a person of ordinary intelligence, and while taking but little room, is easily adjustable, and may be placed at the most convenient angle to the rudder head The jaw may also be adjusted to any size of rudder head. The shafts are covered with brass, and are made 21 inches for the smaller size and 26 inches for the larger size The makers have recently added



a device to the shaft by which the rudder may be held in a fixed position at any angle, thus making the work of the steersman very easy in a steady breeze on a fixed course. Both these and the other styles of quadrant steerers are very cheap in price Another new and effective style of steerer made by the Thos. Laughlin Co. is a screw gear, called the 'Puritan." This gear works quickly, is simply made, requires no repairs, and, like the quadrant steerer, will hold the rudder in place at any angle. It has less friction and back-lash than any other in the market. There is a centre-pin for the rudder head, which keeps it in place and gives a steady movement to the rudder. By having a rubber cushion sudden jerks are avoided and the rising of the rudder does not put it out of order. A reverse motion may be had by the simple shifting of a pin. These steering wheels took the highest honors at the World's Fair. They are patented in Canada, where the company have now a large trade

A NEW FIREPROOFING METHOD.

Much attention is being paid to methods of fireproofing the steel skeletons of buildings erected at the present time, especially in the case of public halls, etc. In illustration of this, the *Boston Journal of Commerce* instances the treatment of the great girders of the new Tremont Temple, Boston. The steel girders are first placed in terra cotta blocks, on all sides and below, these blocks being then strapped with iron all around the girders, and upon this is stretched expanded metal lathing, covered with a heavy coat of Windsor cement, over this comes iron furring, which receives a second layer of expanded metal lath, the latter in turn receiving the finished plaster. There is consequently in this arrangement for fire protection, first, a dead-air space, then a layer of terra cotta, a Windsor cement covering, another dead-air space, and finally the external Windsor cement. These great girders are characterized as the vital parts of the whole steel structure, the necessity of their absolute protection being explained by the fact that a rise in temperature of 300° would throw the columns out of place about an inch and a half on each side, and a rise of about 500° would ruin the steel. Another feature to be noted in this work relates to the partitions of the outside corridors about the auditorium, these being built of terra cotta blocks, held securely in place by means of angle irons, and bound together by expanded metal lathing on each side, upon which is placed the plaster.

LIGHT VERSUS CURRENT.

John Forman, of Montreal, representing the Edison & Swan United Electric Light Company, draws our attention to the following interesting remarks recently made by T. A. Edison, which are well worthy of notice at the present day, although when spoken they had more special reference to Great Britain:

"Nearly all the operating companies are on a wrong business basis for any rapid development. Nowadays the chief concern of the station manager is to grind out as much current possible for every pound of coal he burns, he gets economical boilers, engines, and generators, and studies their arrangement; these are so near the practical limits of their perfection that only a 2 or 3 per cent. improvement can be expected, and so long as the station has a fair load, shows a good efficiency, and does not have breakdowns, everyone appears satisfied. The consumer grumbles at the cost of electric lighting, but pays his bill; the shareholder pockets the small dividend, and the manager is happy. They are selling current by board of trade units, although in competition with gas; it is *light* the public wants, not amperes. It has been my pet idea ever since electric lighting started," continued the great inventor, "for the operating companies to sell light, as it is here that the improvement is to be made and the grand financial incentive lies. Let them produce more light—more candle-power per horse-power per hour. I will grant the difficulty of fixing a 'unit of light,' but it is not necessary; it is an easy matter to charge from the meter indications for the lamp hours delivered. If the station simply receives payment only for watts delivered, it has no inducement to increase the efficiency of the lamp; they will even frown upon the inventor or lamp manufacturer who gives the consumers lamps taking half as much current, because it lessens their demand and the total consumption; in fact, it is to the station's interest to see lamps chewing as much current as the poor consumer will pay for. Again, on the other hand, lamp improvements are kept back because the efficient lamp is a short-lived one, and to educate the vast public to study their meter bills instead of their lamp bills is a slow and tedious process at best, and a herculean task at that. To an ordinary householder each 30 cents spent on a lamp-renewal is an evident out-of-pocket expenditure; his main idea is to get the lamp that requires replacement least often; he draws an analogy with the physiological truth, and decides that a 'short and merry' life of the wayward one costs him too much. It is the long-suffering lamp the public wants every time, and electric lighting drags along also. If you enquire of all the stations doing a remunerative business, almost without exception they are charging for light (lamp hours), and prefer to renew customers' lamps free of charge. There is Boston, as a typical example, where they have satisfactorily proved that it pays better to try and burn up lamps and remove those that won't give out. You see, then, every improvement in the lamps, either for life or efficiency, helps the station; it means increase of profits with the dividends in the shareholders' hands, and the public will not suffer, because it is doubly to the companies' advantage to lower the prices."

HAMILTON WATER POWER SCHEME.

Editor CANADIAN ENGINEER:

SIR,—I have read with some interest an article in your January number relating to the Hamilton Water Power and Canal scheme. This article is an example of the way in which many good schemes are first presented to the public by boomers—the big units of power and the huge amounts of capital are handled in a manner quite regardless, leading one to imagine that the writer is familiar with the subject, until the figures are closely looked into.

Your correspondent, Mr. Golding, says that he has thoroughly investigated the conditions of the Grand River for the purpose suggested, and then states his convictions as to this channel being the true way of bringing Lake Erie water to Hamilton. The depth of Mr. Golding's investigations may be inferred from the quotation from the letter of the deputy-reeve of Dunnville, who appears to be the authority Mr. Golding depends on for his information as to the bed of the river. This information, while very useful as far as it goes, is not sufficient for even rough estimates to be based on.

The level of the river bed at the foot of the dam at Caledonia is about 38 feet above the surface of Lake Erie, and the bed is bare rock.

The manifest intention of the article is to place the scheme in an unduly favorable light, and, while the figures for construction of channel and canal are purely assumed ones, having no good data to work from, the figures which might be arrived at with some degree of accuracy have not been fairly dealt with. The cost of water power plant installation has been much underestimated, and that of steam plant has been grossly overestimated, showing a glaring comparison in favor of water power plant.

Now, assuming the scheme to be a good one, is not this way of presenting it to your readers and the public very unwise? A fair statement, after at least some investigation, would meet with consideration, while a booming article such as the one referred to will probably fail to accomplish the end desired.

Elementary questions, such as flow of water in open channel, need not now enter into the discussion, as this question can easily be set at rest, and I have no doubt Mr. Golding's contention is right.

To secure 20 feet of water in the river at Caledonia the rock in the river bed would have to be excavated to a depth of 58 feet for a distance which is quite uncertain, as no data is at hand.

Mr. Golding's scheme is a very big one, but not one which will commend itself to capitalists, as the canal, if it should not succeed in draining Lake Erie, must certainly succeed in draining dry the pockets of the original investors, if it be undertaken this century, for the reason that the demand for this work does not exist; no word in Mr Golding's remarks bears upon probable revenue. Constructing works is a comparatively simple matter when compared with the work of making these schemes commercially successful Where is the revenue to come from? Who will use the power developed, amounting to the modest 100,000 h.p.—an amount 50 per cent greater than the whole amount of power installed in Montreal to-day.

The conclusion of Mr. Golding's remarks leads one to suppose that he is a selling agent for turbine wheels. There is no difficulty in procuring all the good hydraulic plant necessary to meet any emergency, and I am glad to say that there are many reliable manufacturers of excellent hydraulic machinery.

I would not throw cold water on any legitimate enterprise, but this scheme is so loosely worked out as to make what may be a good scheme look very ridiculous from a practical point of view.

There are several water power development schemes before the public now, in more or less advanced stages—some of which will no doubt prove commercially successful, and let us confine our energies and capital to developing these thoroughly; this is the course to be followed if engineers wish to enjoy the confidence of capitalists. Truly yours. HENRY HOLGATE.

