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THE LATE CHEVALIER BAILLAIRGE.

The late Gonezague Baillairge, Q.C., Grand Commander of the Order of Pope Gregory the Great, and Count of the Roman Empire, was born at Quebec in 1806, and died at the age of 88 in a house in Ferlond street, which he had occupied for 84 years. The house contains many objects of interest, such as Louis XV. furniture, books, papers and pictures, covering a period of the last 300 years. Mr. Baillairge's grandfather, who was an architect and engineer, came to Quebec in 1741. The Chevalier Baillairge was educated at Quebec Seminary from 1822 to 1830, where he was a fellow student of Sir R. Caron, since Lieut.-Governor of the Province of Quebec. When the latter was elevated to the bench Mr. Baillairge was made city solicitor for Quebec, which position he held for 46 years.

In 1842 he was one of the founders of Jean Baptiste Society, and in 1848 of the Canadian Institute. He was also one of the founders of *L'Courier du Canada*, 1857. He was offered the position of judge during the sitting of the Seignorial Tenure Commission in 1855. The Recordership of Quebec was offered him in 1856, the position of judge in 1860, and after the death of Judge Power, he was offered a seat on the bench of the Superior Court. He became a Queen's Counsel under the Dorion Administration, and was Battonier of the Quebec Bar in 1876. The good deeds of the Chevalier Baillairge have been as great and widespread as his long life and considerable wealth enabled him to make them. Five mission chapels have been built in different parts of the world—Central Africa, Australia, China, Labrador, North Africa, and Palestine—besides many gifts of large amounts to different churches, chapels, universities and public institutions in Canada. The late Mr. Baillairge left a fortune of about $250,000, of which $100,000 will be taken up by these and other charitable bequests, the remainder to be divided up among the two nephews and three nieces of the deceased.

It will be remembered that T. B. Baillairge, the brother of the deceased, was city surveyor of Quebec, dying in 1865, when his son Chas. Baillairge, the present city engineer, succeeded him.

ELECTRIC TRACTION ON RAILWAYS.

BY J. H. KILLEY.

It is difficult to move people out of the beaten track, and after fifty years experience of steam traction for railways, it is only natural that the idea of employing electricity as a substitute for steam should be a little slow in making its way. It may not be long, however, before we see most of the railways now operated by steam locomotives adopt electricity as a means of traction, distributing it from a series of central power stations at suitable distances apart. Among the advantages of this system of operation would be the economical production and distribution of power from a station for a stretch of road on each side. There will be a pair of condensing engines, or more economical still, a gas engine, using about one-fifth of the fuel required by the locomotive of the best type. Each pair of engines would handle six passenger or freight trains, thus making two cylinders do the work that now requires twelve, the labor of six engineers and foremen being replaced by that of half that number. The locomotive is not economical either in the production of steam in the boiler or in distributing it as power. In the locomotive the ratio of expansion at slow speed is very wasteful, and under the changing conditions of load and weather it is not possible to run the locomotive economically. On the other hand, the automatic cut-off compound engines attached to the latest design of dynamo placed direct on the shaft, can in most instances be relied upon to generate one horse power per hour per two pounds of coal. The makers of some of the new gas engines guarantee one horse power per hour with less than one pound of coal, using a producer gas plant. In a locomotive usually from four to six pounds coal per h.p. per hour is consumed. It is also claimed that the propelling wheels of an electric locomotive do not slip when overloaded nearly so readily as do those of the steam locomotive.

The speed at which the locomotive can be driven is known to have limits which cannot be safely passed; the speed of a locomotive, twenty-four inches stroke, driving-wheels five feet eight inches in diameter, travelling at sixty miles per hour, would be four hundred feet per minute. With electro-motors, there is not the friction due to the reciprocating parts, and the loss occasioned by the emission and compression of steam. The efficiency of any economical device is limited only by the power given in the design. There would be a consider-

able saving in the absence of the tender with its dead weight of water and coal. This would permit more freight to be carried.

The efficiency of any mechanical device is increased by the reduction of the number of its working parts. In the electric motor there are no parts except those in circular motion. When the armature surrounds the axle of the driving wheel, which is the case in electric locomotives, it is possible to get a very great speed without any vibration. In connection with a main line equipped for electric traction, a system of short branch lines could be operated to advantage by means of storage battery cars, which are now found practicable for distances of 30 or 40 miles in Europe with one charging.

It is said that loss in electrical transmission, which now amounts, it is variously estimated, to from thirty to fifty per cent., can be very greatly reduced by the employment of alternating currents, and step-up and step down transformers. The introduction of improvements will undoubtedly extend the use of electricity. In the meantime, great interest will be taken in the Hull-Aylmer line, whose equipment was described in the last issue of THE CANADIAN ENGINEER, as it is the first step in that direction in Canada.

For THE CANADIAN ENGINEER.

DYNAMO CONSTRUCTION.

BY J. B. HALL, B.A. SC., E.E.

A short description and sketches of a two-light dynamo or one-eighth horse-power motor.

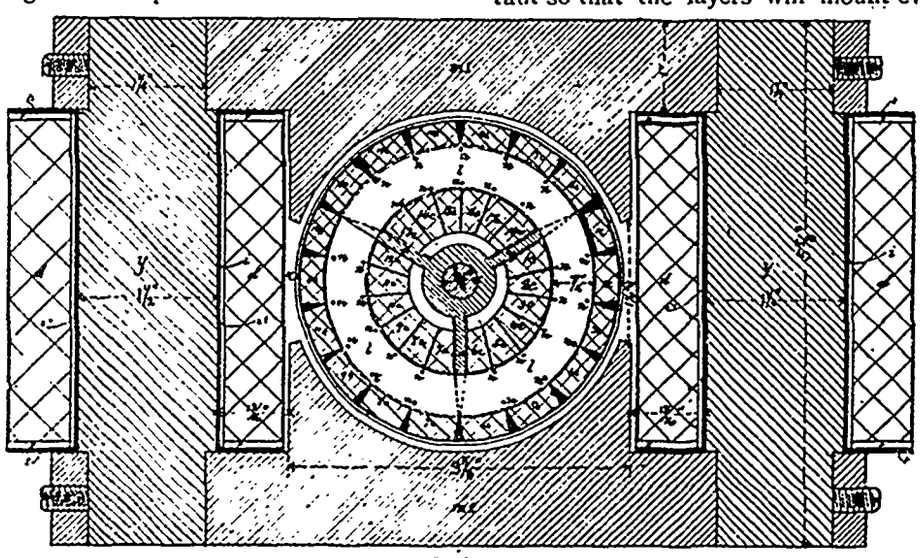


FIG 1.
LONGITUDINAL SECTION.

The following description, with accompanying sketches, is from calculations carefully worked out, and if exactly followed in construction will produce a machine equal in efficiency, durability and appearance to any dynamo of its capacity on the market. Amateur electricians possessed of the usual workshop equipment can manufacture it with little trouble. As it is not the intention to follow the design of the dynamo from an engineering standpoint, the various considerations leading to the selection of the form of different parts, where choice is allowable, will not be discussed, as a tendency in that direction is to make the article uninteresting to the persons for whom it is intended.

The shaft, *b*, is of machine steel, turned and threaded as shown, 10 inches long, $\frac{3}{8}$ inch diameter at bearings and $\frac{1}{2}$ inch diameter at spider, *x*; a hole is drilled in which pin, *r*, is driven, after lock nuts, *z*,*z*, are threaded on. The spider, *a*,*a*. and end, *x*, are of cast brass, three armed (arms $\frac{3}{16}$ inches thick) bored $\frac{1}{2}$ inch diameter to fit shaft, and turned to 2 inches diameter, when on shaft, to receive the laminations, *b*,*b*.

The armature core is composed of sheet iron stampings (termed laminations), Nos. 27 to 34 gauge, three inches diameter outside and two inches diameter inside. The sheets are separated by paper (newspaper will do) of the same shape. They are threaded on the spider, then tightened as much as possible by end *x*, and lock nuts *z*, *z*; when tight, the core *l*, is two inches long as shown; then the surface of *l* is trued up in lathe with a very sharp diamond point tool to $2\frac{7}{8}$ inches, care being taken to prevent burrs from forming across the paper separating laminations. Holes are drilled in ends of core *l*, as shown, *n*,*n*, to receive small wire nails to divide the winding, the nails being withdrawn when the coils *c*, *c* are complete. The core is now ready for winding.

Winding.—Insulate the core and spider with ordinary white tape $\frac{1}{8}$-inch wide, lapping same; then shellac the whole and permit it to dry. Cut eighteen pieces, each 60 feet long, of No. 24 double cotton covered magnet wire; prepare a long and narrow shuttle of fibre or hard wood small enough to go through the inside of core; wind on it the first length. Form two pieces of wood the shape of the coils, and place them on either side of the coil that is being wound, so as to keep the winding in shape. Fasten the beginning of wire on the shuttle to the left hand nail at *lc* (leaving six inches out) facing commutator end, pass the shuttle through between spider *a* and core *l*, keeping the wire taut so that the layers will mount evenly; repeat the process until twenty-three (23) turns are accomplished; the layers inside the ring will need to mount on each other, as there is not room in the space allotted to each coil for the twenty-three turns, side by side; the wire should be evenly wound over the surface. After completing the first layer, wind the second likewise on the top of first back to the beginning, then return over the second layer with the third, and continuing thus until there are six layers of twenty-three turns on the surface, then fasten the end, leaving about 6 inches out. Proceed likewise with the second, third, and so on until the eighteenth coil is finished and the winding closes on itself. After the winding is completed, on the surface is placed a wedge of hard wood, as shown, between each coil to keep them in place; and over all, as shown in Figs. 1 and 2, *w*,*w*, are wrapped bands of thin mica, half inch wide, on top of which the binding wires are wrapped under tension, and while thus are soldered, to hold them in place. The wire nails, *n*,*n*, are with-

drawn, and the whole shellacked and allowed to dry. Care must be taken to keep the tape and insulation perfect—the cotton covering must not be frayed.

To connect the wires to commutator, slip it on shaft tight against nuts z, z, scrape the cotton covering from the wires where they go into slot, take the end of

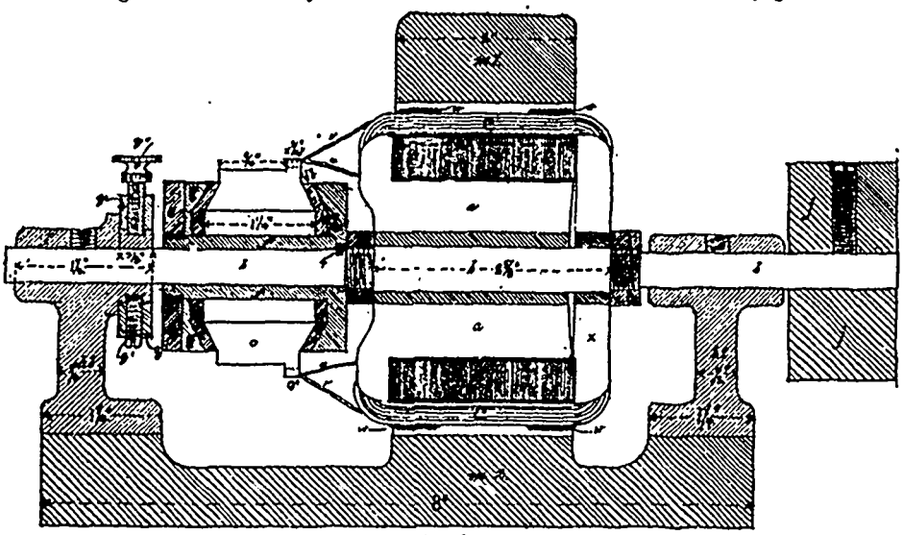
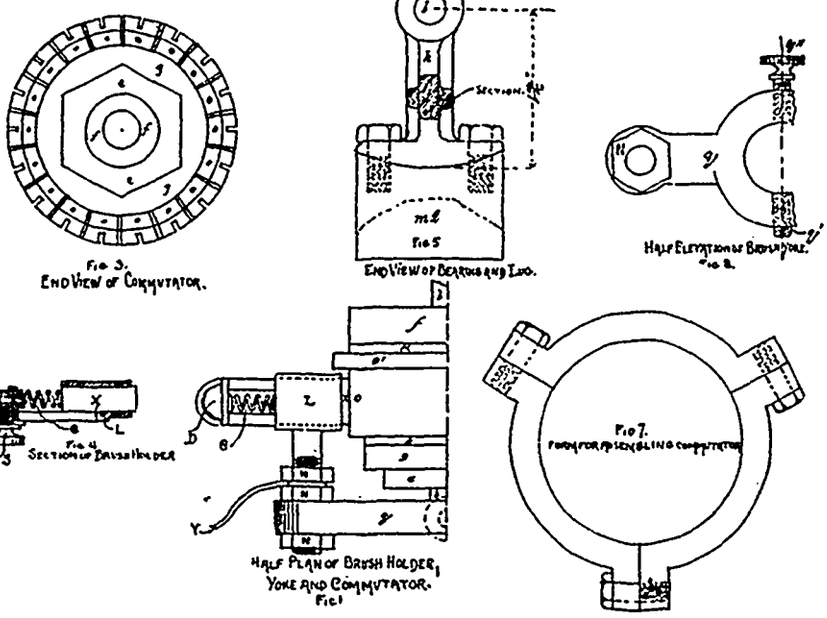


Fig. 2.
Cross Section.

The commutator, e, f, g, k and o, Figs. 2, 3 and 6, is formed of wedge-shaped slips of brass, o with mica $\frac{1}{32}$ inch thick between; the lugs o' are slotted to receive the two No. 24 wires and room for soldering same. The brass segments, o, and the mica insulation, are held together by the core f and collar g tightly pressing against the segments the insulating cone-shaped rings k, k, of fibre or vulcanite, the

coil No. 18 and the beginning of coil No. 1, place them together in the slot that is directly opposite them in segment o, solder them, allowing no solder to touch anywhere but in the slot, then take the end of coil No. 1, and the beginning of coil No. 2, place them in the next slot, soldering them; continue thus around the commutator until all the coils are connected. Be sure no solder is touching the coils or other parts of the machine.



pressure being obtained by hexagonal nut e. The core f, collar g and nut e may be of brass or cast iron. The segments, o, are so wedged that except by a severe blow they will not be dislodged. The core f is bored to fit shaft and slotted to receive pin r, which prevents it from slipping. A form for assembling the commutator is shown in Fig. 7; it is composed of three pieces held by screws, is turned a trifle larger inside than the finished size of commutator; the screws are loosened and the mica and brass segments are placed evenly in, and when the twenty segments are in with the mica separating same, the screws are tightened; it is chucked in the lathe, the ends are turned to the proper bevel; then the washers k, k, core f, end g and nut e having previously been prepared, are placed upon the segments and tightened, as shown; the form (Fig. 7) is removed, and the surface of o turned on its own shaft.

Cut the wires off flush with lugs and turn them smooth.

The field is composed of wrought iron yokes (y, Fig. 1) $3\frac{5}{8}$ inches long, $1\frac{1}{2}$ inches diameter, turned down to $1\frac{1}{4}$ inches where they fit into pole pieces. Lowmoor iron is to be preferred. The pole pieces are castings (m 1 and m 2, Figs. 1 and 2) of best stove plate iron, cooled slowly so as not to harden. The holes are drilled neat to receive the yokes, y, and are fitted with set screws, s, to fasten the yokes. The lower pole piece has projecting arms to receive the bearings, which arms are turned to the same diameter as the bore of the field, $3\frac{5}{8}$ inches. The turning should be carefully done.

The completed armature should be balanced on a pair of level straight edges, and any deficiency made up by fastening small strips of lead on the arms of the spider.

The bearings (*h,h*, Fig. 2) are of brass with a $\frac{1}{8}$-inch gas pipe thread to receive small oil cups. They are bored for $\frac{3}{8}$-inch shaft and turned to fit into base (*m*, 2).

The field coils (*d,d*, Fig. 1) are wound on brass or zinc spools (*i,i*, Fig. 1), No. 16 gauge, soldered flanges, insulated with press board (*p,p*, Fig. 1) ends and six layers of paper, centre (*i,i*, Fig. 1). The wire is evenly wound and consists of 2,000 turns, 1,100 feet to each coil of No. 30 double or single cotton-covered magnet wire. The beginning and end of coils ("leading in" wires) should be heavier and well insulated, say No. 24 wire, doubled. The outside of coil to be covered with two layers of paper and one layer of muslin or tape on top, shellacked to make a finish. The coils are connected in series, that is, the beginning of one coil is connected to the line wire, the end of the same coil is connected to the beginning of the other coil, and the end of that coil connects with the line. Be sure that both coils are placed on yokes, *y,y*, in the same direction.

The brush holder (Figs. 4 and 6) is composed of yoke *y*, which is sawed out of red fibre, and drilled as shown; holders *L*, regulators *D*, and springs *C*, all of brass. The carbon brushes are $\frac{1}{4}$ inch thick, $\frac{1}{2}$ inch wide, and $\frac{3}{4}$ inch long. The springs are of No. 19 wire. The pulley *j*, for driving, is for 1-inch belt, 3-inch diameter, fastened to shaft by a set screw. Upon completion of the machine, the commutator should be turned true in the lathe with a sharp tool and a fine cut, so that no burrs cross the mica insulation. The brushes are fitted to the commutator's surface with OO sand paper.

To connect up as a dynamo, join field wires to line *Y* on either side, and run line *Y* to work (*i.e.*, lamps). To run as a motor, run lead wires through switch, connect field coils by branches to mains at switch; insert in one side of armature connections from switch, a starting box or rheostat, in which, when starting motor, the resistance may be gradually cut out. The speed is about 2,000 revolutions per minute, voltage 100, and output (as a dynamo) 1 ampere.

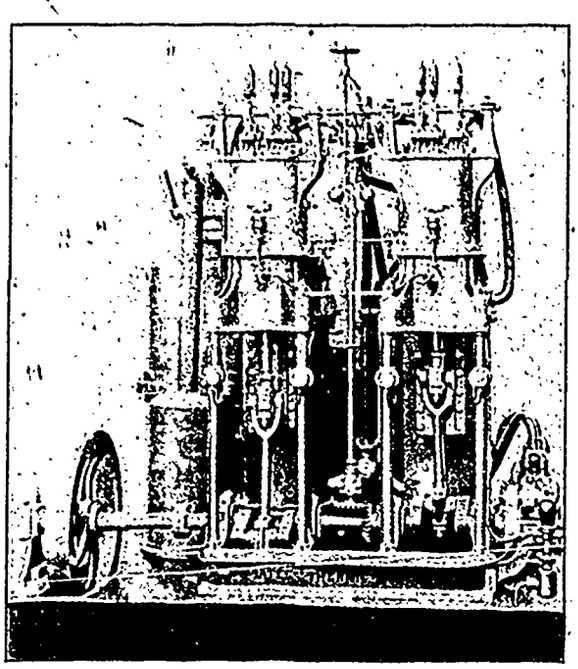
For THE CANADIAN ENGINEER.

A NEW SELF-CONTAINED MOTOR.

J. H. KILLEY, HAMILTON.

The motive power acting in this machine is different in most particulars to any previously constructed, and bids fair, in an economical sense, to rival the best gas engines. The machine is put into motion by a fixed gas under pressure, which is generated from coal, the generator having no smoke stack. It is a combustion of coal with super-heated steam at high temperature by a flame under the fire grate in a current of compressed air. This is an anomaly, but it is claimed to be an accomplished fact. Engines of this kind are now running in France up to 150 horse-power, with an unusually small quantity of coal for power developed. This motor is found capable in an engine of 150 h.p. of running with $\frac{3}{4}$ of one pound of coal per h.p. per hour. Engines are now being built of 1,000 h.p. that are expected to reduce this very materially. This, if successful, will be without doubt the best economical result that has ever been got out of coal firing.

This machine was invented by a man named Gardie, since dead, but has been improved by an American engineer named Bates. A company is being formed to construct the machines, and a precise scientific test will soon be made to demonstrate its capacity to the public. The machine consists of, first, a combustion chamber, at the top of which, on the left hand, a hopper is shown into which the coal is fed; the hopper is then closed securely against pressure. The lever above the balance wheel opens a valve, which allows the coal to fall on the grate. In the rear of the machine are the generators, which are heated by the gas from the furnace, and through the generator a small amount of water is pumped by a small pump on the right hand side of the machine. The water first enters the lower part of the cylinder jacket, from which it flows to the upper part,



which is at a temperature of 1,000° F.; it comes then in contact with a current of compressed air; then through the generator, going up under the grate of the fire chamber, where the gases of the coal are mingled with the superheated steam, making a chemically fixed gas under a pressure of from 160 to 170 lbs. per square inch. This is passed from the chamber into the cylinders of the engine, where it is cut off and expanded, the diagrams being equal to that of a first-class Corliss engine with a small amount of clearance, totally unlike the ordinary caloric or gas engine, both of which show from $\frac{1}{5}$th to $\frac{3}{10}$ths of the theoretical efficiency of the product of combustion. Even this is much in excess of the theoretical efficiency of the best steam engines. In this engine there is no explosion, and only three per cent. of clearance in the cylinders, it is claimed.

The engine, as built at present, is working single action, requiring two cylinders for a complete engine. This is necessary to work the gas properly, and to procure the factor of expansion as well as the combustion, and the full utilization of the products of combustion is shown by the result. These engines are apparently adapted for marine work; no boilers are required, and no condensers. Any amount of power required could be placed in much less room and weight than engines, boilers and their accessories, as now in use. There is the question of its adaptation to the locomotive, which, in due time, will be realized if the claims of the inventors are well founded. An engraving of the motor is shown in the course of this article; it will be seen that it is not unlike an ordinary marine propeller engine.

OF MUCH INTEREST—TO US.

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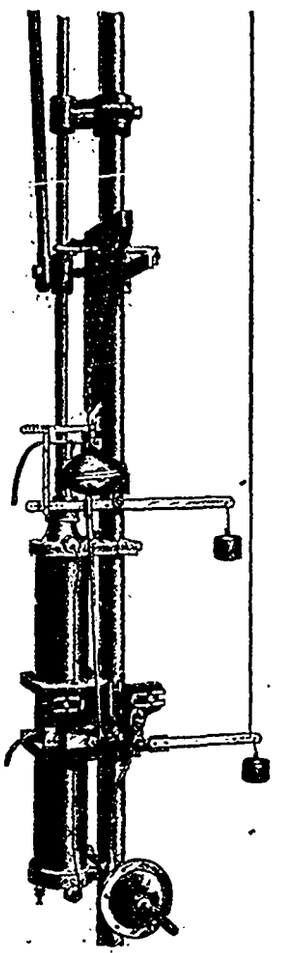
AUTOMATIC VENTILATOR.

BY ROBT. W. KING, MEMBER CAN. SOC. C.E.

In the primitive ages of man, when genus homo was cold, he made a fire in the middle of the floor, the smoke and products of combustion escaping through a hole in the roof—thus the brain of man early worked on the now more intricate problems of heating and ventilation, his necessity being the mother of his invention. That did not require much invention, the reader may say. Well, try it by lighting a fire without the aid of a match or a neighbor to run to for assistance. The man who invented the process of making fire by rubbing two sticks together was one of the discoverers and geniuses of that age, but died without the reward of a patent office or the handing down of his name to posterity.

Having been kindly invited by the editor of THE CANADIAN ENGINEER to give a description of my new Automatic Ventilating Apparatus, probably the first question the reader will ask is "What is it?" It can



be best explained in this way: When the fire burns low, perhaps going out entirely while the occupant is asleep, the hole in the roof lets in the cold; again, when the fire burns bright and fresh, the hole in the roof is not large enough to let out all the smoke and surplus heat. It was a nice question to determine the correct size of that hole. Now, the needs of man require that it shall be continually changing its size, and that automatically, according to the internal changes of temperature; also if the temperature falls below a certain degree, it must be entirely closed, or above a certain degree, it must be entirely open, and to an abundant extent—here necessity again becoming the mother of invention, various devices are conceived and put in operation to operate ventilating shutters, dampers in cold and warm air tubes, smoke-pipes, ash-pits, etc., etc.; some of the more recent ones are operated by electricity. Thus a thermostat finger moving to the right or left, as change of temperature occurs, makes an electric contact or connection, either on one side or the other, to operate mechanism to open or close the desired ventilator, damper, etc., as the case may be. These (as pointed out to me some time ago) are open to objection. A friend of mine was using an imported machine to operate a continuous shutter in his greenhouse, or, in other words, say an opening 100 feet long by 2 or 3 feet wide; he was growing roses, etc., for sale as cut flowers during winter, to excel in which an even temperature and good ventilation are required. The operation of the ventilator was as follows: A fall in temperature would cause the thermostat finger to move to the closed position, and down would come the shutters; in a few minutes temperature became excessive, causing the thermostat finger to move to open position, and up would go the shutters to let in a blast of cold air again, chilling the thermostat to bring shutters to closed position again. This might be repeated under some conditions that would occur perhaps ten times in an hour. This resulted in anything but an even temperature, and something better was required. Thus another necessity appeared, followed by another invention being recorded in the patent office.

