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The Canadian Engineer

VOL. IV.—NO. 2. TORONTO, JUNE, 1896. PRICE, 10 CENTS $1.00 PER YEAR.

The Canadian Engineer.

ISSUED MONTHLY IN THE INTERESTS OF THE

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

SUBSCRIPTION—Canada and the United States, $1.00 per year; Great Britain, 6s. Advertising rates on application.

OFFICES—62 Church Street, Toronto; and Fraser Building, Montreal.

BIGGAR, SAMUEL & CO., Publishers,

E. B. BIGGAR
R. R. SAMUEL

Address—Fraser Building,
MONTREAL, QUE.

Toronto Telephone, 1392. Montreal Telephone, 2589.

All business correspondence should be addressed to our Montreal office. Editorial matter, cuts, electros and drawings should be addressed to the Toronto office.

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For THE CANADIAN ENGINEER.

ELECTRICITY FROM THE WIND.*

If there be one subject more than another in which I am deeply interested, that subject is electricity. And if, during the last few years, there has been one question more than another that has occupied my mind, energy and resources, that question has been, "How can I obtain electricity from the wind?" It was, therefore, with much pleasure that I read last winter, in the scientific journals of America, that on the other side of the Atlantic, in the Kingdom of Holland, was a society that had for its object the promotion of industry, and that that society had called for papers on the subject upon which I have labored so long. I consequently beg to submit the following disquisition, believing that if weighed in the balance of practicability, it will not be found wanting.

First, then, allow me to state that I have had just such a plant as you require for an illustration in operation during the last few weeks; it will, therefore, be unnecessary for me to describe a supposed installation, as I possess a real one, and as this plant is the result of a long and systematic course of study and experiment, I perhaps cannot do better, at this time, than to refer briefly, to the different undertakings wherein I was unsuccessful, and at length and in detail to the system which I succeeded in perfecting; concluding with special reference to those points to which you have more especially called attention.

* Abstracts from a paper by E. O. Baldwin, Dixville, Que., read before the Netherlands Society for the Promotion of Industry, Haarlem, Holland, and compiled by the author.

After investigating the relative merits and demerits of different windwheels manufactured on the American continent, I finally procured a sixteen-foot, steel, geared wheel, called the "Aermotor," and made in Chicago. This wheel is similar to, if not identical with, a wheel of the same name sold in London, and with which you are undoubtedly familiar. The vane is attached a little to one side of the centre of the wheel, in such a manner that the wind has a tendency to turn the wheel parallel to the vane or edgewise to the wind whenever its velocity becomes abnormal. Counteracting this inclination of the wheel to turn out of the wind is a long, rigid coil spring, swinging the wheel back at right angles to the vane. The purpose of this arrangement, as you will readily understand, is two-fold: to regulate the speed and to prevent its being wrecked during a blizzard. The wheel is placed upon a tower sixty feet high and fourteen feet square at the base. In the lower part of this tower is a dynamo room; in the upper part of this is a horizontal line shaft, connected by an even bevelled gear to a vertical shaft, which vertical shaft is in turn so geared to the windwheel above, that it, and consequently the horizontal shaft, turns six times as fast as the windwheel. Upon the line shaft is a thirty-inch pulley, from which a belt runs to a ten-inch pulley on a countershaft. This countershaft carries a twenty-inch pulley, from which a bolt runs to a four-inch pulley on the dynamo, which is a one kilowatt, one hundred and ten volt, shunt wound, Edison-type machine, requiring a speed of eighteen hundred and thirty revolutions per miuute.

Having set up and connected this windwheel and dynamo, my next undertaking, and the one with which I experienced most difficulty, was to so regulate this machinery as to generate an invariable electro-motive force. Of course the regulating device of the windwheel, to which I have referred, while controlling the speed closely enough for most mechanical operations, did not hold the velocity of the dynamo steadily enough. Next I undertook to produce a constant voltage by regulating the velocity of the dynamo, allowing the wheel to run at whatever speed the wind might drive it. This I undertook to do by the use of two frictional cone pulleys, one above the other, and having a centrifugal ball regulator by which an endless belt, running between the frictional cones, was shifted backwards and forwards by a carrier which worked on a long screw in such a manner as to maintain the velocity of the lower cone constant. This regulator was unsatisfactory in two respects. In the first place it consumed too much energy, as the cones had to be set very closely together to prevent their slipping upon the endless belt. In the second place it did not work quickly enough, and consequently the electric pressure would often rise or fall twenty-five or thirty volts.