Montreal, January 14th, 1895.

Personal.

ROBERT F. STUPART has been appointed director of the Toronto Observatory, in the place of the late Prof. Chas. Carpmael.

RANDOLPH HERSEY, of the firm of Pillow, Hersey & Co., Montreal, is leaving for California, where he will take up his abode.

RICHARD ARDAGH, chief of the Toronto Fire Department, who received injuries at the great *Globe* building fire, on the 6th January, died on the 27th ult He joined the force in 1847 and has been chief since 1876.

RICHARD WARAM, G.T.R. car foreman at Peterboro', has received the appointment of foreman of the mechanical department of the G.T.R. at Port Hope. His place is filled by Samuel McLean. Mr. Waram has been foreman on the Peterboro' branch for twelve years.

DR. A. R. C. SELWYN, director of the Geological Department, Ottawa, has been superannuated, after twenty years of valuable service. His successor is Geo. Mercer Dawson, LL.D., F.R.S., F.G.S., F.R.S.C., etc., son of Sir Wm. Dawson, who had hitherto been assistant-director. Mr. Dawson was born in Pictou, N.S., in 1849, studied at McGill College and at the Royal School of Mines, London, Eng., and was appointed to the Geological Survey of Canada in 1875. He is the author of several reports and scientific papers, and has done a good deal of valuable exploration work in the almost unknown regions of British Columbia and northern Canada.

ALEX. MCARTHUR, of the firm of Alex. McArthur & Co., paper makers, Montreal, had his hand badly crushed in the machinery last month.

W. H. BROWNE, formerly manager of the United Electric Light Power Co., of New York, has been appointed to the position o general manager of the Royal Electric Co., Montreal, recently vacated by Charles W. Hagar.

F. H. REYNOLDS, patent solicitor, Montreal, died a few days ago of heart failure, resulting from an attack of pneumonia. Mr. Reynolds was born in London, Eng., in 1843, and came to this country in 1865, since which time he has practised his profession in Montreal.

CHARLES W. HAGAR has retired from the managership of the Royal Electric Co., and has been appointed special agent for the Guardian Fire and Life Assurance Co. (Ltd)., with offices in the Board of Trade building. Mr. Hagar is so widely known, and is so popular among his large circle of friends, that it is needless to speculate upon the chances of his future success in the line he has chosen. Two or three days ago Mr. Hagar was presented by the officials and employés of the company with a handsome desk and suite of office furniture, accompanied by an address, in which they expressed their great regret at parting with their late manager.

WILLIAM PERRY, hydraulic engineer, connected with the firm of R. H. Buchanan & Co., Montreal, returned a few days ago from New York and Boston, where he went in connection with the Blake & Knowles Steam Pump Co.'s agency. Mr. Perry is well known through Canada as thoroughly practical in pumping machinery, his experience extending from 1851. He has just put in the longest suction and syphon pipes to pumps in Canada, on a 10x5x12 Blake duplex steam pump. He connected a suction pipe half a mile long with a 19 foot lift, while the largest pump company in the United States would not touch it, claiming it was impossible to do the work, and would not build the pump for the job. Quite a number of such jobs have been done by Mr. Perry.

Industrial Notes.

BRIGDEN, Ont., is considering the question of establishing water works.

A. BOIRE is establishing in Granby, Que., a factory for the manufacture of baskets.

WALKERVILLE, Ont., Wire and Iron Works are to be sold for the benefit of the creditors

THE Hamilton City Council will apply for legislation to dissolve the gas company's perpetual charter.

TAYLOR & COPE have opened a factory at Vancouver for the manufacture of caskets, coffins and furniture.

MCALLISTER BROS.' flour mills at Pakenham, Ont., which were burnt a short time ago, are to be rebuilt at once.

I. R. OWENS & Co., of South Woodslee, Ont., have removed their sash and door factory from that place to Ridgetown.

T. B. GODFREY'S hardware stock at Vancouver, B.C., has been sold to V. E. Campbell, who has just started in the business.

A FIRE broke out in the drying house at Eddy's paper mills, Hull, Que., but was extinguished before very much damage had ensued.

THE additional new boiler for the Amherstburg, Ont., water works has been put into position. It is believed to be highly satisfactory.

ST. CATHARINES, Ont., Masonic Temple and the Public Library have been totally destroyed by fire. Loss nearly $20,000; insurance, $10,000.

THE Gould Coupler Co. have almost decided to locate their Canadian plant at Niagara Falls, Ont. About 25 hands will be employed at the start.

ST. BONIFACE, Man., ratepayers have defeated the by-law to spend $75,000 for the purpose of constructing a bridge between that town and Winnipeg.

MCQUILLAN & Co.'s tender for constructing waterworks in Meaford, Ont., has been accepted and the contract awarded to them. Their tender was $18,262.

THE Laprairie, Que., Pressed Brick Co. have elected the following officers: President, A. A. Ayer; vice president, J. W. R. Brunet; secretary-treasurer, Fred Westbrook; and selling agent, T. A. Morrison.

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

THE Cleveland, O., Carbon Company are thinking of establishing a factory somewhere in Ontario.

N. G & J. MCKECHNIN have completed the erection of their new door and sash factory in Durham, Ont.

THE Novelty Mnfg Co., Newmarket, Ont., has decided to go into liquidation. The paid-up capital is $145,000.

LARKE & BAILES, founders, Oshawa, have dissolved partnership. The business will be carried on by Mr. Bailes.

G F. STEPHENS & Co., wholesale paints, &c., Winnipeg, are going to branch out into a general hardware business.

GEO A WATSON, inventor of the Watson Hot Water Heater, has succeeded in forming a strong company for the manufacture of his patent.

BOWMAN & MOORE, hardware merchants, Hamilton, are stated to be in financial difficulties. Liabilities about $20,000; assets considerably in excess.

THE Waterous by-law having been carried in Brantford, Ont., the company has commenced the work of erecting new buildings, capable of employing 400 hands

NOXON BROS., manufacturers of agricultural implements, Ingersoll, Ont., opened a few days ago, after a shut-down of some months They employ 150 men.

WM ANGUS, of Montreal, has been granted an order to wind up the affairs of the Coal Saving and Smoke Consuming Company. Jas B Cushing has been appointed provisional guardian.

A REDUCTION of wages has been ordered at the Ontario Rolling Mills, Hamilton. Employés receiving $1.60 per day or less will be reduced 10 per cent, and those over $1 50 per day, 15 per cent

THE Canadian Rubber Co., Montreal, have elected the following officers: President, Andrew Allan; vice-president, Hugh McLennan; manager, J J McGill; secretary-treasurer, J. O. Gravel.

LEAMY & KYLE and Geo. Cassidy & Co.'s saw mill businesses, at Vancouver, B.C, have been amalgamated under the style of Geo. Cassidy & Co. (Ltd) They are adding machinery at the Red Mills.

FREDERICTON, N.B., city council have granted to Hoegg & Co., who propose building a large canning factory, exemption from taxation and free water up to 250,000 gallons for the term of five years.

A COMPANY is asking for exemption from taxation of the Kingston, Ont., council for a factory which they propose erecting for the manufacture of matches, staves, pails and paper. The capital of the company will be $100,000.

P. KYLE'S malleable iron works at Merrickville, Ont., were last month gutted by fire. Loss, $8,000; insured for $3,500. Ed. Kyle's electric light station in the same building was also destroyed, the loss being $2,800, with no insurance.

THE Dominion Lumber Co. (Ltd.), composed of American capitalists, have completed negotiations for the purchase of about 860,000 acres of lumber lands in Nova Scotia, together with sixteen mills, with an established market in England.

THE Metal and Hardware Association, Montreal, has elected officers as follows President, James Crathern, vice-president, Thos. J. Drummond; treasurer, J. B. Learmont; secretary, J. A. Irwin; directors, F. Fairman, Jas. Phymester, Wm. Macmaster and A. C. Leslie.