Referring to perspective cut, a triangular shaped double thermostat is seen suspended above the machine in a position to be most quickly affected by a change of temperature due from the raising or falling of the ventilating shutters; the finger of this thermostat engages with a bell crank lever of a very small valve, controlling water pressure, which is used in this case in preference to electricity; the ports in this valve are not much bigger than a good-sized needle, and the valve is accurately balanced and pivoted so as to move without undue friction. The action of this valve is to turn a fine stream of water on to, or allow water to escape from, a small diaphragm piston contained in the case shown below the thermostat; a rod from this diaphragm descends and connects with a bell crank lever operating a larger valve to turn water pressure on to one side or the other of a large piston of an hydraulic ram, that is used not only to open the shutters, but to forcibly pull them down and hold them down when closed. This latter is necessary in windy weather, and also to break away little icicles that will sometimes form on the edge of the shutters in cold weather. So that any individual portion of the ventilator shutters shall not receive undue strain in being pulled down against an obstacle, each section of shutter has a spring connection, allowing that portion of the hole to remain slightly open, with the tension of the spring tending to close it. It has been found that an ice obstacle under these conditions will gradually melt away till the shutter finally closes. Below the hydraulic ram, at base of cut, is seen a circular-shaped piece, which is simply the casing of a very fine strainer placed on the main supply pipe.

So far as described (less reference to bell crank levers) this apparatus would work to fully open or fully close the shutters as previously referred to; a perfect graded action is, however, obtained of almost unlimited power and sensibility by extending the area or stroke of the ram, which may be done indefinitely, and supplying suitable connections to operate.

This graded action will be understood by reference to Figs. 1, 2 and 3. *A* is thermostat finger; *B* handle of valve lever *C*; *D* one of the bell cranks referred to;

E case containing diaphragm piston; *F* rod of same, making connection to lower bell crank lever operating valve of hydraulic ram. Say for illustration that when the shutters are midway open, a fall in temperature occurs. Generally before an ordinary thermometer will be affected, the thermostat finger *A* moves to the left,

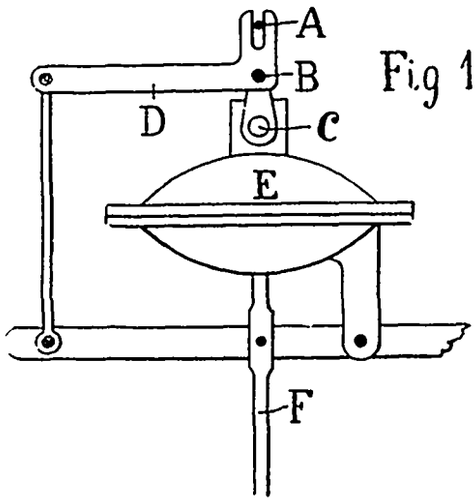


Fig 1

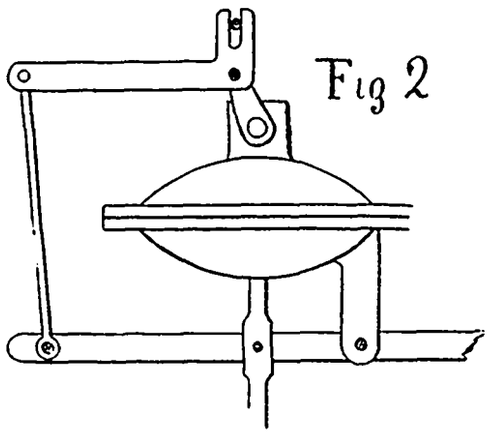


Fig 2

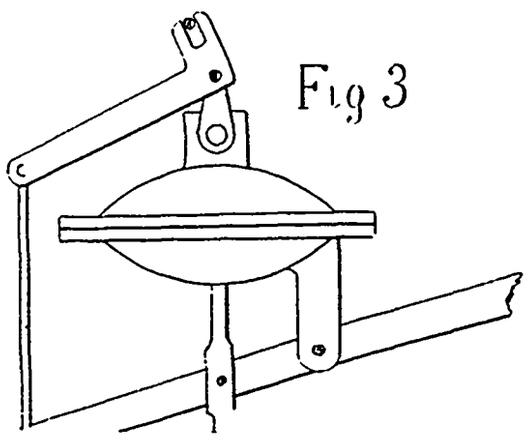


Fig 3

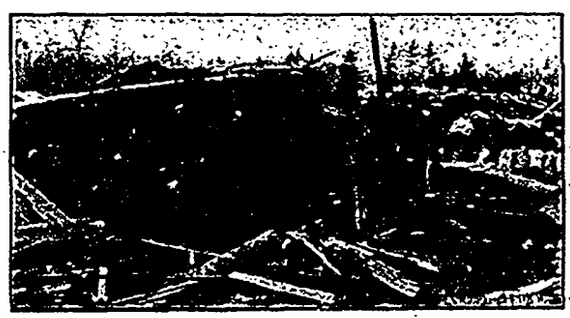
operating the valve lever *C*, as in Fig. 2, to turn on water above the diaphragm, causing rod *F* to descend; this tips the bell crank lever *C*, as in Fig. 3. The thermostat finger remains to the left, but the valve lever *B* has been returned to its normal position, and the downward movement of the rod *F* has ceased. The reverse takes place on a rise in temperature. The large valve through the lower bell crank lever is operated the same way, only that the outer end of the bell crank lever is connected directly or indirectly to the falling or rising shutters.

It has not been considered necessary to describe all the connecting pipes and other details; that will be sufficiently clear through the cuts to the practical eye. I will add, however, that the parts are all adjustable; the two separate movements work in perfect unison the one with the other; the shutters will work in varying positions between full open and full shut within a range of temperature of 5° F., and while in working position will vary the opening to compensate for the shadow of a cloud as it passes the face of the sun. Last fall I placed to order of Mr. H. Dale, of Brampton, six of the ventilators described, operating 100 feet of shutters each, in his new 600 ft. rose house. They stood the test of this winter well, working satisfactorily in spite of snow, wind, or ice. There are now building to his further order additional machines for other houses.

The object of putting six machines in a house, or one to 100 feet, where one could be made to do the work, is that in a house of such length the temperature will vary in different places, particularly in windy weather, so it is preferable to make every 100 feet of house independently regulated. The present design is in two patterns; one double valve as described, the other single valve. It is found the single valve can be built quite sensitive enough for ordinary requirements. Thus with an efficiently regulated steam-heating apparatus, and automatic ventilation supplemented, if desired, by electric alarm bells, the genus homo to-day can leave acres of perishable blooming flowers to the mercy of a Canadian climate unwatched, and sleep in peace; he needs not to rise to replenish his fire or put a cover on the hole in his roof; the untiring hand of an automaton does this with the accuracy and precision no human nerves could accomplish. Mr. Dale has kindly offered to furnish to any interested parties any information required from a florist's point of view. This apparatus, it will be readily understood, can be applied to other ventilating purposes than that described.

INSPECTION BEFORE OR AFTER.

A great many people have the idea that the quickest and easiest way to cure an evil, of whatever kind, is to pass an Act of Parliament on the subject. If the Act can be made of the "thou shalt," or "thou shalt not" order, they esteem the victory even greater. However, making a law is not enforcing it, and greater evils may arise through a law which is not enforced, than those which its enactment was originally intended to cure. The British idea of liberty has always been complete freedom of the individual, together with the exaction of severe penalties for any interference with the freedom



THE ELMWOOD BOILER EXPLOSION.

of others. On the continent of Europe, and pretty generally in the United States, it is believed that the Government is somebody or something by whose permission the rest of the world exists, and that a command from it is certain to be obeyed. The liberties of the citizen seem the gift of the Government.

The different ideas are well exemplified in the

Boiler and Inspection Act, '82-'90 of the English Parliament, and the Steam Boiler Inspection Act, Canada. Under the English Act, the boiler owner may use a boiler of whatever kind and in whatever condition he chooses. It may be tended by skilled or unskilled engineers, and inspected by anyone from a properly qualified inspector, down to the village blacksmith, but everything in the nature of an explosion of any kind occurring in connection with the boiler must be reported

THE ELMWOOD BOILER EXPLOSION.

within twenty-four hours by the owner to the Board of Trade. A preliminary inquiry is held, and if necessary, a second and more exhaustive inquiry. The court of inquiry consists of an engineer and a lawyer, who are empowered to subpœna witnesses, hear evidence, and assess the damages on the owners of the plant. Further, the decision of this court is received as evidence in civil suits which may be taken against the owners for injuries arising from the accident.

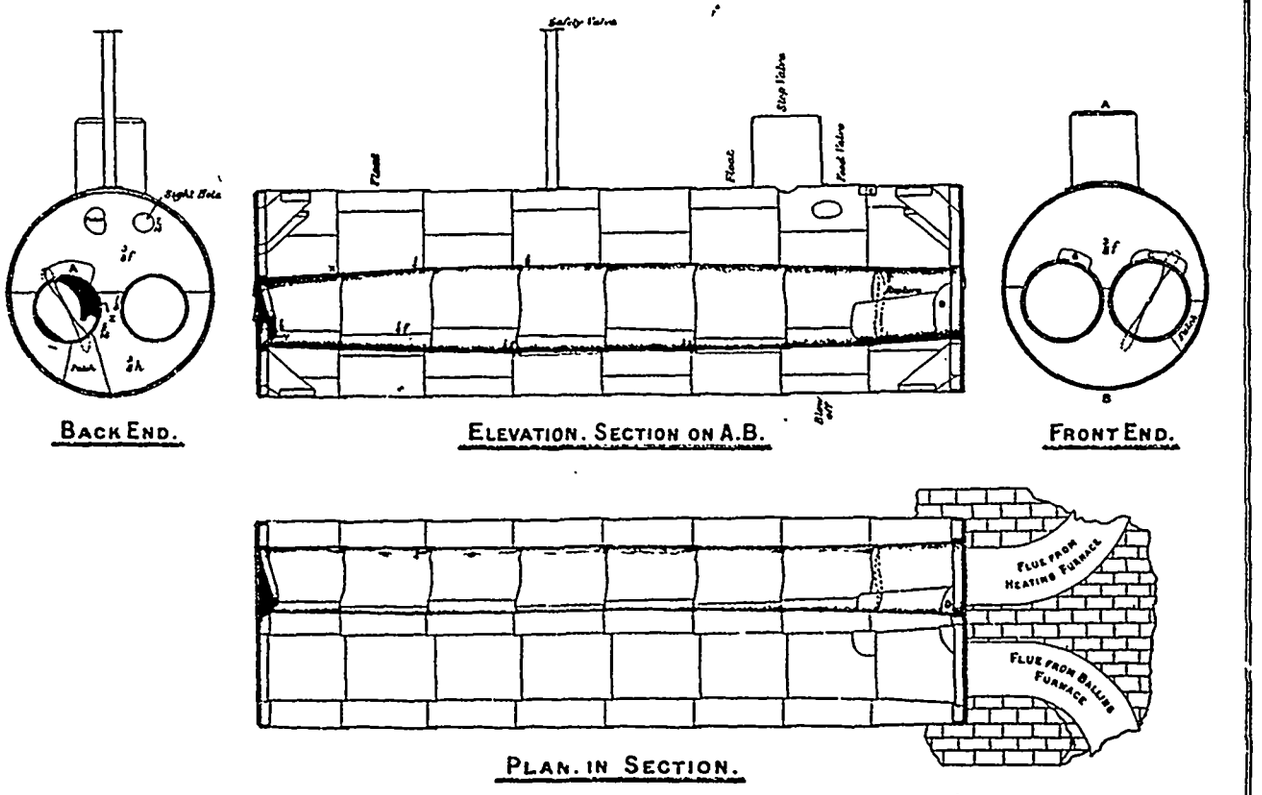
best manner. In no other way can this care and attention be secured, because the only object to which every man will give attention is to his pocket. Now to assure a result equal to this from an inspection law you must assume that all inspectors are perfect, and do their work equally well at all times, which, as long as they are human beings, is too great an assumption to make. The inspection of stationary boilers would be attended with very great expense and inconvenience. Marine boilers in Canada are all laid up for some months in winter, and can then be inspected without loss of time, but stationary boilers are for the most part in continual use and their inspection would therefore be most expensive and annoying.

Full reports upon these investigations in England are published by the Queen's Printer, and sold everywhere at a very small price. In this way the dangerous conditions which cause the accident are made known; the maker of the boiler, and the inspector, if any, who had pronounced it safe, etc., are all made public, and this acts as a check on carelessness or faulty work. In these investigations the detail statement gives: 1st, place of explosion and name of owner; 2nd, date; 3rd, persons killed; 4th, or injured; 5th, general description and age of the boiler; 6th, part which gave way; 7th, purpose for which used; 8th, whether inspected or insured by any company or association; 9th, cause of the explosion; 10th, findings of the court.

As an illustration of the workings of the Act we will give a summary of the report "No. 909" upon an

(Report No. 909.)

BOILER EXPLOSION AT THE EXCELSIOR IRON & STEEL WORKS, WISHAW, N.B.



BACK END. ELEVATION. SECTION ON A.B. FRONT END.

PLAN. IN SECTION.

It was thus seen that the owner of the boiler is under no restrictions. His liberty with regard to the boiler is complete, but if he avails himself of this to endanger anyone else and damage their property, heavy penalties are imposed. It *pays*, therefore, to have good boilers and have them attended and inspected in the

explosion which took place at the Excelsior Iron Works, Wishaw, N.B. The report sets forth fully all the details under each of the different heads stated above, accompanying the whole by drawings of which we give a photo-engraving. A minute statement of all repairs which have been made to the boiler at any time

is given. It was found that in the explosion the right hand flue ruptured at the angle bar connecting it to the back end plate, and collapsed along its whole length. It also ruptured on the circumferential seam marked *F*, on the sketch between the first and second rings near the front end. On the rupture occurring on the back of the boiler the bricks and iron work of the flue were blown out, and the water going to the front end of the boiler and escaping to the flue leading from the heating furnace, which contained gas at a high temperature and molten cinder, caused a second explosion which scattered the brick and iron work of the flue. The primary cause of the explosion, in the opinion of the court, was the rupture of the angle bar connected to the back end plate. The rupture at the back end occurred at the point where it was manifest that grooving had been going on for some time, which grooving should have been detected by proper inspection. The owner was ordered to pay £60 towards the expenses of the investigation. The question, then, becomes one of inspection before or after, of the responsibility of nobody in particular, or the complete and full responsibility of the owner.

THE INSPECTION OF STATIONARY BOILERS.

BY J. H. KILLEY, HAMILTON.

For THE CANADIAN ENGINEER.

Fatal steam boiler explosions are becoming common in Canada, frequently attended with the loss of valuable lives. Yet it is known that they can be prevented on land, as they have been on steamers, ever since the Steam Boiler Inspection and Machinery Act came into operation, together with the examination and licensing of the engineers in charge of them. Before this, explosions and loss of life were common on sea as they are now on land. Many attempts have been made to have laws passed to secure this licensing and inspecting, but without success. Why this should be so it is difficult to understand, as it would be to the ultimate advantage of the owners of the boilers and those in charge of them, and also to those whose business brings them into proximity to such a dangerous reservoir of destructive power as a defective or carelessly or ignorantly cared for steam boiler often turns out to be.

Boilers are often run through ignorance of the danger, under pressure that should not be permitted, and safety valves loaded, not with reference to the strength or safety of the boiler, but to a pressure that will do the work to be got out of the plant. Fires are urged far above what is safe, in fact, there are scores of boilers now running that, on a safe working pressure after inspection, would have to be reduced more than one half. Putting extra weights on the safety valves, sometimes fastening them down, is often practiced, a thing no well-informed engineer would think of doing.

After an explosion, shortness of water in the boiler is often spoken of as being the cause. This is not true, as experiments in this direction made for the purpose of ascertaining the effect of shortness of water have never resulted in a destructive explosion. The cause can always be traced to weakness of the boilers from defective construction, condition, or a pressure that the strength of the materials would not stand. In fact, it can be easily demonstrated that the greater the quantity of the water in the boiler the more destructive the explosion will be. For instance, suppose the pressure on the boiler was 120 lbs. to the square inch, the temperature conforming to this pressure would be 341°, or 129 above the boiling point. Should this pressure be suddenly liberated, about one-third of this water would be instantly converted into steam, projecting the water violently against the plates, and bringing about the total destruction of the boiler, and often of many of those about, as in the recent Ridgeway explosion, and that at Waterdown. In both cases it could have been proved that these boilers had plenty of water in them.

If the explosions and loss of life such as took place on steam vessels in Canada had continued after the Inspection Act had been passed, who would have been to blame? The Government. Many attempts have been made in the past ten or twelve years to get the Ontario Government to pass a law which would insure the safety of steam boilers from explosion, and determine the competence of the men in charge, but the effort was unsuccessful. A good steam boiler in the hands of a competent man, who might lose his certificate by carelessness, would save the boiler, save fuel, and would do more work.

EFFECTS OF ENGINEERING WORKS ON WATER CURRENTS.*

BY CYRUS CARROLL, C.E., M. CAN. SOC. C.E.

It is believed that in designing piers, abutments, breakwaters, wharves, and the like, too little attention is generally given to the effects such works are likely to produce by reason of their inducing currents or interfering with those already existing. We see fairly navigable rivers ruined for purposes of navigation by their currents being interfered with by costly works that have not fully answered the purpose intended. These failures very frequently result from ignoring certain fundamental laws that should guide us in working in harmony with the natural tendency of the elements we have to deal with. If at present a breach is forming, let us, if possible, in using it so manage as not to prevent it from continuing its formation. If a rivers enters a lake in a peculiar manner, beware of diverting it—rather assist it in keeping its normal course. In whatever way the bar across its mouth has been made, heightened and strengthened in one part so as to form a basin at the mouth of the river, by penning back its waters by the dam so made—and in another part washed away to form a deeper channel for the river, the natural tendency of *the elements* is to continue such action and formation.

Does a current follow along the lake shore or meet a river-current in any prevailing manner: do not obstruct it very much if you would avoid shoaling water. Do not divert it without weighing well the effect such diversion may have on works already constructed or hereafter to be made in such locality.

In the case of rivers having one constant direction of current, resulting from gravity, it has been found that the planting of abutments on either side, and piers in the stream, will cause a washing away of the banks above such works—that is to say, on the up stream side. This is especially true of rivers of 50 to 100 yards in width, and having a rapid current. Such effects will be minimized by planting the abutments well back into the banks, and making piers as narrow as possible. Where timber is easily got, the writer has found it most economical to drive a single line of piles for each pier for common road bridges, then to frame a heavy cap on top, making it a bent, in fact. The sides are planked

* A paper read before the Canadian Society of Civil Engineers.

up to above high water line, not only to keep out floating timber, but to serve as diagonal bracing as well.

Where banks begin to wash away, it has been found that fine brush is generally the best and cheapest remedy. It should be secured by stakes or stone, or both, as the case may warrant.

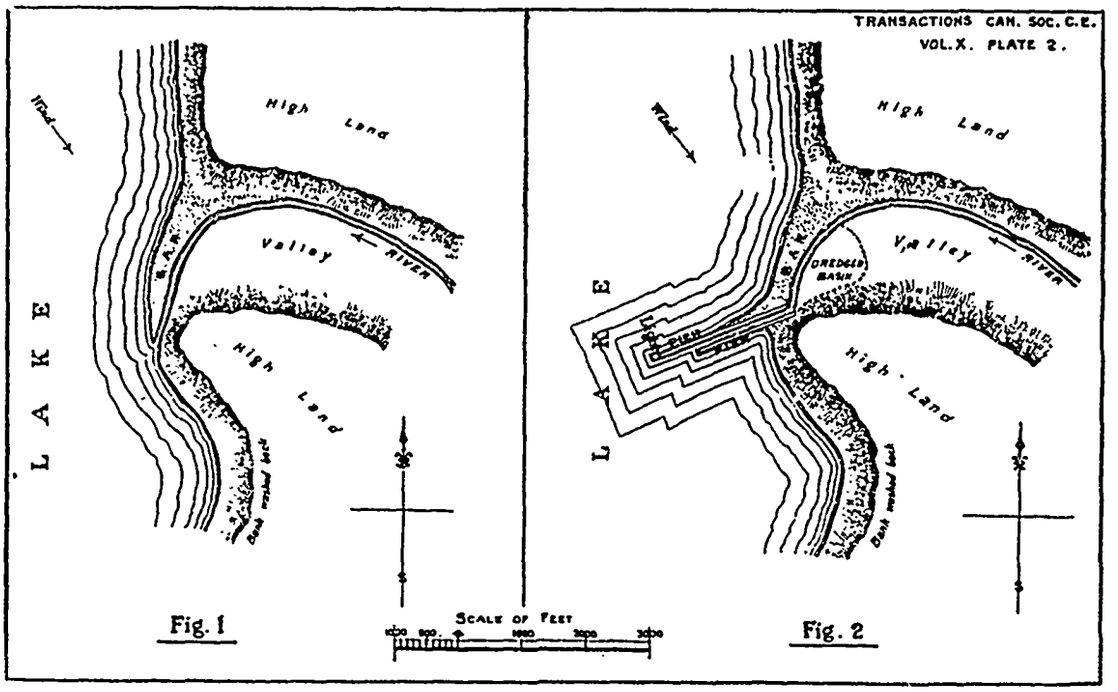
In Lakes Huron and Erie the shore currents point down the lakes, in the direction of the natural flow of the water. This, it is thought, is a mere coincidence, as there is not enough of flow of water to make any appreciable current. The prevailing winds are no doubt the cause of the more constant currents along the shores.

In Fig. 1, we have a very fair illustration of the mouths of the Rivers Saugeen, North Sables, Penetangore, Pine River, Maitland, Bayfield, South Sables, and other rivers. By turning the same diagram as indicated by the dotted north point, it fairly represents Kettle Creek, Big Otter Creek, Little Otter Creek, Catfish Creek, and other rivers and streams flowing into Lake Erie. Long Point too bears down the lake.

In Fig. 2 we see how some of these basins have been made to answer as harbors, after a fashion, as they could not always be entered during storms, though, as a general rule, any vessel making the lee side of the longer pier could in the stiller water move along into the harbor or tie up to the pier. In case of very rough weather on Lakes Huron and Erie, vessels make for the large rivers at either end of such lakes, or seek the shelter of an island if near to one. Failing these, they anchor and endeavor to ride out the gale.

It is here submitted that the plan, Fig. 2, is the best that can be adopted in utilizing at a moderate cost the mouths of rivers entering lakes. Where such works have not proved sufficient, it would be much the best and cheapest way to continue such works out into deeper water.

In no case is it advisable to close up the old channel and form a new one by cutting through the bar or beach. In Fig. 3 we have an illustration of the effects of changing the channel of a river. Lake Burwell, with its neighbor Lake Smith, formerly portions of Lake



It will be noticed that sand bars are formed across the ends of the river valleys, as the results of the opposing currents of rivers and lakes meeting, sometimes fairly and squarely, but generally at an angle, when they coalesce and form one current, the direction of which is determined by their relative forces after the manner of the polygon of forces.

These sand bars begin at the windward side of the valley, and extend quite across, being crowded out into the lake water at the end, by the river current prevailing over the lake current at that point. The river too is crowded against its leeward bank, which is often very steep from being washed away at the base. As a result of such crowding of the bar and river, the channel is often narrow and deep where it passes the bar. The bar or bank on the windward side is strengthened and reinforced by the wash of lake silt up against it. On the river side of the basin, the bar is strengthened by the silt of the river constantly being deposited. The river bank, or rather the lake bank, on the leeward side, is generally washed away. This is particularly noticeable at Port Burwell and Port Stanley, where large areas of high table land have been washed away within the last 50 years.

Huron, but in comparatively recent times cut off from that body of water, but not yet filled up by sand dunes, have for their outlet the South Sables river. The sand dunes extend from the old shore of Lake Huron to its present shore, the distance between such old and new shores being at Fort Franks, about four miles. The river reached the lake by a very circuitous route. Lakes Burwell and Smith being first cut off by the dunes, the river flowed out northerly, the dunes about said lakes becoming higher and extending northerly by the action of Lake Huron, crowded the river up against the edge of the higher land. Thus was the line of the dunes extended northerly—and with it, the channel of the river, till the nature of the shore of the Great Bend turned the river nearly due west. There the current of the lake opposed it from the north-west, and then a bar or beach began to form between the river and lake, crowding the river close up and along the base of the dunes already formed. The beach extended several miles, as shown in the sketch. Had the river not been interfered with, the beach would in time doubtless have reached Kettle Point, where, from the nature of the bottom, the formation of the beach and of the dunes must have ceased.

In the sketch, Fig. 3, it will be noticed there are a few sections of old channel not yet filled up. The river must have been obstructed here at different times from natural causes—new mouths made and old ones closed. From Grand Bend to Port Franks the course of the river shows that it followed along the base of the dunes that had been previously formed. In 1872 a contract was let for the excavation of the Lake Burwell Canal. The canal was intended to act as a drain, to reclaim 16,000 acres of land, which at $5 per acre would amount to $80,000.