Afterwards I constructed an automatic rheostat for the purpose of maintaining a uniform potential regardless of the speed of the dynamo. This rheostat, or box of resistance coils, was placed in the field circuit of the dynamo, and a small machine worked an arm backwards and forwards, which arm carried a reversible dog; this dog was tipped first one way, then the other, by an electro-magnet, in such a way as to put resistance into the field whenever the voltage rose above one hundred and twenty (I decided to run the dynamo ten volts higher than its normal pressure, as the wire did not heat), and to take out resistance whenever the voltage fell below one hundred and twenty. Again I was disappointed; this affair also, while it did not waste much power, like the frictional cones, required time to work. Both of these machines needed time to perform their work; practically speaking, electricity did not. I therefore came to the conclusion that I must have recourse to some contrivance consuming as little time and energy as possible. Having thus briefly referred to the less gratifying part of my work, I will now endeavor to more fully describe a more practicable system, and one which as a direct result of the previously stated conclusions, I succeeded in operating.

Now in order that you may more fully and clearly understand the exact working of my method, I will ask you to refer to Figure 1, hereunto annexed, which is a representation of my specially constructed dynamo and regulating device, which works so perfectly—when the dynamo is belted directly to the windwheel without any intermediate regulator—that it is impossible to discern any flickering of the lamps. *D* represents the dynamo, of which I have already given a description, with an additional winding *R* on the outside of each field, but wound in the opposite direction. This outside winding is short-circuited at *A B* by a vibrating arm of iron which hangs on a pivot at *P*, and the point *B* is held against the point *A* by a coil spring *S* at the other end of the arm. *M* represents an electro-magnet connected in shunt with the main lines *L* of the dynamo. The manner in which this combination works is as follows: So adjust the spring *S* that the instant that the voltage attempts to rise above one hundred and twenty, the electro-magnet *M* overcomes the tension of the spring *S* and opens the short-circuited coil *R* at *A B*. This not only throws that amount of extra resistance into the field, which alone would diminish the number of amperes of current flowing in the field circuit, and therefore partially demagnetize the field and lower the voltage of the dynamo, but as the current traverses this resistance *R* in an opposite direction to the field current, it acts in opposition to the exciting current of the field, and serves still further to demagnetize the field and bring down the electro-motive force of the dynamo. The pressure, however, does not fall, but the small fraction of a volt before the spring *S* reasserts itself and closes the connection at *A B* when the voltage again attempts to rise, is again prevented by the action of the electro-magnet *M*, a very rapid vibration of the arm *C* continues and the voltage of the dynamo remains constant, regardless of the sudden changes in the direction and velocity of the wind.

Having thus accomplished the most difficult problem connected with generating electricity by the wind—regulating the pressure of the electric current, whereby the dynamo driven by wind power is placed on an equal with the dynamo driven by the best regulated steam or water power—allow me before passing on to the storage of electrical energy to briefly call your attention to a few points of superiority of this mode of regulation over other systems. In the first place, the regulator works quicker than any other of which I know, and consequently it regulates more closely. Besides this, it does not, practically speaking, consume any energy; by which I mean it takes no power to work the regulator, and energy is only wasted by the wheel being driven at times faster than need be, but this is only experienced when there is a superabundance of wind, and never when there is a scarcity. Furthermore, this system has a great advantage over some others which only regulate between certain velocities, as it makes no difference how fast the dynamo runs, it is impossible for the voltage to rise above the required electro-motive force, for just as soon as it attempts to do so the field is demagnetized.

Moreover, there is another great advantage in winding the resistance *R* (in Fig. 1), on the field in the opposite direction to the field winding. In similar regulators where this is not done, the amount of resistance thus thrown into the field to lower the voltage, needs to be more than double the quantity used where the wire is wound on the field in the opposite direction. Consequently, the spark of rupture becomes troublesome; that is, the points of contact have occasionally to be cleaned and platinum or silver contact points have to be used; but in reducing the amount of resistance short-circuited, as is done when it is wound backwards on the field, the spark of rupture causes no trouble whatever; it is, in fact, almost imperceptible where only a few watts are used, providing the points of contact are large. As the spark of rupture is dependent on the number of watts used, the spark may be wholly obviated by using a second dynamo, or exciter, to magnetize the field. When an exciting dynamo is used, it is preferable to use a series-wound machine, wind a few turns in the opposite direction and short-circuiting them as before represented. By using a series-wound dynamo for an exciter there is one other advantage; the self-induction of the field of the dynamo, of the field of the exciting dynamo, and of the short-circuited coils, all tend to hold the electro-motive force steady, and by the use of this series-wound exciter and regulating device, the voltage is held more steady than I ever saw done with the best regulated steam plants. This last plan, however, is not my own. It has long been most satisfactorily used by one of the largest dynamo manufacturing companies on this continent, where a wide range of speed is unavoidable. This last arrangement needs to be resorted to where a large number of watts are used, otherwise the spark of rupture becomes troublesome.