A COMPANY is about to apply for legislation for the purpose of building a large hotel at St. Hyacinthe Among the applicants are M. E. Bernier, A A. Thibaudeau and T. G. Harvey The capital will be $50,000, and the work of building will probably begin April 15th.

THE Kingston *Whig's* new building is one of the most substantial of the new business structures erected in recent years in the Limestone City. It is four stories high, faced with Credit Valley stone, and its ariole windows make its front aspect very imposing.

AFTER the January dinner of the Montreal members of the Province of Quebec Association of Architects, Andrew T. Taylor, F.R.I B A., read a paper on "St Paul's Cathedral, London," which was illustrated by a number of drawings and views. J. Nelson was in the chair.

W. H. THORNE, T. Carleton Allen, A. T. Townshend Thorne, Geo. McDonald and Thos. Bell are applying for incorporation under the name of W H. Thorne & Co (Ltd.), St. John, N.B., with a capital stock of $200,000. They will carry on the hardware business now conducted by W. H. Thorne.

AN extension to the building of the Medical Faculty at McGill College, Montreal, was opened by the Governor-General last month. The erection of this building completes a set of buildings 280 feet long, traversed from end to end by two corridors. The plans were prepared by Andrew T. Taylor of Montreal.

OWING to the disastrous nature of the fires which have taken place in Toronto lately, the city will purchase two powerful engines and a water tower. The first cost of two steam fire engines properly equipped would be about $18,000, and $6,000 per year afterwards. The late fire chief recommended also the erection of a new station.

THE Maclaren Match Company, Ltd., Buckingham, Que., capital stock $40,000, is applying for incorporation, for the purpose of carrying on the business of lumberers, manufacturers of matches, sashes, doors, and wooden ware of all kinds. Among the applicants are C. D Chitty, D. & J. A. Maclaren, of Ottawa, and Albert Maclaren, of Buckingham.

A. LUCAS, of Calgary, has been to Toronto trying to interest capitalists in an irrigation scheme for the district lying between Calgary and Jumping Pond Creek. The district is issuing $100,000 worth of debentures, and the idea is to dig a ditch through the whole country side. It comprises about 100,000 acres of land, upon which already settled there are about 100 farmers.

THE Canada Wire Mattress Co.'s works at Toronto Junction were last month completely destroyed by fire. Loss $33,000. Insurance about $21,000 The cause of the fire is a mystery, but it started in a small shed adjoining the main building, in which there were some varnish and oil. Twenty hands are thrown out of employment. The factory will probably be rebuilt at once.

THE London, Ont., Gas Co. is about to make a big cut in prices to meet the competition arising from the introduction of electric light. Gas in that city now costs $2 per thousand, with a 25 per cent reduction for prompt payments. The company has during the past year added considerable machinery with a view to the cheapening of the production.

DURING the past year the Imperial Bridge Co., of Montreal, have built eleven bridges and supplied structural iron for four large buildings, the Longue Pointe Asylum for the Insane, the Hospice at Clair at Mile End, the Deaf and Dumb Institute at Mile End, and the Deaf and Dumb institution of the Viator Brothers at Bordeau, near Montreal. They have also supplied structural work for about fifty stores, and have imported material for similar work for the present year.

THE Howlands Falls Pulp Co.'s mill at Bangor, N.B., is now ready for operation. The plant is said to be one of the finest in the world, and has a capacity of 30 tons per day. The wet machine room measures 150 x 60 feet, two sides of which are composed wholly of glass; the digester room measures 110 x 28 feet, and contains six very large digesters. The other departments are on a similarly large scale. The company have spent $200,000 on the mill and plant, and will spend $60,000 per year for labor, besides the cost of operations in the woods.

THOS. E. LEATHER, who for the past ten or twelve years was with the Ontario Rolling Mills Company, and T. H. Watson, lately with John Proctor & Co., have entered into partnership, under style of Leather & Watson, to do business as sales agents in iron and steel and general railway supplies at Hamilton, Ont. Both members of this firm are young men of wide experience in their line of business, possessing the best connections in the trade throughout Ontario, where their deserved popularity in their previous positions has eminently fitted them to do a successful business on their own account.

THE Toronto Steel-Clad Bath and Metal Co. (Ltd), Toronto, are out with a facetious little folding card, entitled "Why We '*Wood*' Not" Their reasons, tersely stated, are as follows: "Because woodwork, be it ever so carefully seasoned, oiled or treated, will in the humid and changing atmosphere of a bath room absorb some of the moisture and harbor impurities, which a non-absorbent material cannot do. This is especially noticeable when wood is used in the actual construction of the bath itself, such as the old style 'boxed-in,' the fibre, and kindred kinds." This is why the only woodwork allowed in baths turned out by these well-known makers is the narrow capping on the top. All the rest of the material used is metal, and this is found to be the best plan from a sanitary and every other point of view.

JOHN MCDOUGALL, Caledonia Iron Works, Montreal, has been appointed general manager of Canadian agencies of the eminent firm of Henry R. Worthington, Brooklyn, N.Y. Mr. McDougall, together with special sub-agents—namely, R. H. Buchanan & Co

of Montreal, for Province of Quebec; Craig, MacArthur & Co., of Toronto, for Province of Ontario—will carry stocks of the leading kinds and sizes of pumps, condensers, meters, etc., for which the Worthington firm has a world-wide reputation. Orders placed with Mr. McDougall or any of the sub-agents will have the best attention. The large Worthington waterworks pumps are manufactured in this country by Mr. McDougall from designs and patents of the Worthington firm, and contracts for the city of Montreal and other corporations have been executed and given the most complete satisfaction. At present a "Worthington" 5,000,000 Imperial gallon power-pump is being manufactured by Mr. McDougall for the city of Montreal.

Mining Matters.

THE Atkins syndicate are developing the McCue group of mines on Twelvemile Creek, B.C.

THE Central Natural Gas Co., of Dunnville (Ltd.), capital stock $3,000, has been incorporated.

THE Spanish River Talc & Nickel Mining Co., of Algoma, has been incorporated. Capital stock, $96,000.

G LODGE, formerly of the old Dominion Mine, Colville, has taken charge as foreman of the "Le Roi" mine, Rossland, B.C.

THE work of lining up the furnace at Acadia mines, N.S., commenced last month, and with eight days work it was lined up to 35 feet.

THE Cariboo ten-stamp mill at Camp McKinney is running night and day, crushing ore now being taken out close to the "Amelia."

HUMPHREYS, VANDEVANT & Co., steel and iron manufacturers, of Pittsburg, Pa., have in view the erection of large smelting works in Toronto.

AT the "Gold Rod" mine, Midway, B.C., Mr. Boss has six men at work. The shaft is down 35 ft., and will be continued to depth of 100.

ON the "Wiegand," Leine River, B.C., the new shaft is down 35 feet. The vein, which was 2 feet wide at the surface, is now 5½ feet, and shows good color.

CAPT. R. C. ADAMS, of Montreal, has recently opened several quartz ledges in the Okanagan district, B.C., containing free milling gold; also at Boundary Creek.

THE vein of clean ore on the "Antoine," Slocan district, which was only 10 inches wide, has been stripped, until it now discloses a width of two feet.

THE Calabogie Mining Co have elected the following as officers: J. G. Campbell, president; Peter McLaren, vice-president, and J. A. Allan, secretary.

R. E. WALKER is to shortly put down another gas well at Caledonia, Ont. The supply in the other wells appears to be increasing rather than diminishing.

DR. DE BERTRAM and other capitalists have secured large areas of coal lands near the head of Grand Lake, and propose to open up these as soon as their proposed railroad to Fredericton is completed.

THE Oromocto, N B., Coal Mining Company have elected the following officers: Edward Moore, president; Wesley B. Nason, vice-president; Parker A. Nason, secretary; and Luke C. Dewitt, treasurer.