The cost of the canal was about $80,000, but the result was very disappointing. Land was benefited to some extent, but not reclaimed. Only 1,000 acres of the benefited lands have been sold. The canal began at 1½ miles east of Lake Burwell, bottom width 30 feet, side slopes 1½ to 1, average depth about 6 feet in clay and vegetable matter. About one mile of the canal through Lake Burwell in water and soft mud. Then

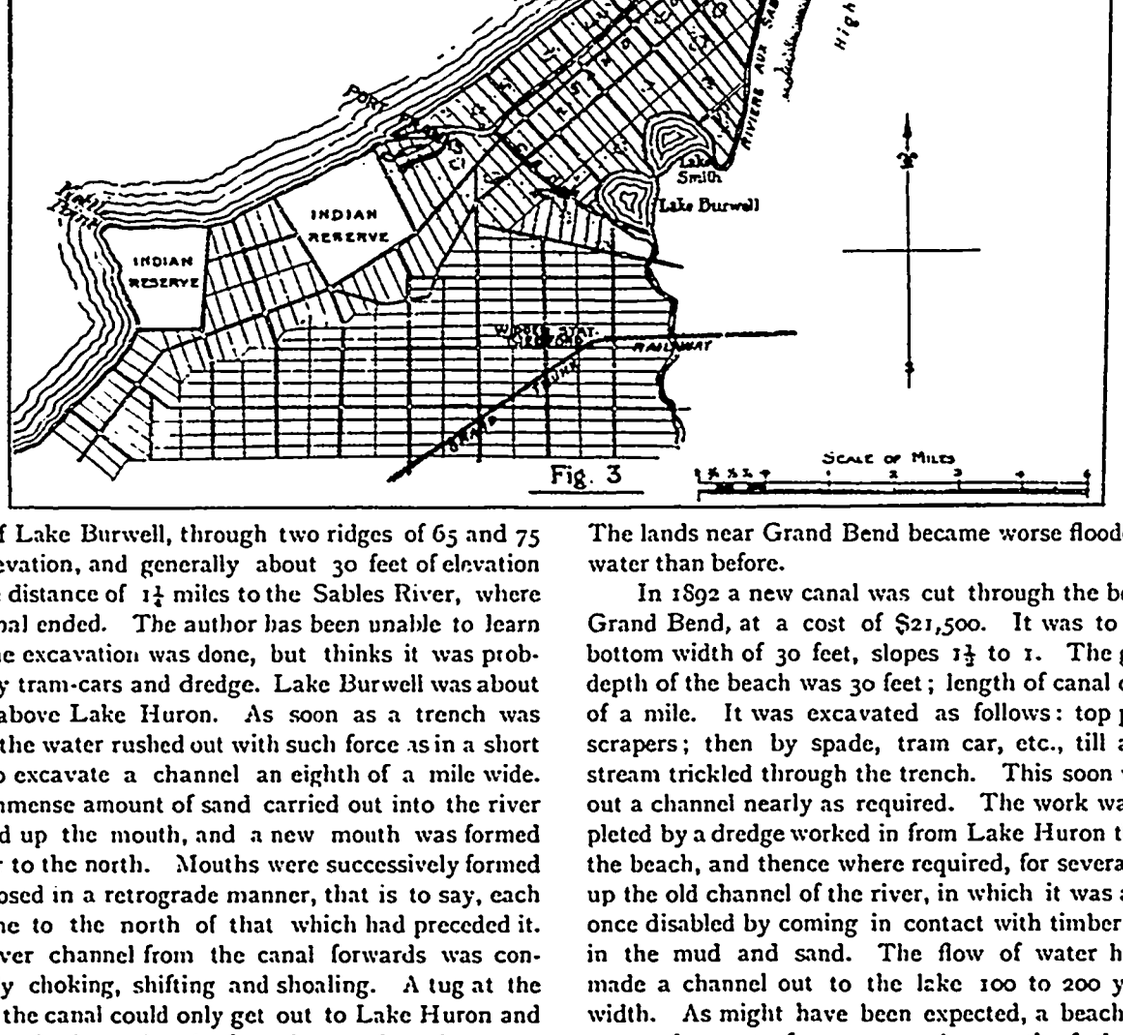


Fig. 3

west of Lake Burwell, through two ridges of 65 and 75 feet elevation, and generally about 30 feet of elevation for the distance of 1½ miles to the Sables River, where the canal ended. The author has been unable to learn how the excavation was done, but thinks it was probably by tram-cars and dredge. Lake Burwell was about 4 feet above Lake Huron. As soon as a trench was made, the water rushed out with such force as in a short time to excavate a channel an eighth of a mile wide. The immense amount of sand carried out into the river stopped up the mouth, and a new mouth was formed farther to the north. Mouths were successively formed and closed in a retrograde manner, that is to say, each new one to the north of that which had preceded it. The river channel from the canal forwards was continually choking, shifting and shoaling. A tug at the end of the canal could only get out to Lake Huron and back again by going backwards, so that the screw would scoop out the sand so as to leave a channel for it to float in.

There was a considerable amount of lumber produced at Port Franks; also salt, there being large salt works there. Since the canal was dug, the river is so spoiled for navigation that these products are teamed four miles over the soft dunes to the Grand Trunk Railway.

The *regimen** of the river has been completely destroyed. No works of a permanent nature can be made at the lake shore or along the river. The damage resulting is not easy to compute in dollars and cents. Every year, every freshet brings down a lot of sand for the river to work through and out of as it may. The narrowest part of the canal is 60 feet, its widest a quarter of a mile, and this through and amongst the highest of the dunes. Lake Burwell is nearly dry every summer. Lake Smith covers two-thirds of its former area.

From the Grand Bend, the old channel, deprived of its current and of carrying the water out of Lakes Burwell and Smith, filled up for a very considerable part of the distance between Grand Bend and Port Franks; on this portion so filled, the sands are heaped up so that no trace of the former channel is visible. The lands near Grand Bend became worse flooded with water than before.

In 1892 a new canal was cut through the beach at Grand Bend, at a cost of $21,500. It was to have a bottom width of 30 feet, slopes 1½ to 1. The general depth of the beach was 30 feet; length of canal quarter of a mile. It was excavated as follows: top part by scrapers; then by spade, tram car, etc., till a small stream trickled through the trench. This soon washed out a channel nearly as required. The work was completed by a dredge worked in from Lake Huron through the beach, and thence where required, for several miles up the old channel of the river, in which it was at least once disabled by coming in contact with timber buried in the mud and sand. The flow of water has now made a channel out to the lake 100 to 200 yards in width. As might have been expected, a beach or bar at once began to form across the mouth of the canal from its north side. This is rapidly extending southerly, and carrying the channel along the base of the old dunes, on the line that was the margin of Lake Huron

* The term "regimen" has for several years been used by the U.S.A. engineers to express the natural and equable condition of a river such as it has acquired from natural causes and in a long period of time.

previous to the building of this canal, with the beach between the channel and the lake almost parallel to the old channel of the river.

The lake bottom at Grand Bend being harder than it is farther south, the dunes were less there than they were farther to the south—where the soft nature of the lake bottom favored their formation. Hence the waters penned back flowed out at Grand Bend, and scoured out a channel from that point to Lake Smith, through the soft material along that part of the river. But at Grand Bend a hard bank of clay with boulders was encountered, which turned the stream west or south of west. Here the beach began to form which crowded the old river up against the base of the dunes—and extended itself, carrying the river with it to and below Port Franks.

One of our learned Chief Justices has remarked that the man who diverted a large river assumed an immense amount of responsibility. As the writer in 1885 stood on the bank of the canal 100 feet above the water, with the washed-out channel one-eighth of a mile wide in front of him, he thought he could appreciate the force of the Judge's remark.

GAS ENGINES ON LIGHT RAILWAYS.

Editor CANADIAN ENGINEER.

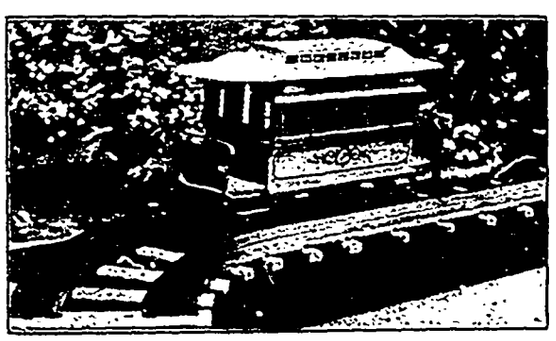
SIR,—In Europe, as a means of working passenger and light freight traffic on railways, cars with gas and petroleum motors as the propelling power are now coming into use. There are being introduced by the Traction Syndicate of 22 Chancery Lane, London, self-contained cars fitted with gas engines, and carrying the gas supply compressed in steel tubes. Such cars are now running on the Thornton Heath and Croydon tramway. They certainly have much to recommend them. The cars are not very different from ordinary horse cars, and run quietly and easily, emitting neither smoke nor steam, and are quite under control. No machinery whatever is visible, the engine and gearing being entirely enclosed, the motor lying under one seat and the balance of the machinery under the floor of the cars. The driver stands on the front platform, with the brake handle and working lever beside him. The motors have two cylinders placed face to face at opposite sides of the crank shaft at one end of the engine. The shaft is a balance wheel; at the other end a pinion which gears into the wheel on the first motion shaft. On this shaft are two pinions of different diameters giving speed of four or eight miles per hour to the car, higher speeds not being allowed on the English highways. The engine cannot be stopped *en route*, but must run constantly; it is, however, subject to a regulating device that acts when the work is light, as the governor cuts off the gas supply from one cylinder altogether, the other doing all the work. By weight regulators on the governor, the speed of the cars can be reduced 50 per cent. The gas is carried in three receivers under a pressure of 120 pounds to the square inch. It is compressed by a gas engine and pump; the gas is carried to the cars by a flexible hose, the time required to charge each car being no longer than that required for changing horses. The consumption of gas is 25 cubic feet per mile, run with passengers on. The cars carry 28 passengers; with these they will mount an incline of 1 in 16; in going down they can be stopped by the brakes in their own length, it is claimed. They go round curves of 35 feet radius. The new motors are said to have an advantage over tramway steam locomotives, which in some districts have done good service. It has no steam boiler requiring renewal and repairs.

The first section of the gas-motor tramway was inaugurated at Dessau in Germany in 1894, and the second in December of the same year. The track is the same gauge as on ordinary railways; the maximum gradients are two-thirds of one inch to the foot; the sharpest curves 40 feet radius; the weight of each car is six tons, with 28 persons on board. The motors are of the Otto type, and are from the Dentz works at Cologne. The motor, as placed on the car, is horizontal and has two cylinders; it is seven horse power. These cars easily ascend gradients hauling a trailer full of passengers; also, since the opening of the railway the company has purchased freight cars and trailers. Upon reaching Dessau after a travel of eight days on the railway, they were placed on the rails at the station and run to the tramway depot at the other end of the city, by the test gas stored in them when they were built. The gas is compressed for the whole of the cars by an eight-horse power Otto motor and pump. If the pumps were run fourteen hours per day, they would be sufficient to supply 40 cars. There are now 14 motor cars on the line four of them being 10 horse power. Those interested in a remarkably simple and cheap method of traction power on light railways should study this system, as it is capable of being utilized to a much greater extent.

CANADA FIRST.

RAPID TRANSIT.

The problems upon which rapid transit depends are not wholly those connected with the motors. There are other difficulties, and they operate, at present, to prevent us utilizing to the fullest extent the speed of which



our locomotives are capable. The chief of these is the danger of a train running at a high speed jumping the track. Improvements in locomotives, which would enable the present speed to be doubled, could easily be made; but it would be impossible to run them on the present tracks. A number of men are looking for the solution of this difficulty, at present, and a Canadian inventor believes he has found it. V. A. Emond, of Quebec, has lately patented in Canada and the United States a system by means of which each car carries its own track and runs on a series of rollers contained in a grooved rail.

The advantages which are claimed for this contrivance are as follows: Trains can be run at a speed of several hundred miles per hour without danger of derailment. All risk from obstructions on the track is obviated. As the rail is entirely covered and provided with holes at the base for the escape of water, etc., it offers advantages, hitherto unattained, in contending against frost, snow, rain, dust, etc. The trucks having no wheels, shafts, nor bearings, liable to break at any

moment, do not require oil or packing, and will not involve any daily expense in service. They will also be much cheaper in construction than the ordinary ones. The grooves or conduits on the under side of the rail afford facilities for placing telegraph and other similar wires, and will thus save the cost of the present system

V. A. EMOND, SR.

of poles and overhead wires, besides giving to conductors of trains the means of immediate communication by wire with any point on the line. This combination of rails and truck will permit of the use of much lighter cars, thus lessening the cost of rolling stock and motive power. In addition to the amount saved in material, the invention will also save the sums paid for accidents and loss of life.

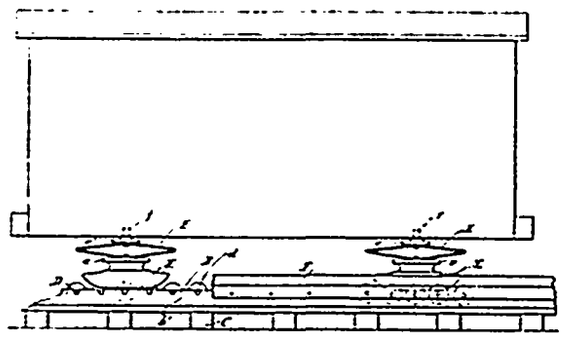


FIG. 1

Reference to the illustration will make quite clear the novel features of the invention. Fig. 1 is a side view of a portion of railway constructed according to the invention. Fig. 2 is a cross-section, and Fig. 3 is a plan view of one of the rails. *A* is the outline of the car body, and *B* the rails upon which the car runs. Each rail, *B*, is provided with a V-shaped groove, *b*, and flanges, *b'*, for securing it to the ties, *C*. The grooves in the under sides, which may be used to contain telegraph or other wires, are marked *C'*, and *c* indicates holes in the rails for draining out water. *D* are rollers, which are journalled in notches, *d*, in the upper sides of the rails, *B*. The inverted V-shaped runners, *E*, slide upon the rollers, *D*; they are secured in pairs to *e*, and *E'* are springs arranged above the plates, *e*, and coupling them to similar plates, *e'*. A pair of runners is placed at each end of the car. The car is connected to the plates by a pin, *f*. The cover plates, *F*, are secured to the rails and prevent the rollers and runners being displaced.

Nothing but a practical demonstration, on a large scale, of the merits of this departure in railroad construction, will satisfy the public of its possibilities. Of the advantages claimed, many seem hardly probable of attainment at the first glance. How can the risk from obstructions be lessened by securing the train to the track? If an object be heavy enough to derail a train, as at present operated, it will certainly cause something like telescoping when run into by a train going at from

FIG 2

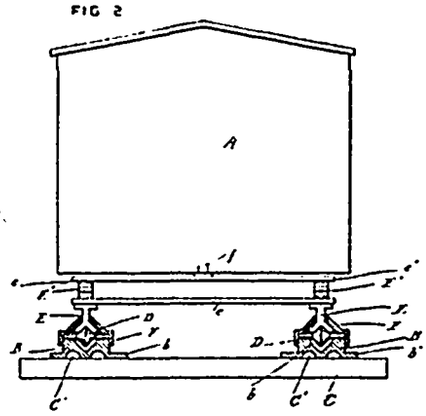
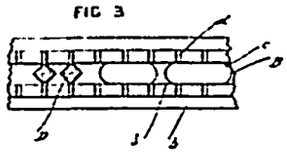


FIG 3



three to five times the present speed. Then, anything which would cause the runners to rise from the journals at the end or side of the car, ever so slightly, as the swaying of the cars rounding a curve, or the meeting with an obstacle on the track, would develop friction between the runners and the cover-plates, with a result varying from a slight loss of speed to the destruction of the rail. The drainage provided for the rail may be ample

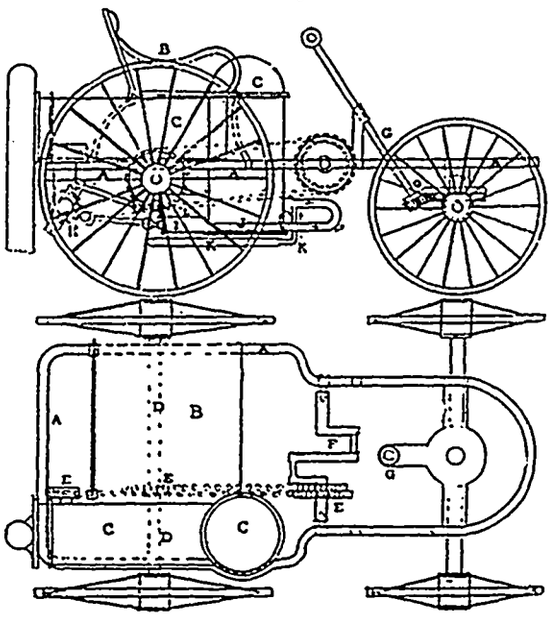
V. A. EMOND, JR.

and may dispose even of the sleet difficulty, though we do not see how it will do so, but snow will certainly pack into the opening, and in such places as level street crossings render the rail useless. We do not see how it will be cheaper to provide a rail and journals as described, rather than to maintain rolling stock as at present, especially where, as in Canada, the rolling stock in proportion to the mileage of the road is not of large amount. In Great Britain, where the traffic is heavy, the lines very short, and the climatic conditions more favorable, a successful experiment might perhaps be made.

THE FIRST LIGHT AUTO-CAR.

The first moto-car which used petroleum, says the April number of the *Auto-Car*, London, Eng., was made from the designs of Joseph Wilkinson about 1865. It was constructed in the famous shops of Joseph Clements, since celebrated by Smiles in his "Industrial Biography." It was at Clements' that mechanical England was revolutionized by the invention of the

planing machine, and by the putting of the leading screw into lathes, and it was there, too, that the famous calculating machine was made for Charles Babbage. Wilkinson got the idea of building a light moto-vehicle from seeing the heavy steam carriage at the great exhibition of 1862. It only weighed a hundred weight. Mr. Wilkinson is still working at the moto-cycle problem, and hopes to make as great an advance in the future as he did in the past.



The cut above gives a rough idea of this early vehicle. *A*, gas tubing frame. *B*, seats for two. *C*, steam generator fitted with tubes. The vertical ends the tubes when in coils, the horizontal part when straight tubes, and the flame sucked through by the exhaust steam at the end of generator. *D*, driving axle. *E*, pitch chain wheels and chains for driving from the engines to the pedal crank, and further by another chain to driving axle *D*. *F*, pedal crank to assist at starting, or hills, or in case of breakdown. *G*, steering gear. *H*, engine crank, with chain wheel at end *E*. *I*, air pump for forcing air with the petroleum into the generator. *J*, tube for air blast, connected with air pump *I*. *K*, petroleum tube connected under the seat with the oil supply. The oil is sucked up by the air blast *J*. *L*, engines, double cylinder.

IRON MANUFACTURE.*

BY WM. SMAILL, B.A.SC.

The three principal forms in which iron is in general use are cast iron, steel and wrought iron. These differ from one another in the amount and conditions of the contained carbon. It is a well known fact that iron has been known to the world for about 5,000 years. Even to-day in the uncivilized and semi-civilized portions of the world we can find the crude and ancient forms of manufacture that were in use in those ages. The open fires built on a hillside or some windy, exposed position, come first, then the low open mud furnaces using forced blast, the pneumatic apparatus being of many different kinds: Skins sewn into bags for bellows were trodden on by the workers' feet; bamboo tubes, with pistons packed with feathers or leather and operated by manual labor. These many forms and varieties of open fires lead up to the Catalan forge and American bloomery, the blast being generally supplied by the water trompe.

All these methods produced wrought iron, or iron of a steely nature from the ore direct. They are practically only of historical interest, being very wasteful in fuel and iron, requiring very pure ores and charcoal for fuel; their capacity was so small that they are not in the least suited to meet the enormous demands now made for iron. With few exceptions, all the iron at the present day is obtained by the production of pig iron, which is afterwards converted into wrought iron or steel. When we bring an iron ore into contact with carbon, at a high temperature, either in the form of solid carbon or a gaseous compound, first, we get the ore reduced to a metallic, spongy mass of wrought iron; if exposed to the action long enough and at a sufficient temperature, the iron becomes carburized to such a degree that it becomes fusible and is known as cast iron. To carry out this operation on a manufacturing basis, we must first have a considerable-sized furnace, and the substitution of earthy fluxes, instead of iron, for the removal of the impurities of ore and fuel. By proper variation of the ore, fluxes, fuel, blast, heat of furnace, etc., the reduction of the ore, carburization of the iron, and combination of the metalloids with the iron, may be made to range through greatly varying limits, and products which differ greatly both in chemical composition and physical properties are obtained under the name of pig-iron.

Charcoal was the fuel used in all the earlier operations for the production of iron in all its forms. In England the consumption of wood was so great, and forests were being denuded so rapidly, that an Act was passed in 1581 restraining its use to very limited sections of the country. The first to use mineral fuel in a blast furnace was Lord Dudley, about 1620. He found it worked satisfactorily, and obtained a patent of monopoly for 31 years, but his furnace and plant were destroyed by the men, who were opposed to such innovations. This experience deterred others from using coal, and it was not till nearly a century afterwards, when people became again alarmed at the increasing demand and growing scarcity of home timber, that the use of coal became general.

About 1785 an ironmaster by the name of Henry Cort, of Gosport, Eng., after many years of patient research and tiresome experiment, which cost him some $100,000, patented two inventions: first, the conversion of pig iron into wrought iron, using the flame of pit coal in what is known as the puddling furnace; second, the drawing of the iron into bars, etc., by means of grooved rollers, which operation was previously performed by means of hammer and anvil. Puddling and rolling reduced the cost of labor and manufacture to about one-twentieth, at the same time yielding a much better quality of iron. He was robbed by government officials of his business, property and all income from patents, and died in poverty.

It was remarked by early furnacemen that a furnace would drive better, *i.e.*, make more iron in the same time in winter than in summer. The reason, of course, is the lesser amount of moisture in the air, and it being somewhat condensed, they were supplying more oxygen to the fuel in the furnace, running the blowing machine at the same speed as in warm and damp weather. Then we have various unsuccessful experiments and trials made to cool the air before entering the furnace. At one time it was proposed to pass the air through long pipes containing quick lime to remove the moisture, but this was never tried.

* A paper read before the Applied Science Graduates' Society of McGill University, and published exclusively in THE CANADIAN ENGINEER.

Neilson, a young gas engineer of Glasgow, was granted a patent in 1828, entitled: "Improved application of air to produce heat in fires, forges and furnaces, where bellows or other blowing apparatus are required." He found in experimenting with an ordinary smith's forge, that if the blast were heated, the iron in fire was brought to the same heat, using far less fuel than could be done with cold blast. After numerous attempts to obtain the consent of some of the ironmasters in the vicinity to make the experiment at a furnace (there being a very strong prejudice against any meddling with the furnace, as while a furnace was running properly, a small set-back meant, sometimes, weeks before furnace would be again on good iron), the first trial was made at the Clyde works, in 1829. At each tuyere or blast nozzle was placed a wrought iron box, or oven, heated by a fire underneath, whereby a blast temperature of 200° F. was attained. Even this small rise showed a decided improvement in fuel consumption and increased output. Boxes were short-lived, however, and were soon replaced by cast iron retorts, six feet by two feet nine inches, which were much more durable, and temperature of blast rose to 280° F. The first proper stove was erected in 1832 by Neilson, at the same works. Blast was passed through a series of Λ-shaped pipes placed in one large oven, which supplied all the tuyeres with hot blast at a temperature of about 600° F. The waste gases from furnace were next used to heat the blast. First arrangement was simply passing the hot gases over the pipes conveying the blast, whereby excess of heat was absorbed, but gases were not ignited. In the next type of stove they were ignited with an access of air for combustion, and from this on great improvements were made in forms and types of stoves, until a temperature of 800° to 1,000° F. could be attained; this is the limit of safety for an iron pipe stove, as above this temperature they are liable to crack or burn out. Cowper, in 1860, patented his stove, in which firebrick was used to absorb the heat from the burning gas. Whitwell patented another form about the same time, and from these two types have arisen many forms of brick stoves which are all improvements in construction. A modern furnace has a complement of three or four stoves, which can maintain the blast at any desired temperature up to 1,500° or 1,600° F.

Blowing apparatus has improved in like manner, from the old skin bags and bellows, bamboo tubes, water trompe, wooden and iron tubs worked by water power, noisy, clumsy-geared machines, through all these stages up to the beautiful vertical cross-compound condensing engine of to-day. Each modern furnace is supplied with a pair of blowing engines, capable of delivering up to 30,000 cubic feet of air—and sometimes more—a minute, able to force this amount through the large amount of fine stuff which generally gets into a furnace.

The blast furnace itself, although retaining much the same internal shape, has enlarged greatly in size. A century ago one 25 to 30 feet high, and the greatest diameter being 6 to 8 feet, producing 4 or 5 tons a day, would be considered large. Now at present a big furnace means one 80 to 100 feet high, and a diameter of 18 to 22 feet, turning out 300 tons a day or more. But it does not occupy any more ground space than the huge piles of masonry used in the older furnaces. They were generally built near a hillside, and a platform ran from the side of the hill or incline to the furnace top to dump in the raw materials. The first boilers and some of the first stoves utilizing the waste gases were placed on top of the furnace or on the hillside adjoining. The furnace top was afterwards entirely closed by bell and hopper, and gases drawn from under the bell through flues to the stoves and boilers placed on the ground level. The waste gases to-day supply all the heat for steam required, heating the blast, and sometimes to calcine some of the ores. Certain furnaces using raw coal collect the tar and ammonia from the gases also.

Immense strides have been taken the last few years in the replacing of other fuels by coke, and methods of washing, cleaning and coking the raw coal. Previous to 1850 the increased production each year was obtained not by greater efficiency of plant, but their increased number. At this time a stack 50 feet by 15 feet would be considered large, and a product of 20 to 25 tons a day good work. Sir Henry Bessemer's mechanical genius and work he did, in the 10 years experimenting, to make an economic success of his process for the conversion of cast iron into steel, has been the starting point which has so revolutionized the iron world that it is fast converting the age of iron into one of steel. Sir Henry is alive to-day, one of the few great inventors who have lived to see and derive the benefits from his invention. Besides many honors, he has received something over $5,000,000 in royalties, etc. One of the best things the Bessemer process did for the iron industry was to open the eyes of ironmasters to the value of chemistry in furnace work. This process required iron of a certain composition; this demanded care in selection of all raw materials and careful analyses of all supplies and product, so the careful preparation of all the ores and fuel was brought about. Where to-day three to four tons of raw material are required to make a ton of pig, five to six were formerly used. No up-to-date plant is equipped for work without a well fitted laboratory for speedy work, all supplies and output being bought and sold on analysis. Iron and steel works' chemists have during the last few years converted the use and manufacture of iron and steel from the old "hit-or-miss" methods to a science.

First actual Bessemer steel made in America was at Wyandotte, Mich., in 1864, and first rails were rolled at the North Chicago Rolling Mills, May 24th, 1865; the total production of steel rails in America, in 1867, was 2,550 net tons; 1890 was the largest year up to date, with a production of 2,091.978 tons. The perfection in detail of most modern steel plants is such that the iron is run direct from the blast furnace into ladles, thence direct to the converters; the resulting ingot never cools until it is in the finished rail. First market prices of Bessemer rails was about $130 per ton; they are selling to-day for $28, which was the amount of duty imposed on them in 1870 in the United States.

Germany and the United States have during the past twenty years shown most marked improvements in their iron manufactures, and, in fact, all departments of metallurgy. In 1875 there were over 680 furnaces in the United States, and the output for that year was 2,023,733 tons pig. Furnaces had increased in size up to 80 feet by 20 feet; one of these using a blast pressure of 6 to 8 lbs., and temperature of blast 800° to 900° F. Consuming less than 1½ tons of coke to make even a No. 3 iron was considered to be doing exceptional work. Managers were then only beginning to appreciate the value of chemistry and possibilities of the furnace. Some furnaces will now make more iron in a day than the maximum weekly output of twenty

years ago, and use less fuel. Take, for example, No. 7 furnace of the Illinois Steel Co., size 85 feet by 20 feet, during the month of November, 1895: averaged 314 tons a day (has gone over 350), using 30,320 cubic feet of air per minute, at a temperature of 1135° and pressure of 9.4 lbs. per square inch. The fuel consumption was only 1,620 lbs. coke to ton of iron, and 3,716 lbs. ore, 561 limestone, 90 lbs. scrap, were required to make a ton of iron. One of the furnaces of the Edgar Thompson steel works has made over 600 tons of iron in one day. The Claire furnace, at Sharpsville, Pa., size 75 feet by 16 feet, in 1895 made 75,634 gross tons of Bessemer pig, an average of 207 tons per day. The rated capacity of the furnace is only 60,000 tons per year. Andrew Carnegie is erecting at Duquesne four new furnaces. They will be 100 feet high and 22 feet in the bosh, making them the largest in the world. Rated capacity will be 700,000 tons per annum.

At an address delivered a short time ago in England by the president of one of the largest technical societies, the statement was made that Great Britain was fast losing prestige as a manufacturing people. Among the reasons given were: 1st. The superiority of the technical schools in Germany and the United States in particular. 2nd. The protective policy pursued by these countries, which had enabled them to develop their mineral resources in such a manner as to make them self-sustaining. The following table shows the relative proportion of the world's product, which was the output of the furnaces of Great Britain, United States and Germany, respectively:

Date.	Great Britain. World's prod. Per cent.	United States. World's prod. Per cent.	Germany. World's prod. Per cent.	World's prod. In tons.
1870	52.30	14.60	9.97	1,402,508
1880	43.43	21.50	15.05	17,841,760
1890	29.38	34.21	17.04	26,899,099

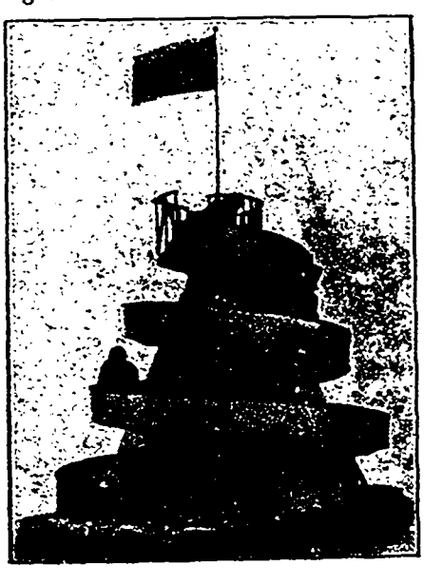
The Morill protective tariff was imposed in the United States in 1861. In 1860 she produced 821,823 tons pig iron; in 1895, 9,446,308 tons. In 1865 only about 100,000 tons of coke was used; last year over 7,000,000 tons was consumed. Previous to 1860 only about 100,000 tons of Lake Superior ore was used; 1895, 10,429,037 tons were produced, and to December, 1895, about 100,000,000 has been taken out of this region. I cite the advances and conditions in the United States, not because of any extra good-will towards them in particular, but for the reason that they have driven the British ironmaster from our market, cut into our own furnaces terribly, and they are our competitors in the field to-day, and we have to look sharp under present conditions to maintain our own production, which gives employment directly and indirectly to thousands of Canadians.

It is more difficult to-day to reduce the cost by cents than it was dollars twenty years ago, and in the rapid interchange of technical information the leaders must reap their profits quickly, because others soon follow in their lead. Plant must be engaged to its fullest capacity; partial idleness means increased cost, suspension of work, and, finally, failure. We are making excellent progress, considering everything, during the last few years. Our technical schools are improving fast, and we have a kind of protection to our mines; although not amounting to much, the intention was good. We have mines awaiting development in every province of the Dominion. The outlook for the coming season is the most promising in the history of the country, which is very gratifying, as we all know if we are going to make this Canada of ours continue to grow and prosper, it must come through its immense mineral resources.

THE SPIRAL SLIDE.

Our engraving, with the words "Modele de Glissoire Spirale" inscribed, is that of a working model of a novel conception by Chas. Baillairge, C.E., city engineer of Quebec, of a "Spiral Slide," the slide being built around the frustum of a cone.

This model, of which the nucleus or frustum of the cone is 10 feet high, 3 feet in diameter at top and 12 at base, is built on a truck or carriage, and formed one of the allegorical cars of the procession during the late Quebec Ice Carnival; a number of boys during the promenade mounting by an inside ladder up the centre, sliding down the spiral track around the cone, and, as seen in the cut, entering the structure ready to ascend the rungs again and start on another tour.



MODEL OF A SPIRAL SLIDE—(MODELE DE GLISSOIRE SPIRALE.)

The number of circuits around the model is by the height limited to three, to afford head room for the slider, and reduces the total length of slide to about 85 feet; but when built where there is room enough for a fourth circuit, say a diameter of 16 feet, the acquired velocity would take the slider around a fourth or fifth time and lengthen out the slide to 130 feet or more, by merely having an outer rail super-elevated in a way to counteract the tendency of the sleigh to go off at a tangent by centrifugal action; the object being of course to hug the cone and always be close to it, and ready to re-ascend, instead of having to walk back as with an ordinary straight slide.

The structure as planned by Mr. Baillairge would have been 50 feet high and 60 feet in diameter at base, with some seven circuits instead of only three, and a stretch of slide of over 1,000 feet, instead of one hundred. In the slide as proposed, there is, instead of a mere ladder, a circular stairway of convenient size, the diameter at top being 12 feet instead of only 3, as in the model. Had it been erected as proposed, near the Frontenac, arrangements could have been made by which parties might have availed themselves of the hotel elevator to reach the top and walk out on to it without the fatigue of mounting a stairway; or a lift of any simple kind could be built to answer the purpose at little expense.

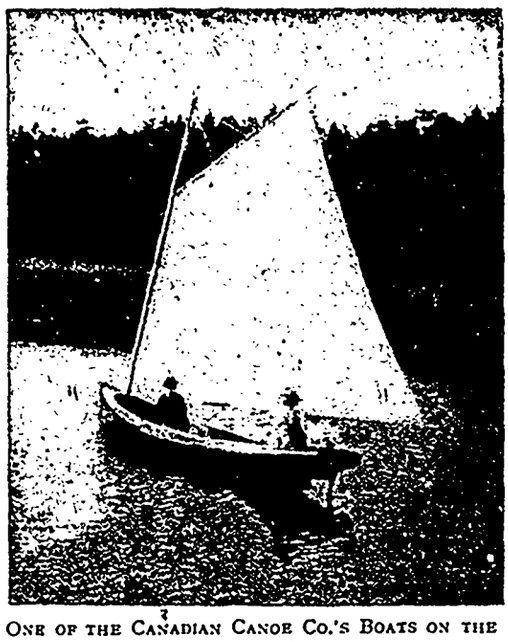
Such a slide, though designed for winter, may be used all the year round by the mere substitution of

rollers for runners under the sleigh, traineau or toboggans. Want of funds, it appears, was the only reason why this slide was not carried out, and we have no doubt that the idea, which is novel and original, will be carried out by some more wealthy community than Quebec.

We are pleased to learn that the Canadian Society of Civil Engineers has fixed the date of the summer convention to be held in Toronto, on the 18th and 19th of June next. We bespeak for the members a hearty welcome.

Everybody is ready to acknowledge the propriety of upright dealing with his neighbor. He puts to himself a case in which work falls to him, and he feels indignant at the prospect of the work being taken away; in fact, he feels that he has been undermined. When it comes to practice, however, the conditions become changed. Despite the movement in the Canadian Society of Civil Engineers, and the resolutions adopted at the last annual meeting, the scramble for work continues in its worst form. A notable case of this is to be found in the proposed water works system for the town of Mount Forest; several engineers have sent in plans and estimates, one set of which has been so far adopted that a by-law has been framed on them, *and yet none of these engineers have received any remuneration!* This is an irregular transaction on the part of the council, and may make them pay for their water works a price a long way in advance of an engineer's fees. The engineers are irresponsible persons in this case, and can escape all consequences of their faults or errors by stating they were not employed or paid; but the council assumes a serious responsibility in accepting plans and preparing a by-law under such conditions.

The remarkable development of the bicycle, and following that the advent of the horseless carriage, will make good roads a greater necessity than ever before in the history of the world, and especially on this continent, where road building has always been a neglected art. The Romans, in their invasion of England, left their impress on the country in those substantial roads which none but Romans seem to have understood the value of at the dawn of the Christian era, and these object lessons have not been lost on the practical Briton, who appreciates solid work. In consequence the highways of Great Britain are the best in the world to-day, and the country reaps a real dividend on the outlay by cheapened cost of transportation. In Canada and the United States in the past, lack of capital and make-shift haste in development have left our highways not only rough, but in reality expensive for transportation purposes; and the quicker our municipalities wake up to the need of more attention to scientific road building the better it will be for their pockets and the public comfort. The Government of Ontario is the first Provincial Government in Canada to realize the situation, and the literature they have been issuing for the last two years, and their recent creation of a sort of "road department," give us hope that this province will not rest long under the reproach of the bad road abomination. In pointing to this hope, we must not fail to mention the services rendered to this cause by a lay journalist—Andrew Patullo, of the Woodstock *Sentinel-Review*—who has not only agitated the subject with patience and persistence in his paper, but has spent much of his time without recompense in giving addresses at various places throughout the country. Such public spirit should not go unrewarded, and we trust this work will be taken up by newspaper men and members of Parliament in every other province of Canada. There are many people who still fail to see that a good solid road will pay a cash dividend on the investment, but this is because they have not looked below the surface. Like judicious advertising, good roads really and truly pay.



One of the Canadian Canoe Co.'s Boats on the Humber, near Toronto.

REPORT OF THE BRITISH COLUMBIA MINISTER OF MINES.

In the Alberni district it is reported that on McLaughlin Range, China Creek, and Cowichan-Alberni road, one hundred and forty-nine mineral claims were recorded. Extensive development work is going on in the Mineral Creek group, exposing several veins of free gold, the most noted being the Alberni, Missing Link, Mountain Rose, Champion, Ace of Spades, and Last Dollar; average assay about $30 per ton. Franklin and China Creeks—Thirty-eight mineral claims recorded. The Star of the West group of mines is the most noted, the work done exposing several veins of blue quartz, averaging $25 per ton, mill test. Coleman and Chesnucknet Creeks Alberni Canal—Twenty-four mineral claims recorded. Work exposes masses of crushed quartz, mixed with cement, low grades; average mill test, $8 per ton, on deep water. Copper Island and Sarita River, Barclay Sound—Fourteen mineral claims recorded. Work done exposes several rich veins, with a good percentage of copper. Extensive development now going on; also on deep water. Sechart Channel, Barclay Sound—Eleven mineral claims recorded. Large bodies of ore have been discovered, also quartz carrying gold in paying quantities, on deep water. In other parts of the Alberni district there are thirty-two mineral claims recorded on Sproat Lake and Cous Creek, on the opposite side of the Alberni Canal from China Creek, showing that the gold range extends in that direction.

Two placer claims recorded on China Creek, four hydraulic leases issued. The rents of eighteen leases have been paid at dates when due Work has been done on the following leases. Alberni syndicate, $100; Cataract Hydraulic Co., $7,000; Lulu Hydraulic Mining Co., $500; W. B. Ganard, $500; F. T. Child, $700; F. McQuillan, $3,250; Nanaimo-Alberni Gold Mining Co. (2 leases), $1,500 on each. A good wagon road has been built to the China Creek mines from the town site of Alberni, and a first-class trail has also been made from the Alberni Canal to the Granite Creek mines. Total claims recorded, 262; free miners' certificates, 107 and 1 substitute; transfers, 81; certificates of work, 35.

In the Cariboo district quartz mining is almost at the same point as last year S. J Marsh has bonded Black Jack mine, leased the Government reduction works and purposes to erect a cyanide plant at Barkerville, to be in operation next spring. The Cariboo Reefs Development, Limited, of London, England, has begun work by

running a tunnel 250 feet to tap the ledge. It is expected that the Island Mountain Co. will put in a ten-stamp mill in the spring While activity in quartz mining is limited, the placer mines of Cariboo maintain their old reputation. Of the large number of men employed, only about half were on productive works, the rest being engaged in development. Extensive hydraulic plants are being put in similar to those at the Cariboo and Horsefly mines. There are now about thirty leases of hydraulic ground on the Quesnelle River, where two years ago there were but five. The gravel banks along this stream offer most favorable conditions for hydraulic mining, which is limited in extent only by the amount of water obtainable. Gold has been discovered in paying quantities on Pine and Summit Creeks, about six miles north of Barkerville. The ground on these streams is now located, numbering some twenty claims in all. On Shepherd Creek, a tributary of Pine, the Discovery Co. has paid its shareholders handsomely, although working under adverse circumstances, owing to the light water supply. Several prospecting parties went out in the direction of Bear and Goat Rivers, to the north-east of Barkerville, and confirm previous reports of the great possibilities of that section, in consequence of which several parties will winter there. River dredging in this district is now beginning to assume tangible shape, and two scows are in course of construction at Quesnelle Mouth, into which dredging plants will be placed to commence operations on the Fraser and Quesnelle Rivers in the early spring.

The report says that a number of very extensive plants in this district are not mentioned, because the inspector had not visited them in person. The revenue derived by the Government from the mines in this district for the eleven months ending 30th November, 1895, was $10,000 greater than for the same period in 1894. There have been issued from the Richfield office since 1st of January last—58 hydraulic leases, 42 creek leases, 29 dredging leases, 166 placer mining claims, 84 mineral locations, 83 water grants for mining purposes; free miners' certificates, 1,249. The gold product for the year, closely approximated, is as follows: Barkerville, $81,000; Lightning Creek, $40,700; Quesnelle, $18,200; Keithley, Quesnelle Forks and Horsefly, $145,000; estimated product for whole district from date of collection of statistics till 31st December, 1895, say, $16,000; total, $300,000.

In the Cassiar district work has been as active as formerly, and the returns, as closely as can with any accuracy be obtained, are as follows: McDame Creek and tributaries, $9,650; Laird River Division, $475; Thibert Creek and tributaries, $4,000; Dease Creek, $8,450; total, $22,575.

The gold commissioner for Lillooet says, among other things: "The total yield of gold from the district (ascertained from reliable sources only) is $40,663, showing a slight increase on the yield of last year, but still much below the average of past years. I have no report to make on any really new placer mining discoveries, and summed up briefly, the production ($40,653) for this year has been obtained from the gravels of the Fraser River, and a few of the tributaries of that river, principally in the immediate neighborhood of Lillooet."

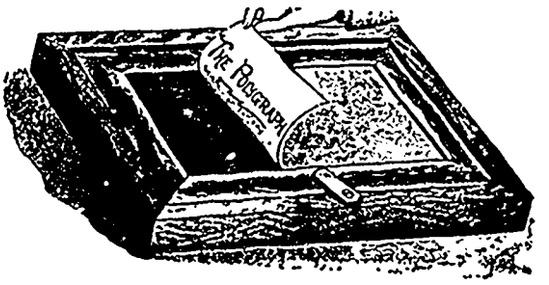
In East Kootenay the number of free miners certificates issued during the year is reported to be 404. Placer mining shows a considerable decrease from previous years. The different companies who are interested in hydraulic mining are not yet far enough advanced in their operations to be able to show any results. Mineral claims have this year, for the first time, become productive in reality. A large quantity of ore is now awaiting the opening of navigation for shipment to smelters. The demand for means of transportation has resulted in the commencement of the construction of two new steamers and the enlargement of a third to ply on the Kootenay river. Coal mining in this district has made no progress during the year. Coal is here in enormous quantities, but it must remain unused until the coal fields are reached by railways. The principal beds are in the Crow's Nest Pass, but a promising seam has lately been discovered on the St. Mary's River. The oil fields in the south-eastern corner of the district remain undeveloped. Oil indications have been found outside of the territory which was previously known to be oil bearing. The yield of gold from the various creeks is estimated at: Wild Horse Creek, $13,000; Moyie River, $2,000; Perry Creek, $1,500; Bull River, $700; Findlay Creek, $200. Lost and Man's Creeks, $175, total, $17,575.

The detailed report from West Kootenay concludes with the tonnage of the various sub-divisions during the year 1895:—Nelson, 1,871; Ainsworth, 54,327; Trail Creek, 23,361; Slocan, 9,264; total, 88,823 tons. The mines in this district are well worked, and tramways, concentrators and smelters are being constructed. The Revelstoke division has suffered from the rush of prospectors to Trail Creek.

In the Yale division $48,400 was taken out as follows:—Agassiz, $400: Huntersville, $500; Hope, $258; Yale, $8,050; Prince Albert Flat, $700: Spuzzum, $2,852; North Bend, $3,900; Keefers, $1,755; Lytton, $18,818; Spence's Bridge, $1,175; Ashcroft, $5,000; total, $43,408; taken away by private hands and unaccounted for, $5,000; total, $48,408. Number of free miners' certificates issued, 290, equal to $1,450; general mining receipts, $4,296.44; total, $5,746 44.

BURLEIGH'S POLYGRAPH.

The accompanying is an illustration of the polygraph manufactured by George H. Burleigh at Gananoque, Ont. With this machine ordinary writing can quickly be multiplied to the extent of ninety to one hundred and twenty-five copies, bright and clear, from one original. It will reproduce anything that can be done on paper with an ordinary pen. The number of copies that can be obtained from one original vary a little according to the character of the work, but if more copies are wanted than one impression will give, it is only necessary to go over the operation again.



The process was invented by Kwaysser and Husak in Austria, and patented in several countries. It has gone through several modifications, and been sold under different names. These forms have always had many objections. Among them may be mentioned, the public were not instructed how to use it; or, it would print very poor copies; the lines would blur; the sheets would stick to the surface and sometimes tear, and after used a few times the surface was left in a condition unfit for further use. Mr. Burleigh saw the need of an apparatus that would be at once reliable and cheap, minus the above disagreeable features. He undertook to remove the objections mentioned, and has after two years careful experiments, brought it to its present state of perfection, producing a machine which he guarantees will print a clean, sharp line; give bright copies; will not blur, will let the sheets leave the surface quickly and easily, can be used over and over again in succession; it is not necessary to wait for the remaining ink to be absorbed, it is removed in half a minute; in the using of it the surface is always left in good condition for use the next time; and it will do the finest work every time used until worn out. For manifolding small quantities of price lists, circular letters, notices of meetings, programmes, invitations, reports, statements, designs, music, examination papers, drawings, etc., it will be found indispensable in every office. Complete and simple directions how to work it are sent with each machine. These "directions" are copyrighted, and are the results of long study, costly, and the most careful experiments running over a course of two years. They tell you all that is necessary to know about the use and care of a polygraph. Anyone can easily follow them and do the finest work.

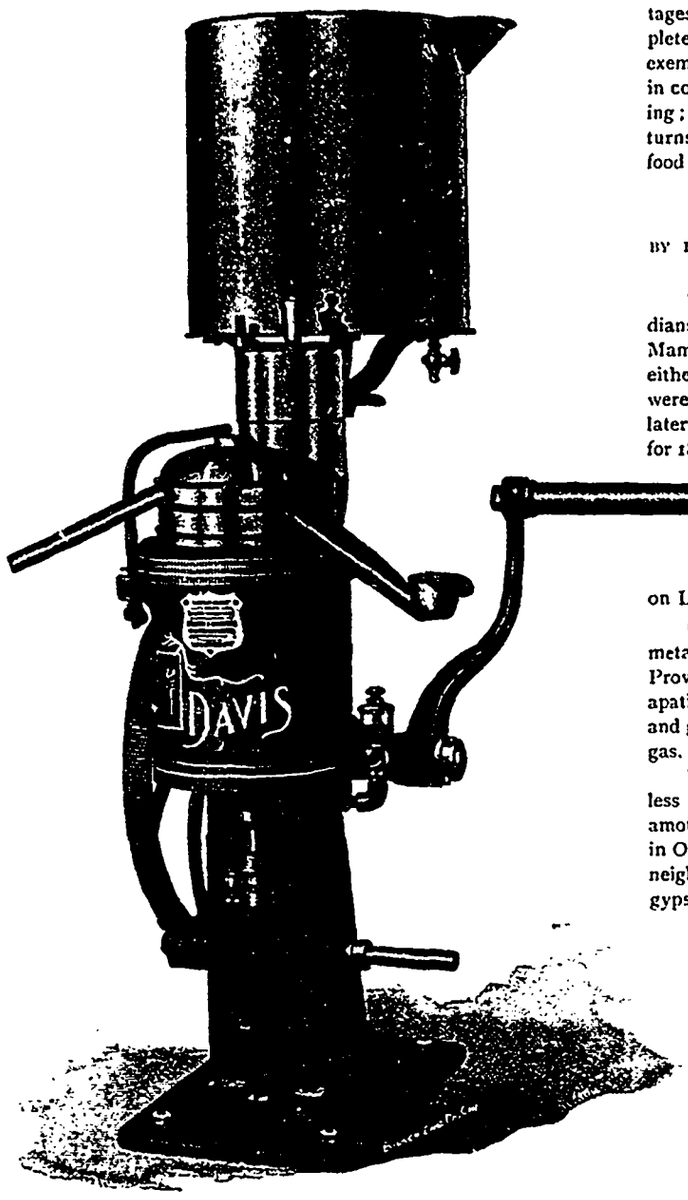
The polygraph consists of a handsome varnished case, durably made, in which is the improved printing surface from which the impressions are taken. If used to full capacity once a month, it is estimated to last seven years. Considering their usefulness and the very low price at which they are offered, they are deserving of a large sale Canadians should appreciate the fact that so useful an apparatus is now made on Canadian soil. Six sizes are listed, and larger ones made to order. For samples of its work, address the proprietor and manufacturer, Geo. H. Burleigh, Gananoque, Ont.

CREAM SEPARATORS.