AT Point Ann quarries, near Belleville, Ont., about 35 men are working at present. A Morrisburg firm will shortly put on about 75 men to get out about 20,000 yards of stone for use on the Cornwall and Williamsburg Canal works.

THE line between the Reco and Goodenough, B.C., crosses what is know as the "new find" on those mines at the widest part of the ledge, and as the ore is very high grade the ground is very valuable, being worth not less than $500 an inch.

THE Broad Cove Coal Company are progressing favorably with their work. They are nearly through with the sinking of a shaft to the coal deposits, and are busily engaged in a railway from the shaft to Loch Leven, which is the site of their harbor.

BEN. FINNELY reports that the group of mines going under his name in the New Denver, B.C., district is showing up to their best expectations. He and his partners have run a tunnel in 95 ft., all in concentrating ore. There are 70 tons of shipping ore on the dump, and three feet of it in the breast of the tunnel.

THE Strathern company has been doing a considerable amount of prospecting on their group of mines at Fairview, B.C., and has suspended work till spring. The prospects on the Brown Bear and other mines owned by the company are decidedly good.

THE "Divide" claim on Kruger Mountain, near Vernon, B.C., will be worked next season. Average samples give $18 in gold, 77 per cent. of which is found by pan amalgamation to be free. The gold is very fine, and is disseminated through the rock.

FRANK C SMITH and three other men who have been working on the "Baby Mine," near Perth, Ont., secured about three tons of mica in a fortnight recently. It is stated that work will be resumed shortly on another mica mine, known as "Walker's," in the same neighborhood.

THE S. & G. N. Mining Co. have sunk the new shaft of the Skylark down 90 ft. on the vein, and they will continue it another 10 ft. Three assays, on ore taken at a depth of 75 ft., gave respectively 268 oz. of silver and 1 oz. gold; 766 oz. silver and 1 oz. gold, and 780 oz. silver, 1 oz. gold.

THE present volume of business in phosphates is not very large, and for the most part the industry is not flourishing. The prospects for its future, however, are rapidly brightening, and a well-known capitalist is authority for the statement that eventually a home market will be opened for phosphate in Quebec and in the West. Its use is increasing largely.

AT Fairview, the Morning Star mine, owned by McEachren & Mangott, is running night and day. The ore is free milling, and 17 tons are run through a ten-stamp mill every 24 hours. For the past five weeks the results have been $350 a day in gold. The vein is 12 feet thick, and averages all through $15 a ton. A few days ago a rich pocket was struck resulting in one day's run of $1,000. The ore only costs $1 a ton to mine and deliver at the mill.

THE Tulameen Mining Co. (Ltd.), Ottawa, capital stock $20,000, are applying for incorporation. Their object is to work and develop mineral lands in British Columbia, and to acquire vessels, construct telegraph lines and other works necessary for the company's requirements. Among the applicants are W. Lovitt Hogg, Montreal; A. W. Fleck, of Ottawa; Barclay Stephens, Montreal; W. D. Powell, C.E., of Ottawa, and C. B. Powell, of Ottawa.

NOVA SCOTIA'S output of coal during 1894 was 2,055,1 4 tons, an increase of 86,500 tons over 1893. Of this total 1,170,000 tons were from Cape Breton mines. While the Cape Breton mines show an increase of 132,320 tons, the Pictou and Cumberland collieries show a decrease of 50,000 tons. The export to the United States exceeded 12,000 tons, an increase of 11,000 tons over the previous year.

S. J. RITCHIE, a wealthy capitalist of Akron, O., who did much toward the development of the Sudbury, Ont., nickel mines, recently presented a memorial to the U. S. House of Representatives, wherein were contained some very serious charges against Judge A. J. Ricks, of Cleveland, O., and others. Mr. Ritchie avers that in 1889 he was negotiating for the sale of the Sudbury properties for $15,000,000, and that his associates then conspired to rob him, and that they were aided by Judge Ricks (and others in high positions, cited in the memorial), by means of the corrupt use of judicial power.

THE War Eagle Mining Company has been incorporated under the laws of the State of Washington and will be registered in British Columbia in due course. D. Clark is in charge of the works, and is working on both drifts, turning out 50 tons a day. In a few days stoping will commence, and the output then may be anything up to 150 or 200 tons per day. The question as to the transport out of the camp of this mass of ore is now anxiously being discussed Mr. Robins has been appointed assayer at the War Eagle, and an assay office, boarding house and ore chute, are being put in. On clearing the ground for a road near the ore chute a body of ore fourteen feet wide was disclosed, which appears to be of the same nature as in the tunnel.

THE Ontario Mining Institute held a meeting in Kingston on the 3rd and 4th January. Among the papers read were Dr. Goodwin's on "Nature's Concentration of Minerals"; one by T. L. Walker, on "Dykes in the Sudbury Region"; one by Mr. McKellar, on "The Silver Mines of Thunder Bay"; by Mr. Millar on "Ontario Rocks"; by Dr. Coleman, on "Gold in Ontario, and its Associated Rock and Minerals"; one by Prof. Nicol, on the "Compounds of Boron," and one by Mr. Miller, on "Iron Deposit in the Glendower Mine." A good deal of ordinary business was also gone through with at the different sessions, and the meeting was completed by a banquet at the Hotel Frontenac, at which there were a hundred guests.

THE Jenckes Machine Co., Sherbrooke, Que., have shipped a large hoisting engine 24 x 42 in. to the Dominion Coal Company and a 24 x 30 straight-line air compressor is now being made for the same company. They have also shipped to the Tarbrook, N.S., Iron Company an air compressor and three drills, and a rock crusher for the C P.R. at Vancouver. This company are now getting ready a rock-crushing plant for the road department of the city of Sherbrooke.

Railway and Marine News.

THE C P R have decided to take over the Nakusp and Slocan Railway at once.

THE Aylmer branch of the C.P.R. will probably shortly be taken over by the Pontiac Railway.

A PROJECT is on foot to establish a direct steamship service between Montreal and St. Johns, Nfld.

THE Dominion Government contemplate the building of a large wharf along Barrack street, Kingston, Ont.

WILLIAM EVANS, of Deseronto, has been appointed inspector of hulls, in the place of Capt. Harbottle, deceased.

THE Lower Fraser River Navigation Co. (Ltd.), Westminster, has been incorporated with a capital stock of $15,000.

A COMPANY is applying for a charter to build a railway from the Taku River to Lake Teslin, in the Yukon mining district.

THE Dominion Atlantic Railway Co contemplates the construction at an early date of a branch line to Kempt *via* Carleton.

THE contract for the construction of the Dartmouth branch of the I.C.R. has been awarded to Daniel McGregor & Son, St. John.

CAPT. BLOOMFIELD DOUGLAS, of the Marine and Fishery Department, has succeeded in putting the tidal gauge in operation at Father Point.

THE Mullen-Gatfield Co. are about to build a dock on the river at Amherstburg, Ont. It is to be 450 feet long and one of the finest on the river.

THE keel of the new steamer for the International line, now being built in Bath, Me., is more than half laid It will measure about 256 feet in length.

WORK is going on apace on the new incline railway at Hamilton Tenders are now being asked for ties and rails. The formal opening is promised for May 24th.

THE Kingston & Pembroke Railway Co. are applying to the Dominion Government for power to sell or lease the line, and to extend the time in which it and its branches may be completed.

THE Bangor and Aroostook Railroad Company have appointed O. Stewart superintendent of motive power and equipment, and J. W. Comins as superintendent of bridges, with headquarters at Oldtown, Me.

THE Buffalo and Fort Erie Bridge Co. are applying to the Dominion Government for an extension of time in which to complete their works; also for power to change its head office to Niagara Falls.