The growth of machinery and appliances used in butter and cheese making in Canada has been very remarkable during the past five or ten years, and it will not be long before this country will lead the world in this specialty. Seeing the large demand for centrifugal cream separators in Canada, the John Abell Engine and Machine Works Company of Toronto have gone into the manufacture of these machines, selecting what is known as the Davis type, which has had great success in the United States and other countries.

The accompanying illustration shows the Davis Cream Separator with handle to work by hand, but a pulley can be put on to work by power, apparatus being supplied to work it by tread power, steam or electricity. The separator is also made to combine with a feed cooker and with an attachment for churning and butter working.

To the uninitiated the process of raising cream by machinery may be explained as follows: When fresh milk is allowed to stand, the globules of fat contained in it being lighter than its other elements, rise slowly to the top to form cream. This is the law of gravitation, and nature's method has been in use from the earliest times.



The object of a separator is to hasten the ordinary process of setting milk, by substituting centrifugal force for gravity. A bucket of water swung rapidly at arm's length pulls on the arm, while the water remains as deep in the upper side of the bucket as on the lower. This is caused by centrifugal force, the same that tends to make a revolving body move away from the centre of motion. The faster we swing the bucket the greater is the pull. Centrifugal force increases as the square of the velocity—that is to say, if we swing the bucket twice as fast, the pull becomes four times as great; if we swing it three times as fast, the pull becomes nine times as great, and so on. If we put milk into the bucket to take the place of water, and swing it very fast, the centrifugal force pulls the milk against the bottom of the bucket, just as gravity does when the bucket is at rest, the only difference being that when the bucket is swung rapidly the centrifugal force is much greater than gravity, and the pressure on the milk is correspondingly stronger. The result is that the cream is forced to the surface of the milk, just as it would under the influence of gravity, but more rapidly. Exchange the bucket for a bowl rotating on a vertical axis, and the milk will press against the outside of the bowl and the cream form a vertical cylinder. The delivery tube carries the skimmed milk to its pan, and the cream overflows in the other, separating the milk in a continuous manner into cream and skim-milk. The separator bids fair to revolutionize butter-making, in that it assures us a uniform quality of cream and affects the housewife's work on thousands of farms. With a separator at the barn or dairy-room, the milk can be skimmed at each milking in a few minutes, the cream put away in fine shape, and the sweet, pure, fresh skim-milk fed to hogs or calves, with an assured increase of from ten to twenty-five per cent. more butter, and of better quality. All this without the tedious handling of milk from pails to crocks and pans, and without the washing and handling of innumerable vessels.

To sum up, the separator possesses several decided advantages over the gravity methods. These are: (1) more nearly complete and uniform separation of the cream from the milk; (2) exemption from the conditions of temperature, period of lactation in cows, and disturbing influences that may beset gravity creaming; (3) requires no ice; (4) skims the milk while it is warm, and turns out the skim-milk in the best possible condition for use as food for calves; (5) saves time in butter-making.

ONTARIO AS A MINING COUNTRY.

BY DR. A. P. COLEMAN, PROFESSOR OF MINERALOGY, SCHOOL OF PRACTICAL SCIENCE, TORONTO.

The first mining in Ontario was the work of pre-historic Indians, who dug their trenches and mined the native copper, at Mamainse, with tools of wood and stone; but left no other trace either in history or tradition. The first recorded mining operations were also for copper and were carried on about 1770. Thirty years later iron mining was undertaken, and the Bureau of Mining report for 1892 states that iron was smelted at the Falls of the Gananoque, about 1800. With the exception of the bog iron ore mine in Charlotteville township, near Lake Erie, 1723, smelted at Normandale, and the early attempts in Madoc and Essex counties, no further effort was made until the Bruce copper mines on Lake Huron, were opened about fifty years ago.

Gold, silver, copper, nickel, cobalt, iron and lead, among the metals, have been obtained by mining at one time or another in our Province; as well as a number of non-metallic substances, such as apatite, barite, graphite, gypsum and mica, not to mention liquids and gases obtained by boring, such as brine, petroleum and natural gas.

The total output of cobalt from the Sudbury mines amounts to less than fifty tons probably, and the lead produced probably amounts to only a few hundred tons. At present, the metals mined in Ontario are gold, copper, nickel and cobalt, the last three in the neighborhood of Sudbury only. The non-metallic minerals, mica, gypsum, salt, petroleum and natural gas, which is a mineral by a United States legal decision, complete the list. The mining of copper, iron, and phosphate is in a state of suspended animation. Apatite or phosphate was mined in 1870 or 1871; but the first shipment took place seven years later In 1891, 1,551 tons were shipped from Ontario, but from Quebec 4,900 tons. Canadian phosphate has been driven from the market, however, and cannot be expected to be extensively mined until the Carolina and Florida deposits are exhausted.

Barite has been mined at McKellar Island, in Lake Superior. In 1890, the product was stated to have been 1,842 tons Operations appear to have ceased, however, as no further report is made.

Graphite was mined to the extent of 429 tons in 1877. Since then, the product has diminished, though recent explorations with the diamond drill show deposits that should be worked with a profit. Mining operations have been confined to the Ottawa valley.

Most of the gypsum produced in Ontario is mined on the Grand River near Paris, amounting in 1887 to 8,560 tons, and in 1894 to 3,253 tons, valued at $9.760.

The production of mica in 1891 in Ontario was 240 tons, valued at $31,200; in the following year only seven tons; in 1893, 70 tons; in 1894 no output is reported. The new use of mica as a non-conducting packing for steam pipes furnishes an outlet for much material that formerly went to waste in cutting dimension mica, and thus will assist the industry.

All the petroleum produced in Canada comes from the Petrolia region in Ontario. The first important discovery was about 1861. Apparently no more than 500,000 barrels were obtained in any year up to 1887, but in 1893, 1,000,000 barrels were produced, valued at $2,146,937.

Natural gas to the value of $160,000 is reported in 1892, and in

1893 the value was $238,200. There are over one hundred less in the Welland and Essex fields, and most of it is piped across the border to Buffalo and Detroit.

Salt was first discovered in Ontario when boring for oil at Goderich in 1865, and it has since been found at various points in south-western Ontario, from Goderich to Essex Co., where it has been obtained within the last few months. Practically all the salt produced in Canada comes from our province, the amount running from 30,000 to 60,000 tons, and the value from $100,000 to $230,000. No salt is mined in the province, all being made from brine pumped from wells and evaporated, but the amount is unlimited; beds of rock salt from six to one hundred feet thick having been proved to exist under hundreds, if not thousands, of square miles of territory. It is to be hoped that the attempts now being made on a small scale to develop the chemical industries dependent on salt as a raw material, may be successful. If we produced our own soda, soap, hydrochloric acid and bleaching powder, we should materially increase our home manufactures and add to the demand for Ontario salt.

Turning now to the metals, we need not refer specially to lead, which has been worked in an experimental way only at a few points in the Ottawa valley; some thousands of tons of ore having been produced in all, but very little of it smelted or marketed.

Iron is of much more importance. Ontario possesses deposits of all the chief ores of iron. The upper Laurentian of the Ottawa valley contains, especially near outcrops of crystalline limestone, many ore bodies, some of considerable dimensions, most of them magnetite, but some hematite. Southern Ontario has more or less extensive areas of bog ore, and Western Ontario can boast of immense beds of magnetic ore in the Atikokan and Greenwater Lake regions; and of still greater beds of hematite along the Mattawin River; while low grade siderite or carbonate of iron has been found to the east of Port Arthur. In the early days of the province iron ore was not only mined, but also smelted in furnaces of small and antiquated forms, but producing charcoal iron of excellent quality. A good account of those primitive operations may be found in the report of the Bureau of Mines for 1892, where we find that magnetite was used in the Marmora region and bog ore on Lake Erie. Some novelties were tried, such as the use of wood for smelting in a furnace at Madoc. The iron was usually cast into stoves, potash kettles, etc., and found a ready sale in the province. No iron has been smelted, I believe, since 1844 or 1845 though similar charcoal furnaces are working, apparently with good success, under quite similar conditions in the Province of Quebec. These old furnaces were, of course, immensely protected by the difficulty of transporting such a cheap and heavy metal before railways were available Probably only a few hundred tons of iron were produced in all, since the furnaces were of very small capacity. Since those days a considerable amount of magnetite and also some hematite has been mined at various points in Hastings and counties to the east. Between 1859 and 1873 Ontario and Quebec together shipped 207,000 tons of ore to the United States, much the larger proportion being from Ontario. From 1873 to 1891 there were shipped 423,700 tons; and, in all, Ontario seems to have exported more than 600,000 tons; but since 1891 no work of importance has been done in our mines, the rich and cheaply worked deposits of Minnesota, and the imposition of duties in the United States, having driven our ores from the market. The main obstacle in the development of our iron mining industry has been the lack of mineral fuel for smelting; and it will be of much interest to see how the experiment at Hamilton of smelting Ontario ores with coke from the United States will turn out. It is probable that before long Ontario iron mining will again be of importance, especially in the region west of Port Arthur, where inexhaustible beds of hematite and magnetite form the Canadian extension of the wonderful Minnesota iron region, which now leads the world in production. There seems no good reason, except lack of capital and enterprise, why some point on the upper lakes, where ores, flux and fuel can be brought together cheaply by water, should not become a Canadian Cleveland with a great iron industry; and we may not unreasonably hope to see this in the future.

The copper mining of Ontario is naturally divided into two periods, an earlier one when the Lake Huron mines were operated, and the present when copper is obtained from the Sudbury ores as nickel-copper matte. The product of the Bruce, Wellington, and other Lake Huron mines, between 1846, when they commenced, and, 1876, when they ceased work, is valued in the Report on the Mineral Resources of Ontario at $3,300,000. In 1886 we find copper once more quoted in our statistics, 164,000 lbs. having been produced; in 1892 there were 1,936 tons; in 1893, 1,431 tons. This copper is in reality only a by-product of the ore worked for nickel. There is some chance that the Mamainse deposits, which are really an extension of the famous Michigan region, may be worked before long, but the immediate prospects of copper mining as distinguished from nickel mining are not very bright, as the price of the metal discourages fresh ventures. The C.P.R. penetrated the wilds of Northern Ontario in 1882, disclosing the great masses of copper pyrites and magnetic pyrites in what is now the Murray mine, near Sudbury. Before long these ores, first valued for their copper, were found to contain the more valuable metal. Nickel is first mentioned in our statistics in 1889, but the amount produced is not given, since the Canadian Copper Company, the only producer, refused to make its returns public. In 1890, 718 tons of the metal are reported; in 1891, 2,303; in 1892, 2,082; in 1893, 1,642, and in 1894, 2,570½ tons. We have only one important rival as a producer of this metal, the French island of New Caledonia in the Southern Pacific, which provides an output about one-third greater than ours. The New Caledonia ores are of a totally different character from ours, consisting of garnierite, a green magnesian silicate, while ours are sulphides, chiefly pyrrhotite and pentlandite. There seems no doubt that our ore exists in unlimited quantities, and the only question to be considered is the amount of the metal which the world can consume. At present the supply seems to equal the demand, and, since the initial plant is costly, there is no object in new companies going into the mining of nickel. The price has been steadily falling, and, as satisfactory methods of refining it are perfected, this splendid new metal must take a more important place in the world. The use of nickel steel comes slowly into favor, and the great saving in weight for a given strength should bring this alloy into use for structural purposes, especially in shipbuilding. If the British Government could only be convinced of its value in armor plates, we should soon have a boom in nickel mining. With refined nickel quoted at 45 and 47 cents per pound, one would suppose there ought to be a market for solid nickel table-ware and kitchen utensils. It is most desirable, however, that we should refine at least a part of our nickel in Ontario, instead of shipping all the matte to the United States or the old world.

The history of silver mining in Ontario is one of the most interesting and romantic in our mining annals. Silver was first found by Peter McKellar, in 1866, at what was afterwards the Thunder Bay mine; but much more important was the discovery, two years later, of the most famous mine in the Province, the Silver Islet mine. Close to the stormy north shore of Lake Superior, just east of Thunder Bay, a small islet, about 70x40 feet in dimensions, yielded to one or two blasts, silver to the value of $1,200. The next season 10 men secured over $16,000 worth of native silver in not more than 14 days of actual work. In 1870 the Montreal Mining Co. sold out to American capitalists and development was begun in earnest. The little islet was enlarged by crib work and filling until there was room for seven buildings with some space besides; while shafts were sunk to the depth of 1,230 feet. Some of this sinking was through rock tightly bound together with wiry native silver, which, with a number of rich silver bearing minerals, some new to science, formed the chief ore. To treat the ore a fifty-stamp mill was erected on the mainland, and the now widely-used Frue vanner was invented by Mr. Frue, the mine captain. The total production up to the end of 1884, when the pumping engines were obliged to shut down for want of coal, and the mine filled with water, amounted in value to $3,250,000, by far the largest return from any single mine yet recorded in the Province. The product of other mines to the west of Port Arthur brings up the total value of silver from the region to about $4,300,000, according to the Survey Reports. Since 1881, however, the amount of silver obtained has been trifling, and at present no mining is going on in the Thunder Bay district. The mines, other than that at Silver Islet, seem to be shallow and very pockety. Nevertheless, if silver should again reach its old price, it is probable that several of them could work at a profit.

In August, 1866, two prospectors in the township of Madoc found flakes of a yellow metal like copper, which could be beaten out into thin leaves. They were informed by the geologist, Vennor, that the metal was gold. This find was on what was afterwards named the Richardson mine. Other discoveries in the same and neighboring townships followed, and caused a violent attack of the gold fever in the towns to the south. Probably less than $100,000 worth of gold was obtained in all from the region, and five times as much was sunk in useless plant. The failure seems to have been due partly to the pockety nature of the deposits, partly to the refractory character of the ore, for instance, near Deloro, where it is arsenical pyrites; but largely to ignorant and extravagant management. In 1871 gold was found by the McKellars in the western part of the province at the Huronian mine; since then

the yellow metal has been discovered at many points between the Madoc region and the Manitoba boundary. In fact it may be said that few gold producing countries in the world can boast of so wide a stretch of territory that has been proved to be more or less auriferous. Wherever the Huronian rocks appear there is a probability of the occurrence of more or less gold in them. In spite of all this, but one mine, the Sultana, near Rat Portage, can be said to have proved itself a paying venture, though several others begun within the last year or two promise well. The richest specimens come from the Ophir mine and Shoal Lake on the Lake of the Woods, and from Wahnapitæ; but to the present mines showing less brilliant specimens seem more likely to prove of permanent value. The most hopeful portion of the Ontario gold mining region at present is the Lake of the Woods, where at least two mines, the Sultana and Regina, are producing their bricks of gold with great regularity. The Rainy Lake region, after a year of blank depression, is beginning to revive, and there is a probability that some of the true fissure veins on Shoal Lake will be worked energetically during the coming year. The Manitou region is attracting much attention, but is still only in the prospecting stage. The Harold Lake property, opened up by the energetic Wiley Brothers, is also a producing mine and seems to have passed the experimental stage. In and near Moss township, which has the once famous Huronian mine in its centre, interesting gold discoveries have recently been made, and a very large deposit of gold-bearing quartz is being explored by the McKellars near Jackfish Bay, on the north shore of Lake Superior, with results that promise well. The Ophir mine in Galbraith township, and the Vermillion mine in Denison, show no signs of life; nor are the Wahnapitæ mines doing much more than prospecting work The curious McGown deposit of gold and copper ores near Parry Sound is also nothing more than a prospect at present. In the oldest gold mining region of the province, that of Madoc, Marmora, Belmont and other townships, little is being done, though Mr. Ledyard has shown some enterprise in developing his Belmont mine during the year. It would seem as if some of the deposits of arsenical ore in this region could be worked at a profit with the improved machinery and methods introduced since the shutting down of that costly failure, the Deloro reduction plant; but no doubt it will take time before confidence is restored in the region.

In glancing over the results of our mineral industry as a whole, we find that petroleum products give the greatest aggregate returns, far exceeding the results of mining any of the metals. Defective statistics make it impossible to give even a rough idea of the whole produce of our oil wells; but for a number of years the sales must have amounted to more than $1,000,000.

Nickel should perhaps come next, that is, if the value of the refined metal is taken, which is perhaps not fair, since the matte is all exported. Then silver, copper and iron.

Our output of gold has been insignificant, in spite of the immense outlay on plant in the Madoc and Rat Portage regions. The production of salt no doubt far exceeds it in value.

Looking toward the future, we may fairly expect well established industries, like the production of salt and petroleum, to continue the even tenor of their way for a long time to come, unless some change in the tariff makes a marked change in their conditions. Nickel mining may be expected to increase gradually as the world is able to absorb more of that fine metal. Hand in hand with it, our output of copper will, of course, also increase. The immediate future of iron mining does not look very bright, but there must come a time when our western ore deposits, which are practically limitless, will give rise to an important industry.

There seems no immediate prospect of a revival of silver or lead mining in our province, nor are our large deposits of zincblende to the north of Lake Superior likely soon to be drawn upon.

Gold presents the brightest outlook of all for speedy expansion, especially in the part of the Province west of Lake Superior; and I fully expect to see a well established gold mining industry there within a few years, something of a quiet and permanent character like that of Nova Scotia, but on a larger scale, since the extent of our gold field is much greater.

One of the most discouraging features of mining in the Province is the lack of intelligent interest and enterprise on the part of our own citizens. Most of the more important mining ventures of Ontario have been in the hands of outsiders, especially our bold and energetic neighbors, the Americans, who seem to lead the world of late years as successful miners. Perhaps our canny capitalists, when our cousins from across the line, and a few stirring Britishers, have got possession of our best properties, will begin to wake up to the fact that we have gold mines worth working right at home, and that many of them will give far better returns than mortgages or bank stocks in this time of depression.

WILLIAM McWOOD.

William McWood, superintendent of the car department of the Grand Trunk Railway, is perhaps the oldest master car builder in the world—certainly the oldest occupying an official position—having been continuously in the car department of the Grand Trunk since 1855. Mr. McWood was born in Montreal in 1830, and served his apprenticeship as a coach builder in Montreal when a boy, and afterwards worked as a journeyman for McLean & Wright, railway contractors of the same city, for whom he became foreman. Starting with the G.T.R. in 1855 as a journeyman car builder, he became assistant foreman after three years' service, and by successive stages became foreman, assistant mechanical superintendent and finally superintendent, being appointed to the last named position about 1869. An enormous number of cars have passed through Mr. McWood's hands in this long service, and at Carillon there are still to be seen several cars built by him as long ago as 1847. These cars belong to the Ottawa River Navigation Co., and are still occasionally used as spare freight cars on the company's short line from Carillon to Grenville. One peculiarity about these cars is that they were built with wooden breakheads, and these portions of their anatomy are still serviceable. Mr. McWood has been a highly esteemed member of the Master Car Builders' Association, whose field covers Canada as well as the States, and has been repeatedly honored with offices in the organization. For several years he was third vice-president, and for three years in succession (1888-89-90) he was placed in the president's chair, and received the medal given to past presidents. Mr. McWood has been a member of the association since 1875.

THE BALL NOZZLE.

By invitation of Thomas Howard, Canadian representative of the American Ball Nozzle Co., New York, the Board of Underwriters, Chief Benoit, of the Montreal brigade, and the leading fire insurance men of the city, assembled at the C.P.R. elevator, Dalhousie square, Montreal, on 16th ult., to witness the working of the Ball Nozzle as a fire fighter. Mr. Howard's intention was simply to demonstrate the practical working of the nozzle, with which the C.P.R. elevators are equipped, using the company's own hose, etc., but instead of a mere exhibition the occasion developed into a competition between the Ball nozzle and the Descarrie controlling nozzle, the inventor of the latter being present.

The first test was with a stream from the hydrant at about 55 lbs. pressure. Chief Benoit did not consider that the possibilities of either nozzle could be shown from so low a pressure, and suggested bringing down an engine. This was done, and the two nozzles were each given a 100 feet of hose connected with the Silsby engine. The result showed the Ball nozzle's superiority both in volume and range of spray and stream, the latter reaching a height of over 150 feet, against an extremely high wind. Chief Benoit and members of the Board of Underwriters were unanimous in their expressions of admiration of the valuable fire fighting qualities of this nozzle, which, as against the ordinary straight-stream nozzle, an English authority has likened to the Gatling gun, compared with the ordinary rifle. The victory was all the more creditable from the fact that Mr Howard had had no intimation that his nozzle would be called into contest with one worked by its inventor, while the Ball nozzle was put in charge of a member of the fire brigade, who had not had it in his hands before, all of which goes to prove the contention of the manufacturers that simplicity is one of its strongest points. It does not call for any special training to use, the only direction being, "Turn on the water, the Ball does the rest."

The problem of this mysterious nozzle has engaged the attention of many of the leading scientists of the world. One of the most lucid explanations that has appeared was by C. Baillairge, city engineer, Quebec, in his paper last May.

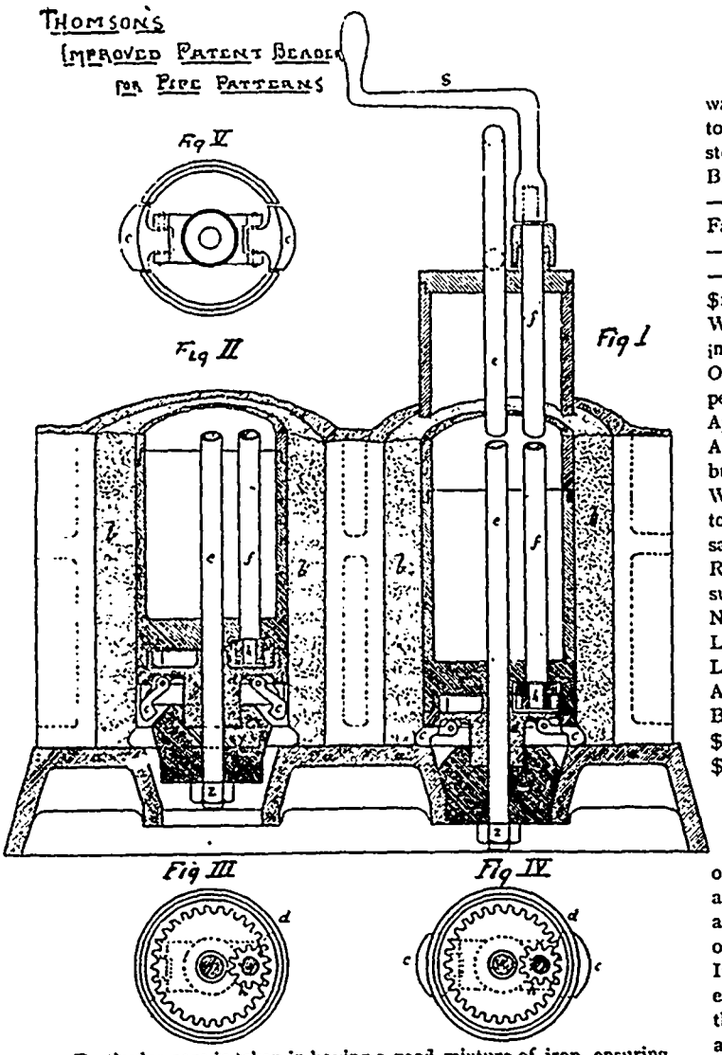
A detailed description, with illustrations of the different ball nozzle appliances, will be given in an early number of THE CANADIAN ENGINEER; meantime, those interested can obtain a copy of a handsome catalogue, illustrated in colors, containing full particulars and testimonials from eminent authorities, by addressing Thomas Howard, No. 10 Board of Trade, Montreal.

DO NOT NEGLECT THIS!

"Canadian Engineer" subscribers are reminded to notify the publishers of any alteration in their address, made necessary by removals, etc. Please give the old as well as the new address.

THE GARTSHORE-THOMSON PIPE AND FOUNDRY COMPANY, LIMITED.

The Canada Pipe Foundry was established in 1870, although the product of pipes was not begun on a large scale until the year 1876, the output at that time being only about five to six tons per day of one size of pipe; at the present time there is a possible output of 50 tons per day of all sizes from 4 inch to 60 inches in diameter, the larger sizes (above 36 inches) being chiefly used for railway and highway culverts, superseding stonework. The pipes made at the works have been used in every principal town and city from Cape Breton (Sydney) to Vancouver and Victoria, B.C., and compare favorably with those made in Scotland and the United States.



Particular care is taken in having a good mixture of iron, ensuring good sound castings. All the latest improvements in the manufacture of cast-iron pipes are adopted, one of which is the patent "beader" invented by Mr. Thomson of this firm. The pipes being cast on the ramming stool ensures the metal being of uniform thickness, which is of the utmost importance in castings of this kind. The firm has lately been reconstructed, and is now called The Gartshore-Thomson Pipe and Foundry Co., Ltd.

TRIAL TRIP OF THE WILSON TRANSIT CO.'S SCREW STEAMER, "W. D. REES."

This steamer, which is the largest vessel that ever sailed from a lake port, went on her trial trip from Cleveland to Fairport, O., on the 15th inst. Her principal dimensions are: length, 413 feet; breadth moulded, 48 feet; depth moulded, 28 feet. She will carry 4,600 tons dead-weight at 15 ft. 1 in. mean draft and 7,100 tons at 20 feet draft. Her engines are of the triple expansion type, the diameter 23 inches + 38 inches + 63 inches, and common stroke of piston 40 inches. She has two Scotch boilers, each 14 feet diameter by 13 feet long, with 6 furnaces, each 46 inches by 9 feet, working pressure 170 pounds per square inch. Diameter of propeller 13½ feet. The steamer was under way continuously for four hours; mean speed attained, 12.2 miles per hour; mean revolutions of engines, 81; steam pressure, 158 pounds; vacuum, 23½ inches. In water, 138°. This steamer is of great strength, and was constructed under the superintendence of Joseph R. Oldham, naval architect, of Cleveland, O. Her water ballast tanks contain 1,800 tons of water. The plating, with the exception of the keel plate, is lap-jointed and quadruple riveted, except at the ends and near the neutral zone, where the laps are but triple riveted. She has twelve cargo and one coal bunker hatches. The upper bottom is extra strong, and in no part less than double riveted, so as to withstand the impact of ore when loading, without the intervention of the usual wood ceiling. She has steel shifting boards for carrying grain, and will receive a 25-year class in the U. S. standard. The compasses were adjusted by Frank Morrison. The builders were represented by Mr. Robt. Wallace, of the Cleveland Ship Building Company, and the owners by Capt. Ed. Morton and Joseph R. Oldham, N.A., superintendent of construction.

FIRES OF THE MONTH.

Cunningham's boot and shoe establishment, Antigonish, N.S., was destroyed.——The Metapedia saw mill, J. P. Mowat, proprietor, $500 loss on machinery.——Chestnut & Hipwell, Upper Woodstock, N.B., carriage factory; total loss.——April 1—Harland Bros.' hardware store, Clinton, Ont., damaged to extent of $500. ——April 2—Frost & Wood, implement manufacturers, Smith's Falls, Ont., storehouse damaged by fire set by spark from cupola. ——April 6—The Vulcan Foundry, Lucan, Ont., damages, $1,000. ——April 9—Heslop's Roller Mill, Wellandport, Ont. Loss, $10,000; insurance, $4,500.——April 9—The Oxford Foundry, Woodstock, Ont., one building damaged to extent of $3,000; no insurance.——April 15—Ontario Wheel Co.'s Works, Gananoque, Ont. Loss, $50,000; to be rebuilt at once.——April 22—Imperial Oil Co.'s Refinery, Petrolia, Ont. Loss, $25,000.—— April 17—The oil storehouse, G.T.R. station, Thorold, Ont.—— April 17—Geo. Ingles, sash and door factory, Lindsay, Ont., one building destroyed; loss $3,000.——April 18—Toronto Electrical Works, Henry S. Thornbury & Co., Toronto; damages amounted to $2,500.——April 23 - C. M. Bostwick & Co., St. Martin's, N.B., saw-mill and stores destroyed.——April 23—The drying house of Ruel's box factory, St. Joseph de Levis, Que. Loss $1,000; no insurance.——April 21—Forest Canning Co.'s buildings, Kingston, N.S. Loss $30,000.——April 26—Jacob Large's planing mill, Listowel, Ont. Loss $1,000.——April 27—Waterworks' storehouse, London, Ont.; five tons of lead pipe destroyed.——April 28—Attempted burning of Harris & Walton's sash and door factory, Belleville, Ont.——Bisnett's saw-mill, Blenheim, Ont. Loss $2,000 ——May 1—Chambers' saw-mill, Scotland, Ont. Loss $3,000; no insurance.

HORSELESS VEHICLE RACE.

It appears that Hamilton, Ont., is not to have the much-talked-of horseless vehicle race. The Hamilton Jocky Club was enthusiastic in support of the idea and were prepared to give prizes to the amount of $1,500 and the use of their grounds, but the promoters of this race and exhibition did not think the amount sufficient. It is unfortunate that the matter should not have been determined earlier, as new competitions and exhibitions are being announced on the other side of the international boundary. As will be noticed in another column, the Rhode Island State Fair will have a race of this kind as a leading feature, and will offer prizes amounting to $5,000. Canada should give evidence of its native energy and ability by making some move towards assisting in the development of one of the epoch-marking creations of our century—the horseless vehicle.

DIMENSIONS OF SHAFTING, ETC.

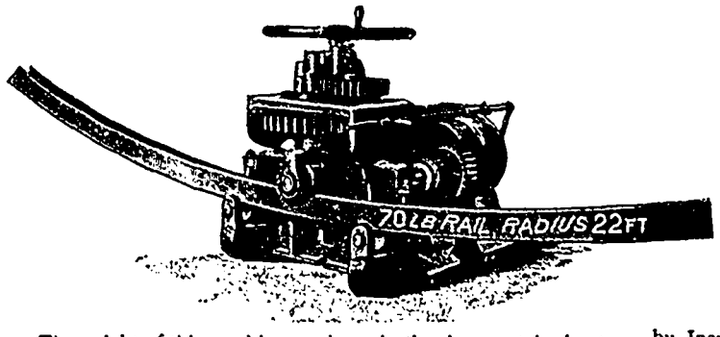
An Ottawa correspondent writes to THE CANADIAN ENGINEER asking what dimensions of shafting, cylinder, and other parts of an engine are necessary for a given power. It is not possible to give an answer to such a comprehensive question without specific data. However, there are a number of valuable publications which may be had, at moderate cost, which will enable anyone to find such results as size of cylinder, length of stroke, etc., upon the assumption of certain specified facts, as the horse-power required, purpose of engine, etc., etc.

THE HALIFAX STREET RAILWAY.

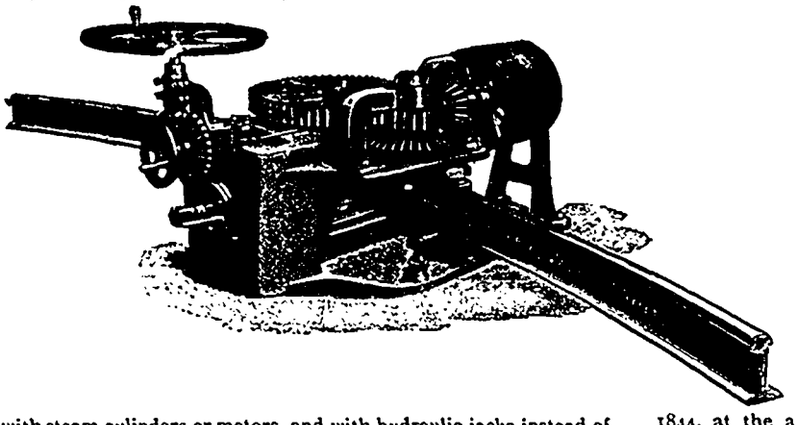
The new street railway in Halifax is equipped in a first-class manner. The engines, four 300-horse power Robb-Armstrong, are among the finest produced by that well-known firm. A generator of 100 kilowatts is attached to each engine. The cars were supplied by the Rhodes-Curry Co., and are said to reflect great credit upon the manufacturers. The electrical equipment was put in by the Canadian General Electric Co., of Peterboro'.

POWER RAIL-BENDING MACHINES.

The accompanying illustration is that of a rail-bending machine made by George E. Smith, of Sherbrooke, Que., and recently used in the construction of the Quebec Central Railroad. It may be used for any kind of rail-bending or for the structural iron work of bridges, etc., and can be worked by steam or any other power. The frame work and bed are solidly built, and, when placed on a suitable foundation, the machine will feed the rail through and at the same time impart a perfectly uniform curvature. This curvature can be regulated by increasing or decreasing the pressure of the middle roller, and, where necessary, in any part of the rail. By shifting the roller pins it is possible to obtain a curvature on either 13 or 17-inch centres. The machine can generally be managed by one man.



The weight of this machine, as shown in the above cut, is about 3,400 pounds A lighter kind is made for railroad rails only, and can be mounted on a platform car and connected by a six-inch belt with any seven or eight horse-power engine resting on the same car and fed from the locomotive The rails can be fed from a car in the rear, through the bending machine, on to another car in front, where they are ready for the track layer. These machines are built also



with steam cylinders or motors, and with hydraulic jacks instead of the compound gear and screw, and will impart an even curvature, without twist or kink, at the rate of one rail per minute. The weight of this machine, complete, as shown in the above cut, is about 2,400 pounds In ordering these machines, send a full size cross section of the rail to be bent.

CANADIAN ASSOCIATION OF STATIONARY ENGINEERS.

The ninth annual banquet of the Hamilton Branch No. 2 of the Canadian Association of Stationary Engineers was held at the Commercial Hotel, April 2nd. Past President R. Mackie was in the chair; Mayor Tuckett, of Hamilton, Ald. McKeown; W. G. Blackgrove, of Toronto, president of the executive council; A. E. Edkins, Toronto, past president; James Hugget, Toronto, District Deputy, and H. Gerry, president of the Guelph Branch, surrounding him. There were also present: A. M. Wickens, past president of the executive council; John Fox, John Bain, and Wm. Sutton, all of Toronto; W. R. Cornish, vice-president of the Hamilton Association, was vice-chairman, W. Norris, secretary, supporting him. The toast list was: "The Queen"—National Anthem, in chorus. "Governor General," "Dominion Parliament, and Local Legislature"—Song, "The Maple Leaf." "Army and Navy"—Song by H. N. Thomas. "Mayor and Corporation"—Response by Mayor Tuckett; song by W. G. Blackgrove; response by Ald. McKeown. "The Executive Head"—Song, by T. Davis, response, by W. G. Blackgrove. "Manufactures"—Trio, Hyslop, Wilson and Davis; response by Mayor Tuckett; song by H N. Thomas; speech by James McLaughlan, Toronto. "Sister Associations"—Response by A. E. Edkins, Toronto; song by W. S. Hyslop. "Learned Professions"—Response by R. C. Pettigrew; song by R. Flint, Toronto; song by T. Davis. "Hamilton Branch, No. 2"—Response by Chairman Mackie. "The Ladies"—Responses by Fox and Huggett; song, Mark Wilson. "Our Host" closed the list. During the evening T. Davis sang, very feelingly, "Twelve Months Ago To-night," in memory of the late Bro. Duncan Robertson.

The following letter has been received by the publishers of THE CANADIAN ENGINEER from the C.A.S.E.:

Toronto, March 14th, 1896

MESSRS. BIGGAR, SAMUEL & CO.,

GENTLEMEN,—I am directed by the Library Committee of the Canadian Association of Stationary Engineers to thank you most cordially for the valuable contribution you have made towards our library. Trusting you may have success in your business pursuits, I remain,

Yours very truly,

W. G. BLACKGROVE,

Secy. Treas. Com.

The first open meeting of the Ottawa Branch of the C.A.S.E., which was held in Burbridge's Hall, Rideau st., Ottawa, on March 28th last, was a most successful affair. The recording secretary, N. D'Aoust, reports that Bro. F. Merrill was in the chair. The question box was opened and the first question, "How to find the constant for regular or irregular speed engines?" was fully explained and illustrated by Bro. F. Robert. "How to find the mean effective pressure with or without indicator," was discussed and illustrated on the blackboard by Inspector Donaldson, who happened to be present. President Merrill gave an explanation of the phrase, "A H.P. Boiler." A number of members gave their ideas as to the different constants of heating surface per horse-power adopted. The meeting decided to adopt 15 square feet of heating surface per h.p. for horizontal boilers.

THE LATE J. GOLDIE.

Jno. Goldie, of Goldie & McCulloch, Galt, Ont., who died at his home in Galt in the end of March, after a long and painful illness, was one of the oldest and best known citizens of the town, and, perhaps, the one who has done most to place it in its present position among Canada's manufacturing centres. Mr. Goldie was a student, as well as a business man. The Astronomical and Physical Society voiced the loss to the thinking public by the death of Mr. Goldie by passing a resolution expressing the deep regret of the members at the death of one who had proved so generous a supporter of the society. Jno. Goldie was born and educated in Scotland, coming to Canada in 1844, at the age of twenty-two. After fifteen years spent in contracting and working as a mill-wright, he formed a partnership with Hugh McCulloch, and bought the foundry business of Jas. Crombie. This business has always been conducted with the utmost skill and probity, the combination of the fairest dealing and the best workmanship making the firm celebrated. In 1891 the business was formed into a joint stock company, with a capital of $700,000.

NEW BRIDGES.

There will be a great rush in bridge building this spring in Quebec, owing to the enormous damages resulting from the recent floods. The names of the bridges destroyed or seriously damaged make a long list. —— Bissonette's bridge at St. Meloche and Plante's bridge at St. Clair, were carried away by the ice.——Three covered bridges over the Thames, near Inverness, Que., were destroyed.——The bridges over the L'Islet at Becancour and the Nicolet at Dupes, Que., were swept away.——The I.C.R. bridge over the River du Sud at St. Thomas, Montmagny, Que., damaged. ——The Drummond County R. bridge over the Becancour at Maddington Falls, Que., was carried away.——The Quebec Central bridge over the Etchemin at St. Anselme, Que., was destroyed, as also the Q.C.R. bridge over the St. Francis at Sherbrooke. These two bridges will cost about $100,000 to replace.——On the St. John River, N.B., the Grand Falls, the C P.R. bridge at St. Leonard's, was carried away, and those at Andover and Upper Woodstock were rendered unsafe for use.——The bridge over the Kaministiqua at Stanley, Ont., was damaged to the extent of $3,000 by the floods. The Port Arthur, Duluth and Western Ry. bridge was swept away.

Industrial Notes.

YARMOUTH, N.S., wants an engineer for the town pumping plant.

THE Safety Barb Wire Company, New Toronto, has assigned.

C. H. MERRICK wants a site for a new boat factory in Arnprior, Ont.

THE Hart Emery Wheel Co. is enlarging its premises in Hamilton, Ont.

PLANS are being prepared for the hospital at Cornwall, Ont. It will cost $15,000.

THE C.P.R. shops at Winnipeg recently turned out a very large locomotive cylinder.

GALT, ONT., is preparing a by-law to authorize the expenditure of $7,500 on its waterworks system.

HERRON BROS.' sawmill, Lanark, Ont., requires a new steam plant, owing to a recent smash-up.

THE Phœnix Mill, Fredericton, N.B., wants an engineer, but he must be under fifty years of age.

THE British Columbia Iron Works have received a site in Trail, B.C., for their branch establishment.

THE Bushnell Oil Co. has issued a writ against Hamilton, Ont., to complete fulfilment of a contract.

THE Excelsior Egg-Preserving Company, of Chicago, will erect a $45,000 plant in Hamilton, Ont., at once.

CONTRACTOR CLARKE, of Toronto, will build the Perth House of Refuge, Stratford, Ont Cost, $15,000.

THE Spring and Axle Company, Gananoque, Ont., turned out recently the first set of ball-bearing axles.

J D. GUAY, mayor of Chicoutimi, Que., is looking for manufacturing enterprises to locate in that town.

THE Canada Carriage Co., Brockville, Ont , recently made a large shipment of vehicles to South America.

THE Bryan Mfg. Co., of Collingwood, has the contract for the new school at Sault Ste. Marie, Ont , at about $6,000.

ONE of the employees of the Hamilton Iron and Steel Company, Hamilton, Ont., was suffocated by the gas from the furnace.

THE Regina Creamery Company of Regina, N.W.T., has obtained its equipment from D. Derbyshire & Co , Brockville, Ont.

THE bonus of $10,000 for the Strathroy Furniture Co. was voted by that town recently with very little opposition, the vote standing 501 to 9.

SHELDON & SON, Aylmer, Ont., recently received an order for a spraying pump for the Ottawa Experimental Farm, and fifteen for the Ontario experimental stations.

THE Linde British Refrigeration Company, Montreal, applies for incorporation. Capital, $100,000. Provisional directors: C. W. Vollman, James A. Wright, and J. Cooper.

THE Waterous Engine Company, of Brantford, Ont. have handed over their old buildings to the city in return for an additional year of exemption from taxation on the new buildings.

THE Ontario Association of Civil Engineers recently held their examinations in Toronto The examiners were Messrs. Sankey, Kirkpatrick, Nevin, Gaviller, S. Gibson, Butler, Van Nostrand, and Coade.

THAT a large export trade in Canadian furniture is possible, is shown by the enormous business done by British manufacturers. Maple & Co., London, the famous furnishers, had recently in their warerooms 39,195 bedsteads.

THE Provincial Board of Health will insist upon changes being made in the Windsor and Walkerville, Ont., waterworks and sewage systems. At present, the water supply of Windsor is contaminated by the sewage from Walkerville.

AT the annual meeting of the Gibson Foundry and Machine Co., Ltd., of St. John, N.B., Alexander Gibson, jr., was elected president; James E. Simmons, manager; A. McN. Shaw, secretary-treasurer, and Joseph McAfee, superintendent.

W. A. KROMER, of Baltimore, Md., has written to the mayor of Hamilton, Ont., stating that he is contemplating the establishment in Canada of a branch factory for padlocks, and asking for information regarding Hamilton and its advantages as a location.

THE McClary Manufacturing Co., London, Ont., has lately shipped a carload of stoves and other goods to the Yukon district, Alaska, a distance of 5,000 miles. The goods go *via* C.P.R. to Vancouver, and thence to Alaska by a C. P. steamer.

CALVIN R. MORRISON, a carriage maker, Shawville, Que., is gazetted insolvent.

THE Aylmer Iron Works, L. L. Sheldon, Aylmer, Ont., is extending its plant.

THE town of Lunenburg, N.S., is agitating for municipal control of its fine waterworks system.

E. LEONARD & SONS, London, Ont., are putting in a new 125 h.p plant in James Anderson & Sons' sawmill at Dorchester, N.B.

WORK is to be begun on the new car shops in Ottawa East at once. An engine house to accommodate twenty locomotives will be built.

BEAR ISLAND COVE and Steep Creek, N.S., on the Strait of Canso, will each have a new lobster cannery this year, according to the Digby *Courier*.

CHESTNUT & HIPWELL, who recently lost their wood-working establishment in Upper Woodstock, N.B., by fire, are rebuilding in Woodstock, N.B.

THE Dominion Bridge Company have secured a contract for the superstructure of five bridges over the Soulanges, and two over the Cornwall Canal.

A SERIES of borings have been made in the harbor at Carleton, N.B., to determine the nature of the bottom. The wharf will be extended, as rock was found.

THE exemptions enjoyed by the Niagara District Fruit Preserving Co. have been transferred to the Lake Street Canning Factory, St. Catharines, Ont.

THE Gurney Co., stove manufacturers Toronto, has given notice to its employees that they must place insurance on their lives for the sum of $100 or more.

IT has been decided to remove the Macgillivray Pipe Works from New Westminster, B.C , to Vancouver. The latter city grants free water and an exemption from taxes.

IF the C P.R. will agree to pay $300 a year to the town of Renfrew for water supply, the prospects for the new waterworks being gone on with at once will be improved.

THE Rhode Island State Fair Association, of Providence, R.I., has offered prizes to the amount of $5,000 for a horseless vehicle race and exhibition next September.

THE aqueductors have been blocked again. They will not be allowed to carry out their plan of damming the River Humber at Toronto unless they have completed their aqueduct.

SARAH GOULD, J. C. S. Shields, F. A. Shields, and others, will be incorporated as the Ontario General Construction Co. to do a general contracting business, with a capital of $50,000.

GOLDIE & MCCULLOCH, Galt, Ont., have been awarded the contract for putting in the engine in connection with the artesian well at the Ontario Agricultural College at Guelph, Ont.

IT is rumored that the Londonderry, N.S., blast furnace will be blown out. Owing to bad fuel and scarcity of water, the past year's product has been unsatisfactory, and repairs must be made.

THE Jenckes Machine Works, Sherbrooke, Que , suffered severely during the recent floods. The whole works were flooded and work had to be suspended, and the plant was badly damaged.

INSPECTOR T. P. THOMPSON recently tested the new boiler being constructed at the Kingston locomotive works for the Kingston, Ont., waterworks department. The boiler stood the test in a most satisfactory manner.

WALLACE BELL, of Montreal, has been engaged by Simeon Jones, of St. John, N B , to drill an artesian well in that city for water. He is also putting in a Northey deep-well steam pump for C. Gurd & Co., the ginger ale manufacturers of Montreal.

THE incorporators of the Port Arthur Pulp Co. are: J. Conmee, J. Whalen, R. Hazelwood, C.E., G. Clavett, Port Arthur, Ont.; W. Gray, of Seaforth; T. L. Bray, Toronto; S. H. Janes, Toronto, and C. Beck, Penetanguishene, Ont. The capital is $200,000.

JUDGE CURRAN recently granted the petition of E. H. Parker for a winding-up order to put the Sabiston Lithographic & Publishing Co. into liquidation. Judge Mathieu has granted a similar petition on the part of the Bristol Brass & Clock Co to put the Dominion Tubular Lamp Co. in liquidation.

PROFESSORS BOVEY AND SMITH, of McGill College, have examined and reported on condition of foundations and foundation walls for Carleton Place, Ont., town hall, just being erected. A block of concrete taken from foundation, laid last fall, of proportions 1—2—5, stood a crushing test at McGill laboratories, on April 16th, of over 30 tons per square foot.

SUSSEX, N B., wants a fire engine.

A B. JARDINE'S tool works, Hespeler, Ont., are running overtime.

THE Springfield cheese factory near Aylmer, Ont., is to put in a butter making plant.

IT is said that Porter Bros., railroad contractors, will erect a large saw-mill near Kaslo, B.C.

THE bridges to carry York and John streets over the railway tracks in Toronto are to be built at once.

IT is said that the Inter-Provincial Bridge Co., Ottawa, will spend $50,000 this summer in building piers.

IT is said that Mr Potvin, of Notre Dame du Lac, Que., will erect a saw and grist mill at Lake des Isles this summer.

MERRICKVILLE, ONT., will manufacture clothes drying machines, says the *Almonte Gazette*. A factory will be established.

PAXTON, TAIT & Co., Port Perry, Ont., have been running night and day recently. A number of large water wheels have been turned out.

W. MCLEA WALLBANK states that he expects the entire works of the Lachine Rapids Hydraulic Power Co. to be completed by November 1st.

J. POWELL, representing a Hamilton syndicate, has applied for permission to build an inclined railway at the waterworks park, London, Ont.

FOR the first quarter of 1896, Dun & Co. report the failures in the hardware, stove and tool trade number 45, with liabilities aggregating $423,231.

THE Pattison Manufacturing Co., Ltd., of Windsor, N.S., capital, $8,000, will be incorporated to manufacture condensers, distilling apparatus, etc.

THE coroner's jury in the Elmwood boiler explosion found that the boiler was defective, but was unable to say who was responsible for its defective condition.

A DIVIDEND of 20 cents on the dollar has been declared by the referee of the Ontario Forge and Bolt Company. The stock, plant, etc., was disposed of for $110,000.

JNO. MACINNIS & SON, Halifax, N.S., will receive $4,000 for building the purifying house of the People's Heat and Power Co., Halifax, the company supplying the materials

J A. BEAUDRY, acting for the Quebec Board of Health, has inspected the sewage system of Granby, Que., and recommends immediate construction of a trunk sewer and other improvements.

RECENTLY the foundry of the insolvent Montreal concern, Wm. Clendinneng & Son Co., was put up at auction, and after some quiet bidding was knocked down to the Banque du Peuple for $125,000.

THE Smoke Preventive Co., of Montreal, has been incorporated. Capital, $10,000, the provisional directors are J. MacFarlane, S. White, W. J. White, F. L. Snow, E. H. Barker, of Montreal.

IN January, 1896, Henry Canniff, carriage maker in Belleville, Ont., gave two chattel mortgages to a local druggist. Since then he has found collections very slow, and the mortgages have been foreclosed.

THE municipal council of Sturgeon Falls has agreed to bonus the Sturgeon Falls Pulp Company to the extent of $7,000, providing the company erect and equip a mill costing about $29,000 and employing from 30 to 40 hands

BALLANTYNE & Co., Preston, Ont., are making extensive shipments of wood-working machinery to the Maritime Provinces. The shipment consists of band saws, pony planers, tenoning machines and buzz planer

THE town of Midland, Ont., applies to the Ontario Legislature for leave to bonus a wood working and pulp factory to the extent of $10,000 The members of the proposed company are H. H. Cook, D L. White, S C. Briggs, Jas. Playfair, J. Chew.

THE Auer Light Company has won its case in England, for infringement upon its patents, and perpetual injunction has been issued. This decision will have an important bearing upon the Canadian case of the same order, to be tried at Montreal soon.

IN Bicknell *v.* Peterson, Judge Falconbridge dismissed the action with costs. It was for an injunction restraining defendants from making, constructing, using or vending the plaintiff's invention of a new and useful improvement in a machine known as "anti-friction walking-beam irons," and for an account of sales made by defendants, and for damages for infringement.

AT the works of the Hamilton Powder Company, Departure Bay Road, Nanaimo, B.C., a thousand pounds of nitro-glycerine exploded, killing a workman, recently.