ARCHIBALD NICOLL has been elected president of the Marine Underwriters' Association, to fill the vacancy caused by the death of John Popham. E L. Bond was elected vice-president and J. H. Routh, treasurer.

THE new Newfoundland railway has been completed to Sandy Lake. Work is not now going on, but will be resumed next spring. It is hoped to reach Bay Island and part of the distance to Port-au-Basque during the summer.

THE Louisburg Railway is expected to be completed this month Work has started on a new iron bridge over Nicholson's brook, about five miles from Louisburg. It will be 350 feet long and 60 feet high in the centre.

THE Ste. Emilie Railway Company are applying for incorporation for the purpose of constructing and operating a line from St. Gabriel de Brandon to St Michel des Saints, passing through St. Damien, Ste. Come, St. Zemon, etc.

THE contract for the first section of the Balsam and Simcoe Lake section of the Trent canal was signed at Ottawa a week or two ago, and the contractor, Andrew Onderdonk, intends to proceed with work immediately. With regard to the Lakefield section, R. B. Rogers and his staff are rushing the survey work, preparation of plans, etc. The survey of the river from Lakefield to Nassau is completed.

No steps have been taken so far to go ahead with the construction work on the Vernon and Okanagan, B.C., Railway. The charter calls for its commencement before April 1st, 1895, and for its completion within one year from that date.

THE bondholders of the Canada Shipping Company, generally known as the Beaver Line, have offered the creditors 37½c. on the dollar for their interest, rather than have the cost of winding-up incurred. The proposition is under consideration.

AT Montreal and at various other points along the line of the C P.R. between four and five thousand men have been thrown out of employment, owing to the company's decision to cut down expenses. The reduction of hands applied to nearly all departments.

THE Victoria, Vancouver and Westminster Railway Co. have been incorporated, with power to build a line from a point near Garry Point on the Fraser River, through Richmond, South Vancouver and Burnaby to Westminster, with a branch to Vancouver.

DAWSON & CHAPLIN, of St. Catherines, N.S., have the contract for the construction and equipment of the railroad from Orangedale to Broad Cove, C.B. The road will be the property of the Boston and Nova Scotia Railway Co., who own the mines at Broad Cove.

THE United Counties Railway Company have just added to their rolling stock a new Russell Wing snow-plow and another engine. They are putting in their shops at St. Hyacinthe, Que., some new wood-working machines, supplied by John Bertram & Son, Dundas, Ont.

THE R. & O. N. Co 's S.S. "Magnet" will be rebuilt during the winter at Sorel, Que Her berth capacity will be increased to 160 passengers, a new engine put in, the cabin refitted, and patent feather paddle wheels put in. The probable cost of the alterations will approach $15,000.

THE Delta, New Westminster & Eastern Railway Co. have been granted a charter to build a line from a point on the Gulf of Georgia to New Westminster, with a branch line from some point in Delta municipality, through Surrey, Langley and Matsqui, to some point near Abbotsford.

THE Canada Southern Railway Co. (Michigan Central) will shortly begin the construction of a branch line from a point on their main line west of Wainfleet to the peat beds close by. This is likely to greatly enhance the value of the large beds of peat controlled by the Ontario Peat Fuel Co.

THE Columbia & Kootenay Railway & Navigation Co. are applying for a renewal of the charter to build a branch from their main line to run north through the Slocan country and connect with the Nakusp & Slocan Road. If granted, construction will commence in two years and be completed in five.

THE Red Mountain, B.C., Railway, which has a charter to build a road from the international boundary line near Sheep Creek to Red Mountain and Trail Creek mines, is applying for power to change the gauge from standard to narrow, and to extend the time in which to start construction work till April, 1897.

THE Calgary & Lethbridge Railway and Irrigation Company are applying for incorporation, with power to construct a line from Calgary to Lethbridge, and thence to the international boundary; to construct and operate a telegraph line in connection with it, and to sell or lease the railway and telegraph lines to any other company.

THE Boston & Aroostook Railway extension has proven so successful that the Boston & Maine Railroad Company are contemplating bringing the line into their system. The means which will be most probably taken to effect this will be the purchase of the road by the Maine Central, which is under the control of the Boston & Maine.

THE North American Transportation Co. will establish, in the summer, a bi-weekly line of first-class Clyde built steamers, with a capacity of 19 knots per hour, to ply between Paspebiac, at the mouth of the Baie des Chaleurs, and St. John's, Nfld., calling at the Magdalen Islands and St. Pierre Miquelon. A branch line will ply between Paspebiac and Gaspé Basin.

MR. MERRITT, Dr. De Bertram, and a number of other capitalists, who recently purchased the railway between Buctouche and Moncton, have raised the necessary capital for extending the line to Richibucto and build a "railway ferry," should the Dominion Government decide in favor of that sort of connection with the Island in preference to a tunnel. They also have in contemplation the purchase of the Central Railway, and arrangements are now being made whereby this line will be extended to Fredericton, provided the Dominion Government will complete its subsidy for construction to that point.

THE Port Colborne & Fort Erie Railway Co. has been provisionally organized, with the following interim directors: Wm. R. German, of Welland; R. G. Cox, of St. Catharines, Ont; Eugene Coste and A. J. Holloway, of Buffalo; and D. McGillivray, L. McGlashan, and Thos. F. White, of Port Colborne. Work will be started as soon as the Government grants the charter.

IT having been stated by a London financial paper that the Chignecto Railway Company had failed to provide capital, A. D. Provand, a director of the company, cabled over to this country to the effect that this was incorrect, and that the capital was ready in waiting for the Canadian Government to grant the extension of time needed for the completion of the work.

IN a storm on the Atlantic last month the Dominion steamship "Sirnia" lost her rudder, and drifted helplessly about until taken in tow by an Anchor Line vessel, and finally, after she had parted from that vessel owing to the breakage of the hawsers, by the Allan liner "Norwegian." The passengers had a terrible experience, but finally the vessel came to port without much damage having been done.

THE Dominion Coal Co.'s railway to Louisburg, N.S., was formally opened last month. A large pier is being constructed at this place, and the operation of shipping coal to Boston on a large scale will be commenced at an early day. The Dominion Coal Co. will, on its completion, be able to ship coal from Louisburg to Boston throughout the winter, and thus keep their mines in full operation all the year round.

THE Richelieu & Ontario Navigation Company's net earnings during the past year amounted to $164,000, or about 11½ per cent. on the capital. The amount carried to profit and loss is $43,000, after allowing for interest and fixed charges and paying a 6 per cent. dividend. The net earnings for 1893 were $27,287. So, as will be seen, the progress has been immense. The bonds of the company have all been sold to Coates & Co., London, the price realized being 95.

A TRESTLE bridge just constructed by the Toronto, Hamilton and Buffalo Railroad, near Dundas, over Binkley's Hollow, collapsed last week, three men being badly injured. Loss about $10,000. The company has taken out a libel action against the Hamilton *Spectator*, owing to some remarks by that journal to the effect that the bridge had been badly and cheaply constructed.

THE Taylor Hydraulic Air Compressing Co. (Ltd.), Montreal, capital stock $500,000, are applying for incorporation for the purpose of acquiring the invention patented under the No. 46,092, Canadian letters patent, and to manufacture and deal in the same. The applicants are C. H. Taylor, M.E., H. Millen, W. T. Ross, J. R. Fair, R. L. Murchison, R. W. Sutherland and H. Mallet, all of Montreal; W. H. Campbell, Belleville; J. G. Fitzgibbon, Norwood, and D. T. Ritchie, of Kilbinside, Scotland.

THE Toronto Harbor Master's annual report for 1894 shows that the number of arrivals at the port was 2,618, or 41 in excess of the previous year. This increase, however, was in steamers, the number of schooners having decreased by 158. There was an increase in receipts, especially in fruit and grain, while there was a falling off in general merchandise and in stone and brick. The amount of coal received by vessel was 137,597 tons, 11,312 in excess of 1893; amount received by rail was 385,512 tons.

THE Richelieu & Ontario Navigation Company have won in another stage of the now famous case which has been under procedure for some time past between them and the insurance companies, *re* the burning of the S.S. "Corinthian." The liability of the insurance companies being disputed, the case was carried into all the courts, in all of which the Richelieu company came out victorious. Finally the insurance companies gave notice of appeal to the Privy Council, but they have now decided to forego this, and to pay the amount claimed, viz., $40,000, to the company, together with all costs.

EUGENE MALO, John Chaffers, and P. Poulin, of Montreal, A. F Savaria, of Waterloo, and Dr. Cartier, of Ste. Madeleine, are applying for incorporation as a company under the name of the Chateauguay and Northern Railroad Co. for the purpose of building a line from Montreal to New York, thence northerly to some point in Soulanges county, thence northeasterly across Montreal Island and continuing to some point on the Great Northern in Joliette county. The company have a subscribed capital of $200,000. The time between Montreal and New York would be reduced by this line by about six hours.

THE Shore Line Railway, Nova Scotia, have elected the following officers: President, R. J. Cross; vice-president and managing director, H. H. McLean; chairman of executive committee, Russell Sage. The company have decided to apply to the Maine Legislature for an act incorporating them in that State, and for power to extend the road to the Bar Harbor branch of the Maine Central Railway; also to extend the road into St. John, east side, and from thence through the county of St. John, via Loch Lomond, to connect with the St. Martin's & Upham Railway; also for power to amalgamate with or purchase the St. Martin's & Upham Railway and the Central Railway.

THE Richelieu & Ontario Navigation Co. are about to build a magnificent new steamer to ply between Montreal and Toronto, owing to the inadequate accommodation provided last season for the increasing rush of business. The new boat will be a handsome steel steamer about 160 x 40 feet in dimensions, with a tonnage of about nine or ten hundred and a passenger accommodation for 250 people. All modern conveniences will be provided in lighting, heating, ventilating, furnishing and all high class accessories to comfort. The new steamer has not yet been named, but she will be launched as soon as navigation opens in the spring. This steamer is merely a beginning of a series that the company intends building in order to meet their ever increasing business. The steel for the new one in construction will be brought from Pittsburgh, Pa., and its cost is to be $200,000.

NOAH L. PIPER & SON, Toronto, are putting on the market a patent tricolor head light. Among the advantages which are claimed for this invention are the following: The case being round, it offers no resistance to the wind; all changes in color are made from the cab of engine, it not being necessary to go out to the headlight; it is fitted with a turntable, allowing the reflector to be turned facing the door, where it can be cleaned without being taken from house: the door having two arm holes, the lamp can easily be lighted in the highest wind. When the engine is on siding, a bright green light is shown forward by turning inside drum to right. When the engine is disabled on main line, a bright red light is shown forward by simply turning the inside drum to the left. The lights are fitted with metallic numbers hung against white ground glass, and show up very distinctly both by day and night. Any number up to 999 can be immediately placed on front, and figures can be moved and any combination made.

THE Quebec Government have granted a year's extension of time for the completion of the following railways: 1. The Lake Temiscamingue Colonization Railway Company. 2. The Lotbiniere and Megantic Railway Company. 3. The Great Northern and Lower Laurentian Railway Company. 4. The Baie des Chaleurs Railway Company. 5. The Quebec Central Railway Company. 6. The Orford Mountain Railway Company. 7. The United Counties Railway Company. 8. The East Richelieu Valley Railway Company. They have also decided to grant to the Quebec, Montmorency and Charlevoix Railway a sum of $100,000, provided the company will renounce its subsidy of $302,400 and will erect a suitable terminus in Quebec city; also to the Pontiac and Pacific Junction Railway Co. the sum of $110,000 provided they renounce the subsidy of $172,920. The amount to be expended in purchasing the C.P.R. branch from Hull to Aylmer, in continuing the line as far as Hull, east, where a station is to be built, and in completing the last section as far as Waltham, near Black River.

Electric Flashes.

THE Kingston Electric Railway are to have another sweeper put on shortly.

THE purchase of an electric light plant for Ripley, Ont., is being considered by the village council.

THE Hamilton City Council is about to apply for legislation to empower it to own and operate electric railways.

MCLACHLIN BROS. recently purchased a timber limit on the Wenoway from Barnet & Mackay, of Renfrew, for $160,000.

AN extension of the Brantford, Ont., Street Railway to Lovejoy's Park, near Cairnsville, was formally opened last month.

THE Montreal Park & Island Railway Company have decided to go on with the work of extending their line to St. Laurent this winter.

THE Bell Telephone Company have been awarded the contract for the erection of a system of electric fire-alarm for Chatham, Ont., to cost $1,210.

FRANK DRYDEN, Toronto, contemplates putting in a new dynamo and electric plant in Napanee, to furnish lights to subscribers for two cents a night.

Two hundred and sixty of the electric lamps contracted for by the London Electric Company for the purpose of illuminating that city are now in operation.

THE armature at the electric light works at Galt, Ont., was burned out the other night, and the hill circuits were in darkness. The loss will be over $500.

THE H. G. & B. Electric Railway Company has secured the contract of carrying the mails between Hamilton and Bartonville, Stoney Creek and Fruitland.

THE hydrostatic test asked for in the specifications for the new electric light machinery installed at Victoria, B C., has been made, and was pronounced satisfactory

THE Westminster, B C., and Vancouver Tramway Co.'s property is advertised for sale by auction at Westminster on April 15th, by the Montreal Safe Deposit Co

M L. RUSSELL and some Ottawa capitalists are about to set up another electric light plant in Renfrew, Ont. This will make the third electric light company in that place.

MERRICKVILLE, Ont., electric light plant, owned by E. Kyle, was last month destroyed in a fire which broke out in the Malleable Iron Works. Loss, $2,800, no insurance

THE rebuilding of the Montreal Street Railway Co.'s offices, which collapsed recently, will be entrusted to Mr Price, of New York, and Mr Hammond, of Cleveland, architects.

THE tender of the Thompson Electric Co., Waterford, Ont., for the electric lighting of Toronto Island by means of a 50-arc light dynamo and complete outfit, has been accepted, the price being $1,000

THE annual meeting of the Montreal Electric Club took place last month The following officers were elected. President, W B. Shaw, vice-president, Mr Edwards, secretary-treasurer, Cecil Danton.

THE Bangor, Orono and Oldtown Electric Railway Co. have practically accepted the proposition of the Worcester Construction Co to construct their line. The equipment is to consist of 12 cars and the road is to be in operation by August 1st.

THE Montreal Junior Electric Club held their annual election of officers last month, with the following result. President (re-elected), E W. Sayer, vice-president (re-elected), Wm T. Sutton; treasurer (re-elected), R H. Street, and secretary, E A. Brissette.

LA Campagnie de Telephone des Comtes de St. Maurice, Champlain and Trois-Rivieres, headquarters at St. Boniface de Shawenegan, capital stock $2,000, are applying for incorporation, for the purpose of operating a telephone line in those counties, and building a waterworks at Shawenegan.

MONTREAL Electric Street Railway Co. are rapidly learning by experience the best method of coping with snowstorms. We noticed that on the day of the big snowstorm, Jan. 26th, the cars were all running during the afternoon, which was a great improvement on what happened on a similar occasion during Christmas week.

Two Bay City, Mich., capitalists are trying to organize a company for the purpose of building a street railway in Stratford, Ont., extending it, if feasible, in the now well-known "radial" manner, to Shakespeare, Ammerée, Wellesley, Rostock, Sebringville, Avonton, Brooksdale, Harrington, Youngsville and Tavistock. They are willing to advance 30 per cent of the required capital, and hope to raise the bulk of the remainder in Stratford.

RECENT GERMAN PATENTS.