W. G. WALTON, of Hamilton, who recently visited Detroit to inspect a moto-cycle built by C. B. King, Detroit, believes it to be a practicable machine, and one in which money may be safely invested.

YOUNG BROS., of Mississippi Iron Works, Almonte, Ont., took the precaution last summer to build a substantial breakwater between the railway bridge and their machine shop. Had they not done so, their shop would have been flooded during the recent high water.

S. DEAN is chairman of the provisional board of the creamery to be built at Saanich, B.C. Advantage will be taken of the new Creameries Act of the British Columbia Legislature, which provides for a Government loan equal to one-half the cost of the creamery.

THE Pictou Charcoal Iron Co. has started at its Bridgeville works two double puddling furnaces, a steam hammer and a train of rolls. The new mill was put in operation on April 10th. The company has nearly 1,000 tons of pig iron on hand, and it is expected that the bar iron made from this charcoal pig will take the place of imported Swedish blooms.

MESSRS. WATSON, FOSTER & Co., of Grey Nun street, Montreal, have obtained a grant of $9,000 from the municipality of Maisonneuve, and will, this summer, erect a capacious rectangular factory there. It will be built on the most approved principles, with a fire wall running through the centre. When the building is ready, every department will be transferred to it, and the Montreal premises will know the firm no more.

THE Metallic Roofing Co., Toronto, has just completed its contract with the city for roofing and siding the extensive new buildings on the Yonge street wharf, with "Eastlake" galvanized steel shingles and "Manitoba" steel siding; has just placed in position in the Albion Hotel, of Toronto, an ornamental embossed steel ceiling; and also a similar ceiling in the offices of the Canadian Typograph Co., of Windsor, Ont.

THE firms manufacturing bolts who have entered into an agreement as to prices, etc., are: the Pillow & Hersey Manufacturing Co., Ltd., Montreal; the Geo. Gilles Co., Ltd., Gananoque, Ont.; the Swansea Forging Co., Ltd., Swansea, Ont.; John White, London, Ont.; Bolt and Hinge Works, London, Ont.; the Canada Screw Co., Ltd., Hamilton, Ont., and the Ontario Nut Works, Paris, Ont, binding themselves to sell bolts of different kinds at a uniform price.

THE Sawyer-Massey Works, in Hamilton, are at present constructing what will be a remarkable engine. It is a traction engine for use on the prairie farms of the North-West, and is being built on plans drawn by Robt. Christie to the order of Wm. Stevenson of Morris, Man Complete it will weigh 40,000 lbs. and will draw fifteen ploughs It will also pass over the fields and thresh, winnow and bag the grain. Much interest is being taken in the success of this new engine.

THE Imperial Bridge and Iron Works (Antoine Rousseau) has filed abandonment on the demand of H. R. Ives & Co. (Samuel Coulson). The liabilities total $27,000, and the creditors are 84 in number. The heaviest are: Bank of Toronto, $10,000; H. R. Ives & Co., $2,806; A. C. Leslie & Co., $600; Ontario Rolling Mills, $553; Banque National, $325. Ontario Bank, $500; Bank Jacques Cartier, $410, Dominion Government, open account, $800; J. E. Robidoux, $100; D. Whelan, $195; A. Paquet, $123; Consumers' Cordage Company, $100; Nova Scotia Steel Company, $117; J. Sherar, $392; Shearer & Brown, $366; Thomas Robertson & Co., $5,005; P. Lanctot, $1,000. L. L. Hagg, $37. Estate P. Beaudry, mortgage $3,090; W. Organder & Co., $133. F. W. Rudford, Montreal, has been appointed curator of this estate.

THE iron manufacturers' meetings which were held at the Windsor, Montreal, have resulted in some changes in value. Plain and barbed wire have been continued as they were before. In wire nails, however, there has been advance of almost 5 per cent., the trade discount of the list being reduced to that extent. The new discounts now are 70 and 12½ per cent. in Quebec f.o.b. Montreal, and 70 and 7½ per cent. in Ontario, with delivery of 10-keg lots where the rate does not exceed 25c. per 100 lbs. In screws there has been a reduction of 2½ per cent. all round. In tacks, shoe rivets have been altered as follows: Iron or soft steel wire shoe rivets, 10c.; brass wire shoe, 25c.; duck billed 17 gauge, 17c.; do. 16 gauge, 16c., with a discount of 20 per cent. The discount on soft steel shoe nails and Swede iron shoe nails has been placed at 50 per cent.

A NEW bridge is to be built at Anthony, Upper Burlington, N.S., this summer.

IT is proposed to build an oatmeal mill at Foxwarren, Man., on the line of the Manitoba and Northwestern Railway.

THE *Farnham Leader* says two big things the Gullene Pneumatic Collar Co., can boast of: The biggest whistle in town and the largest rating.

THE steamer "Campana" has been overhauled in the Davie shipyard, St. Joseph de Levis, and 200 electric lights put in by the Montmorency Electric Co.

THE Dominion Government have practically pledged themselves to give financial aid to the Historical Exhibition in Toronto and to the proposed World's Fair in Montreal, both fixed for 1897.

THE Coldbrook Rolling Mill, St. John, N.B., owned by I. & E. R. Burpee & Co., has been sold to Alex. Rankine, of the nut and bolt works, and Thomas Miller, formerly foreman at the Strait Shore rolling mill.

PHILIP JOHNSON, superintendent of the Dominion Bridge Company, of Montreal, which has the contract for the erection of the bridge at the Hamilton Beach, says that in about six weeks the bridge will be ready for traffic.

THE Guelph Norway Iron and Steel Co. (Limited) have machinists at work increasing the weight of the pulley in connection with the finishing train of rolls. The furnace is also being slightly altered in order to increase the output.

DUNCAN S. MACORQUODALE, of Toronto, described as an inventor, is suing Geo. W. Yarker, financial agent; Charles Miller, G. A. Case and Frances Amelia Hogaboom, executors of the estate of George R. Hogaboom, for $5,000, alleging the non-fulfilment of an agreement to buy a patent for a fare and transfer ticket box.

MURRAY & WILLIAMS, engineers and yacht brokers, Montreal, are at present building five Tregurtha water tube boilers, sizes 20 inches to 26 inches; three new steam launches, two 21 feet long, and one 23 feet long, admiralty type, open launch. One of these launches is being built of clear cedar, and finished in mahogany, all woodwork above water line finished in oil and shellac; boiler and stack covered with polished brass, and all piping of brass. This firm is also overhauling and putting machinery in several old boats

THE International Patent Bureau, of Toronto, has recently perfected its organization by the addition to its management of R. A. Kellond, formerly of the firm of Reynolds & Kellond, Montreal and Toronto, and well known as an experienced patent expert and solicitor. Mr. Kellond has been practising for some years in connection with leading patent law firms in New York city, and his association with G. O. Freeman, barrister, should bring to this popular bureau a good share of the professional patent work, which is recognized as of so great importance to inventors and patentees. Their announcement will be found in another column.

W. B. MACKENZIE, chief engineer Intercolonial Railway, at Moncton, N.B., informs us that a 5-inch bore-hole for water, at the Moncton, N.B., sugar refinery, had on April 20th reached a depth of 240 feet, and was then in the millstone grit formation:—12 feet being through red marsh mud; 12 feet being through blue marsh mud; 36 feet being through sand and gravel (the bed of an ancient river); 30 feet being through red clay; 10 feet being through red clay and small sharp stones; 130 feet through soft red sandstone. Mr. David Kent, of Sussex, N.B., is sinking the hole with a steam percussion drill such as is used for boring oil wells in Pennsylvania.

WE take pleasure in referring to the Toronto Machine Screw Co., who have recently established their works at 109½ Adelaide street west, Toronto. The premises are specially adapted for their business, with an abundance of room, power and good light. The business was originally founded about one year ago by M. Nelson, a well-known business man, and a thorough, practical mechanic. E. Kerwin, the other member of the present firm, is a successful business man of many years standing. The removal to larger and more convenient quarters, in order to accommodate a large addition to plant, machinery and improved tools, will enable them better than ever before to fill orders promptly.

M. ROBINSON, J. Henderson, T. Cairns, W. D. Forrest and W. Owens are to be the first directors of the Owen Sound Sugar Manufacturing Company, Ltd., which is applying for an Ontario charter to establish a beet sugar factory; capital $150,000.

C. A. DOUGLAS, H. N. Bate, J. C. Brennan, D. O'Connor, R. A. Sproule, A. H. Dowslee, and A. McKinnon, of Ottawa, are applying for an Ontario charter as the Ottawa Specialty Manufacturing Company, Ottawa, to manufacture wooden and metalware furniture, interior fittings, etc.; capital $45,000.

Railway Matters.

THE G.T.R. will build a steel bridge at Newcastle, Ont.

THE abutments for the Central Railway bridge over the Salmon River at Chipman, N.B., are completed.

THE municipalities interested are moving in the matter of C.P.R. extension through Embro, Ont., to Stratford, Ont.

GEORGE W. VAUX, formerly excursion clerk of the General Passenger Department, G.T.R., is to be chief clerk of the road.

CHIEF ENGINEER HOBSON, of the G.T.R., will recommend the building of a first-class iron bridge at Barton street, Hamilton, Ont.

FIFTY years is the period of the agreement by which the G.T.R. give the C.P.R. running powers over the line from Hamilton to Toronto.

THE Great Northern Railway of Quebec has had built at the Rathbun works at Deseronto, Ont., a number of box cars, 40,000 lbs. capacity.

THE Rathbun Company will remove the Thousand Island Railway engine house and coal yard to a distance from the Inn, Gananoque, Ont.

THE charter for the Manitoulin and North Shore Railway, which was the property of Mrs. Kilganan, has been sold to a syndicate which proposes to build the line at once.

THE spur to connect the T., H. & B. with the Toronto branch of the G.T.R. will prove very costly. A great deal of cutting is required, and the canal and a street must be bridged.

THE G.T.R. and New York Central are experimenting in the use of their respective types of engines, the G.T.R. having loaned two to the N.Y.C. in exchange for two from the United States.

THE employees of the C.A.R. and O., A. and P. S. Railways in Ottawa, have decided to use a surplus of over $1,000 on hand as receipts from their annual excursions and pic-nics, for the establishment of a library.

A BRIDGE building society in Belgium that has a claim against Mr. Beemer for a bridge on the Quebec, Montmorency and Charlevoix Railway, has made application for the appointment of a sequestrator for the road.

AMONG those engaged on the new Dauphin Railway are H. D. Ellis, formerly assistant engineer for roadways for Toronto; H. W. D. Armstrong, and G H. Hanning, jr., who was also in the Toronto City Engineer's Department until recently.

THE Esquimalt and Nanaimo Railway Company, through the general superintendent, Joseph Hunter, has invited tenders for the construction of iron bridges across Goldstream, Niagara and Arbutus canyons. The Arbutus trestle, the highest of the three, is nearly 200 feet high.

THE town of Sudbury has been disputing with the C.P.R. as to the former's right of emptying sewage into a certain creek whence the railway drew its water supply. The suit has been settled by the C.P.R. agreeing to pay $550 per annum for a supply of water and twenty incandescent lights.

AT the annual meeting of the St. Lawrence and Adirondack Railway Co. the following directors were elected for the ensuing year: Chauncey M. Depew, Dr. W. Seward Webb, C. H. Burnett, John Jacob Astor, E. C. Smith, E. Van Ettan, R. W. Leonard, M. E. McLary and H. L. Sprague.

JOSEPH HOBSON, chief engineer of the G.T.R., has appointed George Masson, of Detroit, to the position of resident engineer of the G.T.R. lines in Michigan. He will perform the same duties as he formerly did under the title of Chief Engineer of the Chicago & Grand Trunk and Detroit, Grand Haven & Milwaukee.

D D MANN, of the firm of Mann & McKenzie, is now surveying the route of the railway to Lake Dauphin, Man. It is now proposed to start the line from Portage la Prairie, where connection is made with the C.P.R., North Pacific and Manitoba and Northwestern Railways. It is said 100 miles will be built this season.

THE Dunsmuirs propose to extend the Esquimalt & Nanaimo Railway for a distance of 100 miles above Wellington, its present terminus, provided that the city of Victoria guarantees the bonds of the road to the extent of $2,000,000 at 4 per cent. for 25 years. As a further stipulation, it is said, the coal bunkers of the firm will be removed to Esquimalt, where all the coal shipping pertaining to the Dunsmuir company's business would be made.

LORD and Lady Aberdeen gave an At Home to the railway men of the C. A. R., O., A. and P. S. and C. P. R., May 2nd, between four and seven o'clock, at Ottawa. Over three hundred invitations were issued.

THE Nova Scotia charter of the S. V. & L. Railway has been transferred to W. G. Reid and others, who are to be known as the Midland Railway Company, and are to build a road from Windsor, N S., to a point between Truro and Stewiacke on the Intercolonial Railway, connecting with Truro, with a branch to the coal and iron fields of Pictou county, and to a port.

AMONG the supplementary estimates passed by the Ontario Legislature are the following: Irondale, Bancroft and Ottawa Railroad, five miles, $3,000 per mile; the Ontario, Belmont and Northern, not exceeding ten miles, $2,000 per mile; the Pembroke South Railroad, not exceeding 15 miles, $3,000 per mile. Ottawa, Arnprior and Parry Sound, $3,000 per mile for two and one-quarter miles, and a transfer of $5,520.

SEVERAL interesting changes have taken place in the Montreal staff of the Canadian Pacific Railway. James Osborne, late superintendent of the car service, is to be assistant to the vice-president; G. S. Cantlie, late general baggage agent, is to be superintendent of the car service; W. A. Grant, late chief clerk of the vice-president's office, is to be stationery agent; A. D. McTier, late chief clerk of the fuel department, is to be general baggage agent; J. P. Driscoll, late chief clerk of the car service, is to be car accountant; W. K. Thompson, assistant superintendent in Montreal, will shortly remove to St. John, N.B., as he has been appointed divisional superintendent of the St. John-Megantic division. Other changes are: Assistant Superintendent Williams, from London to Toronto; Assistant Superintendent Jamieson, from Smith's Falls to Farnham; and Assistant Superintendent Bradley, from Farnham to Smith's Falls.

"RAILROAD DEVELOPMENT" was the subject of a lecture delivered recently in the Grand Trunk Railway Literary and Scientific Institute, by Professor C. B. Smith. Mr. Smith spoke for two hours, his remarks being illustrated by stereopticon views. In passing, he referred to what is now known as vestibule trains, which, though designed more for the comfort of passengers, had much to do in regulating the speed; the advantages and disadvantages of the electric system, and went on to give a history of the track, and the shape of the rails in Great Britain and America, afterwards giving a very clear and comprehensive description (with illustrations) of the Westinghouse air brake. The different systems of controlling the movements of trains before the telegraph was brought into use were also described, incidentally referring to the block system almost universally in vogue in Great Britain. Other appliances were also alluded to, after which the lecturer threw upon the screen illustrations of some of the most famous bridges of the world.

RECENT changes in the Grand Trunk Railway are: Retired—L. J. Seargeant, general manager G.T.R.; W. J. Spicer, general manager C. & G.T.R.; J. Stephenson, superintendent G.T.R.; E. P. Hannaford, chief engineer; A. J. Bailey and M. Macfarlane, bridge inspectors; R. Clark, district engineer; J. Broughton, claim agent; S. Symons, general baggage agent; John Earls, district freight agent; Herbert Wallis, mechanical superintendent. New appointments—C. M. Hays, general manager of the whole system and affiliated lines; F. H. McGuigan, general superintendent of the same Changes—G. B. Reeve, from C. & G.T.R. to be general traffic manager, J. Loud to be general freight agent; J Hobson, chief engineer; F. W. Morse, mechanical superintendent; W. E. Davis, G.P. & T.A., J. E. Quick, general baggage agent; H. W. Walker, general auditor; N. J. Power, auditor of disbursements; R. Quinn and J. Pullen, Division freight agents; C. J. Haigh, G. T. claim agent; David Brown, first assistant general freight agent —these being officers of the system This is a sweeping change in the management of the road, and as we said when the new general manager's reign began, we watch with interest the workings of the new management. There can be no doubt whatever that the management is actuated by the keenest desire to benefit the road. While we deeply regret the absence of our old friends from the places where we have been so long accustomed to see them, we yet extend a warm welcome to the new comers, knowing that they will also do their best for the old road.

W. C. B. RATHBUN, Toronto representative of the Rathbun Company of Deseronto, and a son of the founder of the firm, accidentally shot himself in Toronto on May 4th. The wound will probably prove fatal.

Marine News.

THE clearance charges at inland water ports have been abolished.

ANOTHER steamer for the Muskoka lakes is being built at Gravenhurst, Ont.

STEAMER "City of Windsor" will go on the Hamilton-Toronto route, commanded by Capt. Malcomson.

THE G. T. R. has sold its steel freighter "Wisconsin" for $50,000 to the Crosby Transportation Co.

THE office building of the Richelieu and Ontario Navigation Co. at Three Rivers was carried away by the recent floods.

"SHENANGO, No. 2," the Conneaut-Port Dover coal ferry, is running regularly again. "No. 1" is in the dry dock at Cleveland.

THE passenger steamer "J. L. Cann," of Yarmouth, N.S., has been refitted and put on the Yarmouth-Halifax route. Capt. A. H. Kelley is in command.

J. JOLLY is the Toronto agent of the Hamilton Steamboat Co. this season, Mr. Bishop, the former Toronto agent, having been appointed manager at Hamilton.

THE steamer "Lakeside," of the Toronto-St. Catharines line, will run this season as usual. The officers are: Captain M. J. Wigle, Purser H. J. Johnston and Chief Engineer John Booth.

THE captains of the steamers of the Merchant Line are: "Arabian," Oliver Patenaude; "Arcadia," John Clifford; "Lake Michigan," J. S. Moore; "Cuba," R. Chestnut; "Melbourne," H. Chestnut.

THE officers of the Parry Sound steamers are: "Alfred Morrill"—Captain, W. Richmond; engineer, Jos. Harris. "Magnetawan"—Captain, A. Clark; engineer, J. Morrison. "Emma"—Captain, Chas. Clark; engineer, E. S. Pratt.

AT Lindsay, Ont., the "Marie-Louise" has been rebuilt; Capt. Parkin and Engineer P. Mulcahy are in charge; the steam yacht "Greyhound" is receiving new engines; excursion boat "Crandella" has been thoroughly overhauled; Capt. Crandell will command.

CAPTS. JAMES PLAYFAIR, W. H. Featherstonehaugh, and W. A. Clark have issued a writ against the Reliance Marine Insurance Company, of Liverpool, England, for $17,300 on a policy. The insurance was on the steam barge W. B. Hall, which was wrecked last fall.

R. D. MACKAY, of Hamilton, has purchased the steam barge "Sir S. L. Tilley," Collingwood, and her consort, the the schooner "Merritt." The "Tilley" is one of the largest Canadian wooden freight propellers, and the "Merritt" is a three-masted schooner with considerable freight capacity.

THE steam barge "St. Andrew," which has been in the dry dock at Owen Sound, Ont., has been supplied with new engines by the Bertram Co., Toronto. They are 20 x 40 fore and aft compound, with a 36-inch stroke. The boiler is of 1¼ in. steel, 12½ x 12 feet, and will weigh 30 tons. It will carry a pressure of 150 pounds.

THE "Algonquin," the largest Canadian owned boat on the lakes, will be commanded by Capt. Jas. McMaugh, with A. Graham as mate and James H. Ellis as chief engineer. The captain of her consort, the "Rosedale," is Jas. Ewart; mate, D. Ewart and chief engineer, R. Childs. Jno. Moore, of St. Catharines, who commanded the "Algonquin" last season, will command the "Lake Michigan."

THE steam yacht "Miltonian," at present under construction by the Davis Dry Dock Co., Kingston, Ont., for A. E. Knopf, of New York, will be most complete. Her hull, which is 72 feet long, 12 feet 3 inches beam, and 5 feet 9 inches in depth, is of solid rock. The decks are of narrow, stripped pine, which will be oil finished. The cabins are built of cherry with mahogany here and there. The engine is 150-horse power water tube boiler of R. Davis & Son's design. The yacht will be finished by 1st of June.

THE *Victoria Times* says that at Fort Steele the International Transportation Co. has been formed by the Upper Columbia Navigation and Tramway Co. and Capt. P. D. Miller. They will run from Jennings to Fort Steele, and Fort Steele to Canal Flats, connecting with the Columbia River steamers for Golden. The boats will be the "Ruth," a steamer 130 feet in length, 22 feet beam, 4 feet 6 inches depth of hold; the engines 10x74; the "Gwendoline," which is now being rebuilt, 98 feet in length, 18 feet beam, and intended principally for a freight boat.

THE city of Vancouver, B C., is to subsidize a boat running from Chilliwack to Vancouver.

THE Hudson Bay Co. is repairing its steamer the "Athabasca," at Athabasca Landing, N.W.T.

FRED. CORKEY, Barriefield, Ont., is engineer on the Lumsen Co.'s steamer "Meteor," on Lake Temiscamingue.

J. C. BLAIS, engineer of Public Works Department, is making soundings at Chicoutimi, Que., with a view to improvements in the harbor.

TENDERS have been called for on a sea-going tug, 100 feet long, for the Standard Oil Company. The vessel is to be delivered in Montreal.

CITIZENS of Granville Ferry, N.S., wish to secure a steel screw steamer to run between Bridgetown, Annapolis, Granville Ferry and St. John.

THE C. & K. S. N. Co.'s new steamer was launched at Five Mile Point, on Kootenay river, recently. She will run on the Bonner's Ferry route.

IT is said that a scheme is on foot, backed by the New York Central Railway, to put a new line of steamers on between Toronto and Charlotte, N.Y.

AN effort is being made to have the business of the Alexandria Bay Steamboat Company absorbed into that of the Thousand Island Steamboat Company.

WOODEN ship building still goes on in Nova Scotia. At Port Greville there are five schooners almost ready for launching, and three in the yard of H. Elderkin & Co.

THE M. T. Co.'s new lake barge "Melrose" was successfully launched at the company's dock yards at Kingston, Ont., April 29th, in the presence of fully 1,500 spectators.

THE Dominion line will put on a new ship from Montreal in June The new ship "Canada" will be of greater size and tonnage than any other boat ever sailed from Montreal, it is said.

THE steamer "Cumberland" has been overhauled and put on the St. John-Portland route. Capt. Thompson is in command; Allan, pilot; Le Baron Thompson, purser; Torkay, second clerk, and Leonard, steward.

LETTERS patent have been issued incorporating Hugh McLennan, James Crathern, George Hyde, Abner Kingman, H. E. Murray, of Montreal; Alexander Buntin, of Toronto, as the Beaver Line, Ltd. Capital, $250,000, to carry on general shipping business.

DR. LACHAPELLE, J. D. Roland, Chas. McLean and F. Vanbruyssel, of Montreal, representing the Franco-Belge Steamship Company of Canada, closed the contract with the Minister of Trade and Commerce for a line of steamers between Canada, France and Belgium. The annual subsidy to be $50,000.

THE North Shore Navigation Company has made the following appointments as captains: W. J. Bassett, steamer "City of Collingwood"; F. X. Lafrance, steamer "City of Midland"; G. W. Playter, steamer "City of Parry Sound"; A. A. C. Cameron, steamer "City of Toronto," and W. Wilton, steamer "City of London."

G. W. BROWN, of Windsor, general manager of the Windsor, Detroit & Sault Line of steamers, which include the sidewheelers "Cambria" and "Carmona," says that last season a large part of their traffic came from points in southern Ohio, and that this fact influenced the line in making Sandusky the terminus in the United States.

IN 1894, the steamer "City of Windsor" carried away the lock gates at Port Dalhousie, and was seized by the Dominion Government Bonds were given, and the steamer was released. In the following spring Capt. Symes got judgment for $1,300 for wages and disbursements. The steamer was sold for $3,500. Then the Government claimed priority over Capt. Symes' bill for wages. Judge McDougald has rendered judgment for Symes, on the ground that as the Government did not sell the boat when they seized it, they relinquished the priority of their claim.

THE officers of the Toronto Ferry Co. steamers for the present season are: "Primrose"—Captain, C. Tafford; mate, H. Cotter; engineer, H. Brownley; 2nd engineer, J. Armstrong. "May Flower"—Captain, Geo. Moulton; mate, M. Livingston; engineer, S. A. Mills; 2nd engineer, J. Pickard. "Shamrock"—Captain, T. Jennings; mate, T. Churchill; engineer, E. Abbey. "Thistle"—Captain, A. Martin; mate, N. Osborne; engineer, C. Leralley. "Kathleen"—Captain, J. Fertile; mate, McLaughlin; engineer, Paddy Carr. "Gertrude"—Captain, J. Tymon; mate, P. M. Olsen; engineer, Wm. Hopkins. "Island Queen"—Captain, J. Titus; mate, Olwood; engineer, T. W. Good. "Luella"—Captain, T. Hinton; mate, Wm. Joice; engineer, John Smiley. "J. L. McEdwards"—Captain, Wm. Scott; mate, Henry Brown; engineer, John D. McGinnis. "Arlington"—Captain, H. Farr; mate, Ed. Lawrence; engineer, J. Wesley. "Mascott"—Captain, Henry Florio; mate, Henry Hanna; engineer, Wm. Food.

NEARLY a score of tugs wintered at Collingwood, Ont. Some of the tugs and the officers who will sail them are:

Tug.	Captain.	Engineer.
Saucy Jim	F. Scott	G. Scott.
F. A. Hodgson	S. Carson	H. Bunill.
Jas. Storey	H. Cleland	D. McRoberts.
Trudeau	———	J. Brennan.
D. McCarthy	D. Malcolm	D. McLeod.
W. J. Aikens	J. Morrow	J Tasse.
Orcadia	T. Driver	W. Hill.
Ethel	I. Vancougheret	J. Johnson.
Jas. Clark	B. Darling	J. C. Craig.
Vixen	J. Mckay	W. Keizer.

THE following are the boats and officers of the Richelieu and Ontario Navigation Co.'s fleet for the present season:—

Ship.	Captain.	1st Engineer.	2nd Engineer.
Quebec	Boucher	Gendron	Blanchette
Montreal	St. Louis	Hamelin	Beaudoin
Berthier	[illegible]	Arcon	Doucet
Canada	Legal	Lapierre	Denis Matte
Caroiina	Reverin	Tatalippe	Bonin
Three Rivers	St. Louis	Matte	Befort
Chambly	.....	Lafleche	No second
Terrebone	La Force	Sheridan	"
River DeLorme	Jos. Faubert	Elingburg	"
Hosanna	Hall	Cartier	"
La Prairie	Coursel	Gendron	"
Cultivator	St. Paul	Noel	"
Longueuil	Jodoin	Baudet	Thomas
Hochelaga	Mandeville	Chapedelaine	No second
Sorel	Berthauime	Gendron	"
Hamilton	A. J. Baker	Black	Guilbault
Spartan	Grange	Taylor	No second
Corsican	Sewell	McWilliams	McWilliams
Passport	Craig	Parker	Bouret
Algerian	Dunlop	Wadsworth	No second
Columbian, Bohemian, Island Queen	Spare boats.		

Mining Matters.

THE gas well at Ridgetown, Ont., has been abandoned. In sinking it 2,000 feet $3,000 was lost.

Two discoveries of gold in the northern part of the County of Frontenac, are reported this month.

G. E. BARNES, St. John's, Newfoundland, is going to develop the recent find of petroleum in that colony.

OVER five thousand shares of the stock of the Sawbill Lake Gold Mine were taken up during the first three hours it was on the market.

THE new crusher for the Hill-Thompson gold mine, Cow Bay, N.S., which was built by the Truro Foundry and Machine Co., has been placed in position.

THE Albert Mining and Reduction Co., Point Wolf, Albert Co., N.B., is said to have struck a vein at 150 feet that yields 65 per cent. copper, with 11 ozs. silver and $4 gold to the ton.

THE New Glasgow Gold Mining Company's property at Country Harbor, N.S., is to have a new ten-stamp crushing mill, by Fraser Bros., machinists and engineers of New Glasgow.

THOS. BARNES and J. G. Landon, of the Hamilton Smelting Works, recently examined ore claims on the line of the Brockville and Westport Railway, in the interests of their company.

THE oil operators of Petrolea are being sued, to prevent their draining into Bear Creek. If the farmers who have brought the suit succeed in it, it will occasion great loss to the oil men.

HUGH LEONARD, of Garthby, Que., has supplied 750 tons of chrome iron ore to the Carnegie Steel Co., of Pittsburg, since January 1st.

THE Sudbury *News* is informed that R. P. Travers, manager for the Chicago mine (Drewry Nickel Co.), has received a contract for supplying 1,000,000 pounds of nickel.

IT is New Brunswick red granite that is used in building the American Museum of Natural History in New York. Tayte, Meating & Co., of St. John, have the contract.

THE Oromocto Coal Mining Co., of Fredericton Junction, N.B., has decided to resume prospecting operations, and four men have commenced work with a diamond borer at Central Blissville.

THE British Columbia Miners' Association has been formed at Nelson, B.C. H. E. Croasdaile was elected president; A. L. Davenport, vice-president; John Houston, secretary-treasurer.

THE machinery for the "K" dredge of the Dominion Pulverizing Co., which is to extract gold from the bed of the Fraser River has been placed in position by the makers, Beatty & Co., Welland, Ont.

J. MCCALLUM is manager of the selenite mine at Dutch Settlement, Truro, N.S., and has commenced operations with ten men employed. The selenite will be carted to Elmsdale station, and shipped to the United States.

A. W. CAMPBELL, C.E., city engineer of St. Thomas, Ont., has been appointed Provincial Instructor in Road Making. He will open an office at the Parliament Buildings shortly, where he will be under the control of the Minister of Agriculture.

OWING to the outcry raised against the British Columbia Government's proposal to impose a tax of two per cent on the gross output of the mines, the Government has decided to impose a tax on the net output and allow $3 per ton on ore for expenses.

AT the Weigand mine, Seine River, Ont., the shaft is down 208 feet, with about 50 feet of drifting. There are four levels, the first of which is at 50 feet, the second at 100 feet, and the third and fourth at 150 and 200 feet respectively The ore is most promising.

IN connection with the school of mines, Kingston, Ont., prospectors classes of two weeks duration will be opened this summer at Perth, Renfrew and Pembroke, Ont. Prof. Miller will be in charge. Other places may be favored with courses if the demand for such is urgent.

DURING March $17,000 in gold bullion was produced by the Regina and Sultana mines, Rainy Lake, Ont. The mines operate only ten stamp each, and during two weeks one mill was not working, owing to a break in the machinery. The ore in these mines yields one ounce of gold per ton.

FOLLOWING capitalists: R D Kirk, R. Dickson, C. N. Wilkie, A. D. Wilkie, of Kingston, Jamaica; and J. D Copeland, of Antigonish N.S. (of whom John D. Copeland, Robert Dickson and Charles N Wilkie are to be the first or provisional directors of the company), are to be incorporated as the Modstock Mining Company, to do a general gold mining business in Nova Scotia.

H E. MITCHELL, C. H. Cordingley, T H Gilmour, C. B. Deacon, of Winnipeg; and R Rogers, of Clearwater (Robt. Rogers Thomas Henry Gilmour and Clifford Bannister Deacon, are to be provisional directors of the said company), are applying for a Dominion charter as the Roche Percee Coal Company, Ltd., to do a general coal mining and handling business. Capital, $50,000.

J. D. COPELAND, Antigonish, N S; F. T LeMoine, of North Sydney, W. J B. Bingham, St. John, N.B. (the said John D. Copeland, Frank T LeMoine and W J. B Bingham, are to be provincial directors of the company), are to be incorporated under a Nova Scotia charter as the Victoria Tripolite Company, Lt'd, of North Sydney, to mine tripolite; capital $7,000.

THE Ontario Natural Gas Co. has about completed arrangements for the laying of a gas main to Essex, Harrow and Amherstburg. The mains from which Windsor and Detroit receive their supply will be tapped a mile from Essex, and the work of laying the mains in that town will be commenced at once. It will take three miles of pipe to reach Harrow and nine miles to reach Amherstburg.

A. MILNE, W. Coutts, C. Johnson, jr., of St. George, and J. D. Chipman and J. T. Whitlock, of St. Stephen, apply for incorporation as Milne, Coutts & Co., Ltd., with a capital of $25,000 in $100 shares. C. C. Hennessy, Stephen Couley, F. Bogue, J. R. O'Brien, J. H. Frawley, and H. F. McDougall, of St. George, apply for incorporation as the Victoria Granite Company, Ltd., with a capital of $5,000 in $100 shares. Both companies are to operate granite quarries at St. George, N.B.

THE Silver Cup, Trout Lake, B.C., is shipping ore.

THE Headstone Iron Company will develop their iron property on Loon Lake, Ont., this summer.

AT the Centre Star mine, Rossland, B.C., four miners were killed by the explosion of two boxes of giant powder.

LARGE hydraulic mining interests will, it is said, be developed on French Creek, 65 miles north of Revelstoke, B.C., this year.

THE *Bothwell Times* says that the whole Bothwell, Ont., oil territory is being worked as fast as machinery can be got on the ground.

E. H. DUNBAR, Boston, is reorganizing the Lincoln Gold Mining and Milling Company, which owns the gold mine at Mahone Bay, N.S.

IT is reported that Foley Bros., Minneapolis, have sold the gold location on the Seine river, recently purchased from Ray and Weigand, for $30,000.

GREAT difficulty is being experienced in working some of the Alberni mines, owing to the bad roads. It is almost impossible to get the machinery in to the Duke of York mine.

A. H. UTLEY, M. M. Macdonald and O. R. Sprague, of Syracuse, U.S.A., recently visited the Sprague iron ore mines, near Madoc, with a view to purchase.—*Kingston News.*

THE 43rd Mining and Milling Company of Cariboo, Ltd., of Yale, applies for a B.C. charter. Capital, $600,000. J. Wright, North Bend, B.C., and A. Jamieson, Ottawa, Ont., are interested

Two car loads of hydraulic machinery for the Columbia River Hydraulic Mining Company, which is operating at the mouth of Smith Creek, on the Columbia, have been placed on the ground.

THE Deloro gold mines at Marmora have been sold to a big syndicate for $200,000, and preparations are being made to open the mines and operate them on a big scale this spring.—*Tweed News.*

J. S. ANTOINETTE, of San Francisco, has the contract for the large water ditch and hydraulic elevator plant for the Horsefly Gold Mining Company, which is to be in running order by the 1st of July.

E. G. DRAKE, J. W. Call, D. W. Payne, W. H. Peters, G. McCann, P. McLaren, H. G. Bessey, S. J. Hall, J. B. Coykendall, Elmira, N.Y., apply for an Ontario charter as a mining company, capital $1,000,000.

A COMPANY is being formed to work the minerals on Texada Island, B.C. The surface specimens of gold, silver, copper, tin and iron ores, have long been regarded as very rich, and a series of assays have fully borne out that opinion.

THE new 20-drill compressor of the War Eagle is now running. As soon as the other drills arrive three more will be put to work, making five in all. Two of these will be in the No. 2 tunnel, one in the shaft, and one in the Iron Mask tunnel.

THE Monarch mine, Rossland, B.C., has been bonded to Montrealers who are also interested in the Gold Drop. F. C. Innes, Vancouver, B.C., represents the holders. A vein 13 feet thick was recently struck in the Gold Drop.

LETTERS patent have been issued to R. P. Pattee, B Kelly, J. Mode, and D. McLeod, of Vankleek Hill, Ont., and N. McCallum, of Hawkesbury, as the Temiscamingue Lithographic Stone and Mining Company, Ltd., to quarry lithographic stone and do a general mining business.

IN West Kootenay there will be great activity this summer, particularly at Trout Lake. The district is said to be rich in gold, silver, bismuth, lead and asbestos. The Silver Cup, Abbott Group and America mines were worked all winter with good results, particularly the Silver Cup. The Great Northern Mine Company have exposed a five-foot vein running $150 to the ton. The Albert Group are all rich in mineral and will ship ore shortly. The America vein is two feet thick, running 120 ounces of silver to the ton. The Badshat, to be worked this summer, assayed 300 ounces in silver. The Black Prince, Poole Group, True Eisher, Jenny Lind, Horn, Blackhorn, Par-sold, are all rich in silver, and will be worked this summer. Lardo Creek will be exclusively placer mined from the commencement of mild weather.

MUCH interest is taken in the approaching session of the Canadian Electrical Association, to be held in the Board of Trade building, Toronto, June 17th and 19th. A number of valuable papers are in course of preparation.

Electric Flashes.

STERLING, ONT., will soon be lighted with electricity.

THE Waterloo and Berlin Street Railway is extending its lines.

W. J. GILMOUR is in charge of the electric plant in Brockville, Ont.

THE Electric Light Co. at Gananoque, Ont., will put in two new dynamos.

THE Government will connect Scattarie Island by cable with the mainland.

THE Heat, Light and Power Company, Kingston, Ont., has refused to sell out to the city.

THE Chicoutimi Electric Co. will construct an electric railway between that place and St Alphonse.

KASLO, B C, is determined to have a waterworks system, and is also negotiating for an electric light plant.

THE New York Legislature has passed the bill providing for a trolley bridge over the Niagara river at Lewiston.

A NUMBER of the cars on the Kingston Street Railway have been provided with new and more powerful motors.

THE Toronto Street Railway is being sued by Edward Page for $2,000, and E. W. Cleveland, $5,000, for injuries.

THE franchise and property of the Victoria Electric Railway and Lighting Company was sold April 12th, for $340,000.

HAMILTON, Grimsby and Beamsville Railway has decided not to extend its line to Grimsby Park and Beamsville this year.

THE Tay Electric Power Co 's premises, at Perth, Ont., suffered serious damage by the recent flood. The building will need to be rebuilt.

THE Hamilton, Ont., street railway is trying to reduce the percentage it pays to the city, claiming business is not profitable on the present basis.

OWING to trouble that the Lachine Rapids Hydraulic and Land Company has had in stringing its wires, it has been decided to place them underground.

THOS. NOTLEY was fatally injured and M. Tillman seriously injured by the collision of a trolley car and a wagon in the King street subway, Toronto, April 29th.

THE board of directors of the Sherbrooke, Que., Street Railway Company are J. W. Burke, president; F. J. Griffith, secretary; Walter Blue, Wm. Morris, and J. E. Flood.

THE Niagara Falls Electric Light and Power Co., of Niagara Falls, Ont., have awarded the contract for a 5,000 light incandescent plant to the Canadian General Electric Co. (Lt'd.)

IT is said that the Hamilton and Dundas Railway will be changed to electric traction at once. The line will be changed so as to enable ordinary freight cars to be drawn into Dundas over it.

THE Hamilton Radial Electric Railway Co. have awarded the contract for the electrical generating apparatus required for the operation of their road to the Canadian General Electric Co. (Lt'd.

R. CALLENDER, E. Hart, E. L. Goold, W. T. Knowles, Brantford, and J. E. Thompson, Toronto, will be incorporated as the Callender Telephone Exchange Co., to manufacture and use telephones, etc.

THE London, Ont., council are calling for tenders for street watering this year on two separate specifications, the one providing for the sprinkling of the streets entirely by horse carts, and the other partially by electricity.

ELECTRIC railway schemes are a good crop this year. Dr. Oille, of St. Catharines, has one in hand, and Engineer Powell, formerly with the International Radial Railway Company, has plans out to cover the same ground as the International.

WALKERVILLE, ONT., is to be lighted with gas for the next five years, the contract being given to the Windsor Gas Co. for 100 lights for $18 a year each, or a total of $1,800. Windsor's offer to supply electric light would have been more advantageous by about 25 per cent., says the London *Free Press*.

THE Hamilton Radial Railway has been granted right of way by the council of that city on a 32-year franchise, and is preparing to begin construction. M. W. Hopkins has been appointed chief engineer of construction. The company will strive to have the line between the city and Burlington Beach completed by Dominion Day. The power house will be located at Burlington, Ont.

MAGOG, QUE., is prepared to receive tenders for lighting the town by electricity. Water power can be had from the Dominion Cotton Mills Company there.

AN electric railway is proposed from Bell's Corners to Richmond, Ont., in the county of Carleton. This would be a branch of the Ottawa and Britannia line.

THE new electric light plant at the Union Station, Toronto, is thoroughly satisfactory. It runs 1,100 lights, and was supplied by the Canadian General Electric Company.

BERTON, ONT., is to have electric light at once, if enough subscribers can be had. Mr. Fletcher, of Alliston, Ont., will put in the plant, and J. L. Hamilton will supply power.

ORMOND HYMAN, electrician to the Inland Revenue Department, has been offered the position of chief electrical engineer for the colony of Queensland. Mr. Hyman prefers to remain in Canada.

THE Nova Scotia Telephone Co. have begun work on a new trunk line between New Glasgow, Pictou and Truro. This will connect with the company's long distance line at Truro for Halifax.

THE new electric light and power company in Hamilton, Ont., the Simpson-Noble, is now supplying current. Poles are erected on private property only, the company not having the right to place them on the streets.

THE work of laying the tracks of the Cornwall street railway has commenced. The roadbed will be solid, as it is intended to allow the Grand Trunk to run freight cars over the line to the mills and factories. A heavy "T" rail will be used.

THE Moncton, N.B., street railway and the city have completed arrangements for the construction of the road. The tracks are to be kept clear, the roads repaired when injury arises from the company's tracks, and new electric light poles will be erected by the company The power house will be on the wharf, thus securing cheap coal.

JUDGE WHITE rendered judgment at St. John's Que., recently in the case of the Richmond County Electric Light Co. *vs.* the Sherbrooke Telephone Association, condemning the defendants to pay plaintiffs $213.63 on account of the wrecking of a dynamo at the plaintiffs' station through the act of the defendants in allowing one of their wires to cross the plaintiffs' and produce a short circuit. An appeal will be taken from this judgment.

THE Rathbun Company are building at Deseronto, Ont., an electric self-loading street car, which, it is claimed, will revolutionize cleaning in all towns and cities. One car, it is said, will clean twenty-five miles per day and take the sweepings out of the municipality at a saving of sixty per cent. of the present cost of street cleaning. It is claimed that when completed it will sweep and load forty carloads of dirt or snow without stopping.—*Brockville News, April 24th.*

AN electric locomotive has taken the place of mules in a Pennsylvania colliery, as the motive power for hauling the coal to the surface up the incline from the face of the drifts to the tipple, and, according to the *Mining Journal*, similar locomotives are now being constructed by a Columbus, O., firm for other coal mines in Pennsylvania, West Virginia and Arizona. They are being built from 15 horse-power to 175 horse-power, and suitable for all gauges from eighteen inches up to the standard gauge of four feet eight and one-half inches.

JAMES E. PORTER, Andover; Albert Brymer, Perth Centre D. B. Getchell, Limestone, Me. Stephen Scott, Bairdsville, N.B. Geo. L. Everett, Victoria Co.; John W. Tapley, Riley Brook, Victoria Co.; Alex. Crawford, Birch Ridge, Victoria; J. Fletcher Tweeddale, Arthurette, Victoria Co.; J. Darrell Jago, Arthurette, Victoria Co.; James McNair, Frank Whitehead, Andover; W. H. Boone, Rowena; James Stewart, Perth Centre; Wm. Spike, Andover; John E. Stewart, Andover, apply for incorporation as the Victoria Telephone Co., Ltd., with a capital of $25,000.

E. A. C. PEW, the father of schemes, is promoting another. If he can secure customers for 5,000 horse-power, he would supply Hamilton with power from the Welland River. He said negotiations with a New York syndicate and all financial arrangements were completed, and as soon as the sale of the power is assured, construction will commence, and $1,000,000 will be spent this summer, the idea being to be in a position to supply power by September 1st. Next year, he said, a million more will be spent in improving the plant, and making it suitable for the use of electric railways. The power will be generated at Jordan, where there will be a fall of 322 feet, and the water will be brought from the Welland River, at a point one and a-half miles east of Wellandport, by a canal to Jordan. If the scheme goes through, arc lights could be furnished for $50 a year, while the present price paid by the city is

$92 50, and incandescent lights can be supplied for one cent a night. The mayor of Hamilton stated that the city's 500 h.p. for waterworks purposes costs about $61 per h.p. per year Nothing will be done by the J. G. Brill Car Works, of Philadelphia, to establish a branch in Canada till the Welland scheme is settled.

CONSTRUCTION work is going forward on the new electric railway at Cornwall, Ont., referred to in last issue The road will be 6½ miles long, and the tracks are being laid with "T" rails to accommodate the freight traffic that is to be carried on between the various mills and the Grand Trunk. The rails are to be sunk in the roadbed, and the company are to keep the road in repair for 18 inches each side of the rails. The Rathbun Company, of Deseronto, will supply the cars. A large power house is being built on Water street The company have purchased the Gillespie Point property, east of the town, as a park, in which a pavilion, etc., will be erected. Where possible, the track will be laid at the side of the street, to permit the repair of the sewers without disturbing the railway.

Personal.

NORTH TORONTO, ONT., has placed its electric light and water plant in the charge of Jas. Taylor.

JAS. MCGILL, of Kingston, Ont., auditor for the Rathbun Co., of Deseronto, died on April 25th.

W B. SMELLIE has entered upon the discharge of his duties as town engineer of Brockville, Ont.

R. G. EASTMAN, carriage builder, of Merrickville, Ont., committed suicide recently owing to financial troubles.

MATTHEW NEILSON, C E., has been appointed manager of the street railway, gas and electric light systems of St. John, N.B.

ALBERT PECK, a moulder in Clare Bros'. foundry, Preston, Ont., lost the sight of one eye recently by molten lead spurting from a ladle.

THE heirs of the late Chevalier Baillairge, Q C., of Quebec, have given the "Drapeau de Carillon," which he owned, to Laval University.

IT is said that Hiram Donkin, engineer of the eastern division of the I C R, has been appointed general manager of the Dominion Coal Co in place of David Mackeen

J. A. SAURIOL, engineer at the Gendron Manufacturing Co., Duchess street, Toronto, was seriously injured April 27th, by the bursting of a steam pipe.

DAN MCNEILL, C P.R. locomotive engineer, was killed on April 27th by his engine breaking through a bridge three miles west of Nipegon, Ont.—*London Daily Free Press.*

JOHN KEMP, second engineer at the waterworks pump-house, Winnipeg, fell into the big fly-wheel, April 15th. He was instantly killed, and his body was mangled beyond recognition.

IN the Ontario Department of Public Works, F. R. Heakes has been advanced to the position of architect, in place of Kivas Tully, who has been retained as consulting architect and engineer.

CHARLES COOPER, who has been acting as engineer for various steam saw mills in the vicinity of Sussex, N.B., for the past two years, has gone to Eatonville, N S, to accept a similar position for Messrs Eaton, of that place.

D. E. MCMILLAN, who was appointed 1st April, general freight agent of the Columbus, Sandusky and Hocking Railway, with head office at Columbus, Ohio, is a Montrealer, a graduate in applied science of McGill, who has been in the G.T.R. since 1884.

GEORGE E. SMITH, of Sherbrooke, Que., inventor and manufacturer of rail-bending machines, is making an extended trip through the Western States, to arrange with a number of the leading firms for handling his machines in that district, where a large demand already exists.

PERCIVAL W ST. GEORGE, the Montreal city surveyor, who is on a month's leave of absence for the benefit of his health, is now at Atlanta City, and he reports that his health is much improved.

CHAS THOMPSON, who has been assistant storekeeper in the C.P.R. works at North Bay for some three years, has been transferred to McAdam Junction, N.B., with the position of storekeeper.

WILLIAM PAGE, C.E., superintendent for the London and Provincial Tramway Syndicate, of London, Eng., was in Montreal recently This corporation has recently bought up the street railway in the city of Mexico.

THE widow of the unfortunate Pierre Labbe, who recently died from injuries received by the breaking of an emery wheel in the establishment of F. Gilbert, Montreal has now entered an action claiming $10,000 damages from the latter.

ACTION for $5,000 damages has been brought by Mrs. James against the Jones Mfg Co., Gananoque, Ont., for alleged negligence on their part in not having their machinery properly protected, causing the accident by which her son, Charlie James, lost his arm.

W A. MCLEOD, of Almonte, has been engaged as manager of Gillies & Co.'s foundry and machine shops at Carleton Place, Ont., and will take charge about May 1st. Mr. McLeod has been a prominent business man in Almonte for some years, and was formerly one of the proprietors of the Banner File Works

ALEXANDER LEARMONTH, senior, who emigrated to Quebec from Scotland in 1842, and has since filled a prominent position in the local foundry and machine trade, died on 2nd April, in the Jeffrey Hale Hospital, where he had been obliged some days previously to undergo amputation of one of his legs.

JAS. STEVENSON, late superintendent of the G.T.R., was presented with a substantial sum of money and a complimentary address, lately, by the employees of the road. The deputation was headed by J. M Riddell, assistant superintendent, and others present were F. Price, W. S. Rollo, T. S. Loucks, W. Bennett, W. Kinneston, E. Mundy, E. Townsend, F. Pugh and J. Murdoch. The address was in the form of a morocco-covered album of six vellum pages, and set forth the warm affection which all employees of the company felt for the late superintendent. The purse was contained in a handsome carved cabinet.

JAMES WATSON, managing director of the Hamilton Powder Co., Hamilton, Ont., died recently, after an illness of nearly five months The deceased was born in Glasgow, Scotland, in 1831, his father being manager of the Bank of Scotland in that city. He came to Canada in 1857, and lived in Montreal for a time, after which he came to Hamilton, and was connected with the late Hon. Isaac Buchanan's business. He subsequently became proprietor of the Ancaster Knitting Company, in Ancaster, and when the factory was burned down he organized the Strathroy Knitting Company, of Hamilton, which was also burnt down a few years ago. Since that he has been manager of the Hamilton Powder Company's business.

THE Manitou Wood Manufacturing Company of Toronto asks for incorporation, with a capital of $95,000 to manufacture lumber, woodenware, furniture, pulp, paper, etc.