Compiled at the Patent and Technical Office of Brockhues & Co., Cologne Information on all questions referring to this list is given gratis to subscribers of THE CANADIAN ENGINEER

"Helios," Cologne-Ehrenfeld, arc light reflector. Electric Light and Telegraph Building Co

Paul Spitzeck, Linz a Rh., rope railway carriages for sectional haulage by machinery

Joh. Vaillant, Remscheid, bath stove.

Lothar von Koppen, Kraling, near Munich, instrument for dividing angles.

R Volk, Ratzeburg, free-standing apparatus for microscopes.

August Wickel, Barmen, elliptical compasses

Paul Frauenholz, Berlin, means for the manufacture of bricks from furnace slag

Hugo Kohl, Dusseldorf, apparatus for separating water from steam

Heinr. Wehner, Frankfort a M., apparatus for printing and controlling tickets.

J. A. Essberger and the Union Electricity Company, Berlin, subterranean currents for electric railways.

Ed. Penning-Dupuis, Halle a S., apparatus for moving the points on tramways.

Ernst Kneipp, Offenbach a M., press for the manufacture of seamless pouches for purses, bags, etc.

W. Weyhe, Bremen, fire-proof ceiling.

Al. von Stechon, Allenstein, East Prussia, sword with sheath capable of being taken to pieces.

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 H. B. Willson & Co., Washington, D.C.:—

Andrew C. Davidson, St. Thomas, Ont., pneumatic tire for bicycles

J R. Eden, Berlin, Ont., car coupling.

Stanley C Peuchen, Toronto, assignor of one-half interest to P. Clarke, apparatus for vaporising petroleum or other liquids.

Jonathan J Hamilton, Neepawa, Man., means for changing motion.

John W. Wallace, Port Hope, Ont., can-labelling machine.

Daniel Crough, Ennismore, Ont., clover-seed attachment for mowers.

J R. McConnell and J. A. VanWart, St. Mary's, Fredericton, N.B., safety attachment for cars.

David A. Gordon, Wallaceburg, Ont., barrel levelling and trussing machine.

Robert H. Laird, Toronto, assignor to W. H. Laird, New York, N Y., apparatus for making and purifying gas.

Owen McShane, Montreal, device for attaching clothes to clothes lines.

G. Cochrane, St. Thomas, Ont., wire-weaving fence-machine.

John H. Wynne, Montreal, assignor to Gurney Foundry Co., Limited, Toronto, hot-water heater.

Charles R Austin, New Westminster, B.C., machine for capping and crimping cans.

Pierre Dansereau, Montreal, roller-bearing.

John H. Thamer, Roseville, Ont., adjustable bag holder.

REVIEW OF THE METAL TRADE.

MONTREAL, Jan. 31st, 1895.

The hardware trade are now beginning activities for the coming season, travellers now being pretty generally on the road. The prospects so far are unfortunately by no means encouraging. One of the great difficulties encountered is the lowness of the freight rates into western points, which places points in Quebec province in a disadvantageous position. The present rule of low prices in the States, and, as above-stated, the low freight rates from western points to Hamilton and other Ontario cities, together compel the manufacturers here to reduce their prices considerably in order to meet the competition. The wire manufacturers have recently made large reductions in their list prices, the low rates obtaining in the west unfortunately rendering this unavoidable.

The Patent Review.

46,445 James Mellon, Montreal, tie lifter and rail adjuster.

46,448 H. E. Smyser, Philadelphia, Pa., package-making machinery.

46,451 J B McCurdy, Joplin, Miss., combined surface condenser and feed water heater.

46,454 K W. Blackwell, Montreal, car truck.

46,457 R. W. Mayhew, St. Louis, Mo method of and apparatus for forming joints between blocks of concrete or artificial stone.

46,459 J. A. Brill, motor truck.

46,460 Dodge Wood Split Pulley Co., Toronto, friction clutch.

46,461 Irwin P. Doolittle, Los Angeles, Cal., coupling.

46,462 Wm. Walker, Birmingham, F. R. Wilkins, Handsworth, and Jabez Lowes, Smethwick, Eng., primary voltaic batteries.

46,469 James B Smith, Ingersoll, Ont., machine for crimping wire.

46,470 Joseph H. Savill, Philadelphia, Pa., coupling for water closets.

46,473 D McGill, Wellington, New Zealand, method and means for compressing gases.

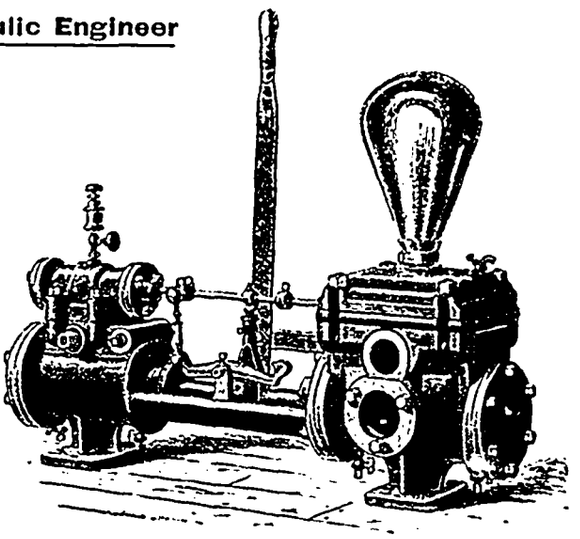
R. H. BUCHANAN & CO.

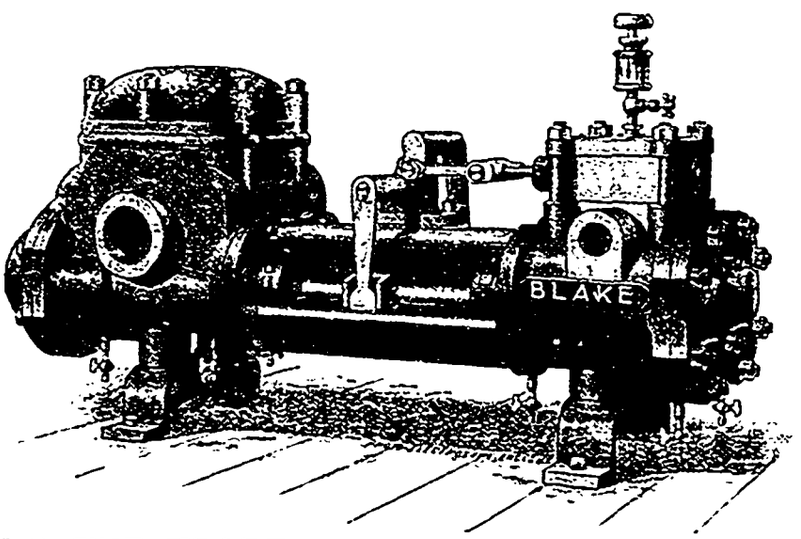
W. PERRY, Hydraulic Engineer

SELLING AGENTS FOR CANADA

FOR THE

GEO. F. BLAKE MFG. CO.





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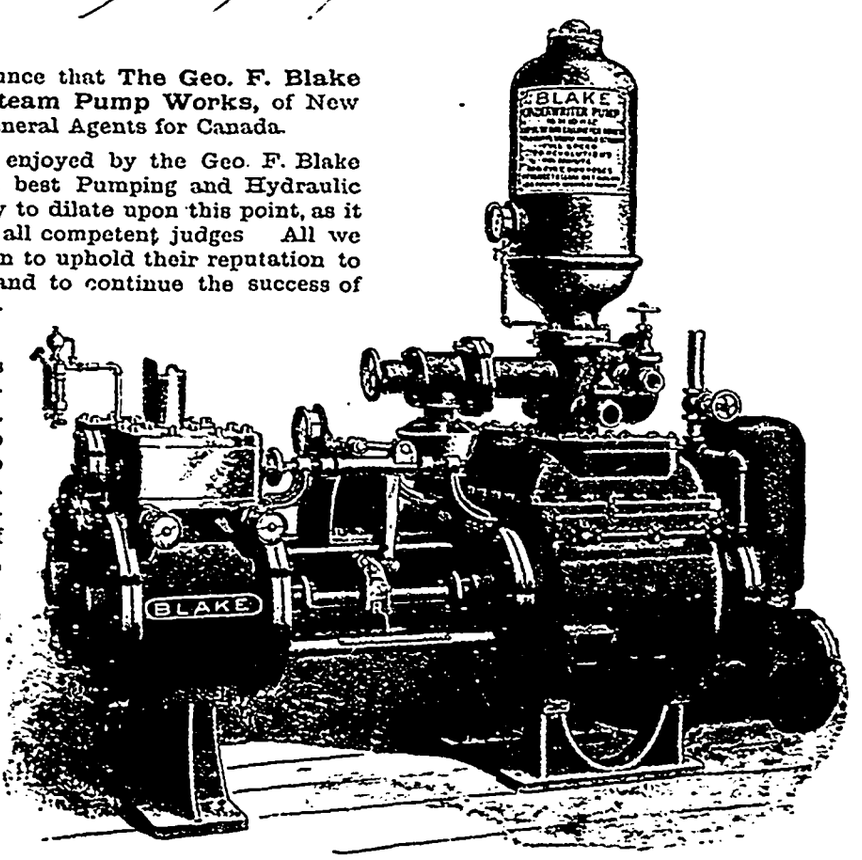

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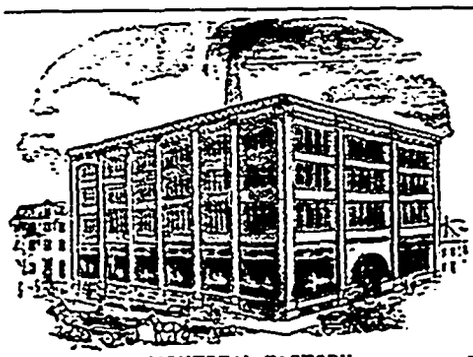
MONTREAL

46,475 H. H. Forsyth, Chicago, railway car seat.
46,476 Sarah E. Pedler, coating for metal building.
46,477 Muskegon Chemical Fire Engine Co., Muskegon, Mich., fire extinguishing compound.
46,481 F. Meyrose, St. Louis, Mo., stove.
46,482 F. B. Comins, Providence, R.I., fire pail
46,486 J A Lynch, St. Louis, Mo., flexible pipe coupling.
46,489 E. Death and E. W. Wyatt, Toronto, automatic railway gate and signal.
46,490 P D. Murphy and E. Knobb, Lockport, N. Y., sprocket wheel.
46,493 B. C. Pettingell, Victoria, B.C., explosive
46,496 P. Rabbidge, London, Eng., telephones.
46,497 J B. Robertson, Belfast, Ireland, driving mechanism for velocipedes
46,500 J A. Hunter, Philadelphia, method of converting iron and steel.
46,501 G. H Sellers, Wilmington, Del., twisting machine.
46,510 C C. Kahne, G. F. Kahne, A. A. Adkins, and A. Worley, of Ashland, Ky., railway signal.
46,511 C. H Jeune, Indianapolis, Ind., and the Mechanics' Development Co., New York, railway rail.
46,512 J H. Stoll and Geo. Stoll, of Hutcheson, Kan., force pump.
46,520 J R Gordon, Sudbury, and Angus W. Fraser, Ottawa, ore crusher.
46,522 J. D Smead, Toledo, O., furnace.
46,528 R. F Hall, Birmingham, Eng., driving chain
46,530 J G Smith, Montreal, gas governor.
46,533 J. Fisher, Matlock, Eng., railway signal wire compensator.
46,535 Jos Coles, Aspen, Col., flue expander and beader.
46,538 D L. R. Rochlitz and F. E Wolter, Hamburg, Germany, pipe union.
46,543 M. Thibault, Ottawa, lifting jack.
46,548 Thos Craney, Bay City, Mich., air-feeding device for furnaces
46,549 J. Dean, Detroit, Mich., steam boiler feeder.
46,555 James H. Swindell, Readsville, Ga., car coupler.
46,557 D. Spencer, Roanoke, and P. H. Cooke and E. D. Quarls, Richmond, Va., piston packing.
46,559 Thos Talbot and A B. Charron, Mattawa, Ont., hand car.
46,562 C. H. Davids, Brooklyn, and J Stewart, New York, variable crank.
46,570 G. E. Edwards and W. Hartwell, Brantford, Ont., danger signal and lock switch.
46,573 F H. Sleeper, Coaticook, Que., alternating current transformer.
46,577 T.W. Norman, Boston, Mass., art of covering insulated wire
46,581 W. Drain, Prince Albert, N.W.T., portable engine.
46,587 J. Doster, Montreal, hose coupling.
46,592 L Julia-y.-Puig, Guayaquil, Ecuador, South America, propeller.
46,593 T. W. Paterson, Victoria, B.C., track-laying machine.
46,597 J Dryelt, St. Thomas, Ont., angle cock for trains.
46,598 F H. Crafts, Buffalo, N Y., driving mechanism for machinery.
46,604 Charles Thackeray, Montreal, furnace grate.
46,607 Canadian General Electric Co., Toronto, dynamo electric machine.
46,608 Consolidated Car Heating Co., electric heater.
46,616 T. W Moran, Louisville, Ky., pipe coupler.
46,625 A. G. Fell, New York, method of treating lead ore.
46,629 E R Besemfelder, Breslau, Germany, method of separating metals from ores.
46,630 J. C. Montgomerie, Dalmore, Scotland, process of extracting gold and silver.
46,636 H. Wolff, Karlsruhe, Germany, safety mining lamp.
46,642 H. Henderson and L. J. Kenngott, Buffalo, N.Y., pattern for casting pipe.
46,643 N B. K. Hoffman, New York, valve for air-brake.
46,644 Metallic Roofing Co, Toronto, metallic shingle
46,647 G E. Hudson, Geo Sanderson and W. J. Baker, all of Scarboro', Eng., water heater and purifier.
46,648 J. E Crawley and Thos. F. McGregor, Milwaukee, feed water heater, &c.
46,650 D. S. Macorquodale, Toronto, car fender.
46,655 C. E. Beaumont, G. P. Wallington, and L. A. Wallington, London, Eng., steam motor or pump.
46,659 C D Jenney, Center Township, Ind., electric railway.
46,660 H A Williams, Boston, Mass., wire rolling mill.
46,663 Jas. Allen Lowe, North Branch, N. J., wrench.
46,667 H. V. Smith, Hartford, Conn., tool holder.
46,668 J. W. Wulff, Blair, Neb., combined wrench and rod vise.
46,670 Jos A. G. Trudeau, Ottawa, electric heating device.
46,679 L. Moore, Baraboo, Wis., car coupler.



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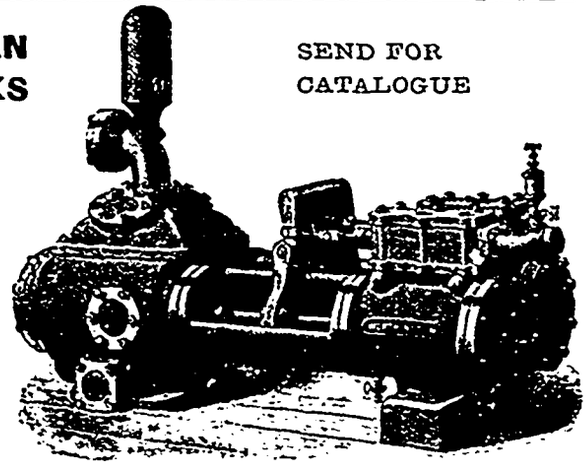

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