I have been thus particular in regulating so as to have a constant electro-motive force for this reason; in my system of deriving electricity from the wind, the storage battery or accumulator which I use, and to which I will soon refer, is disconnected by an automatic electro-magnetic switch, which at the same time connects the motor or lamps to the dynamo, whenever the wind blows sufficiently strong to raise the electro-motive force of the dynamo to one hundred and twenty. This same switch instantly re-establishes the connection of the motor or lamps with the storage battery, and disconnects the dynamo connection whenever the wind allows the pressure of the dynamo to fall below one hundred and twenty. This automatic switch enables me, without paying any attention whatever to the wind, to take advantage of every wind that blows, and thus not only save electrical energy already stored in the battery, but also to take advantage of the wind which others waste, unless they have a second storage battery, while they are drawing from their accumulator.

Having answered what any electrician must admit to be the most difficult question in connection with deriving electricity from the wind, viz., the generation of a steady electric pressure, I desire, in describing the balance of my apparatus, in answer to your inquiry, "What mechanical appliances would be required for this purpose?" to refer you to Figure 2 hereunto annexed, in which L represents the main lines from the generating plant, H storage battery, E an electro-motor, J incandescent lamps, M^2 an electro-magnet, S^2 a coil spring, C^7 an automatic switch worked by the magnet M^2 and the spring S^3, and R^2 resistance put into the line by the same hand switch by which the motor and lamps are turned on, and taken out by the same switch when the motor and lamps are turned off. The purpose of this resistance R^2 is to prevent the current from the dynamo, whenever the wind rises and the motor or lamps are turned on, from burning out the fuse-wire, as the electro-motive force of the dynamo current needs to be higher than the voltage of the storage battery.

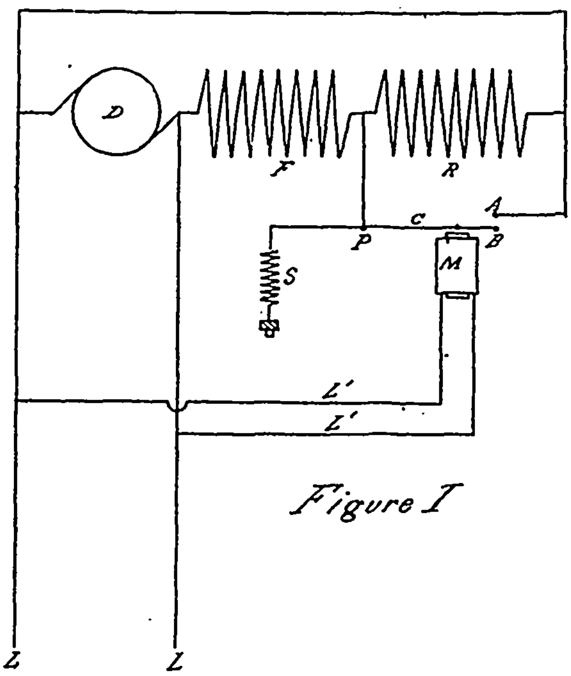


Figure I

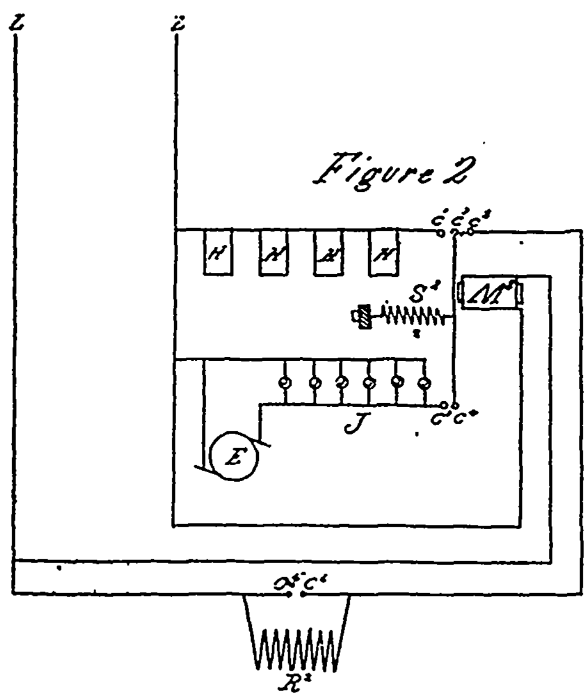


Figure 2

The manner in which this automatic switch and storage arrangement works is as follows: Arrange a two-throw hand switch for the purpose of turning on and off the power or lights in such a way that whenever the switch is turned one way it will connect C^8 with C^4. Assuming the storage battery H to be charged, the motor immediately starts, and the lights burn if turned on, because the coil spring S^2 holds C^7 against C^1. Now if the wind blows, as soon as the voltage rises to one hundred and twenty, that is, become sufficiently high to charge the battery, or in this case to overcome the resistance R^2 and light the lamps, the electro-magnet M^2 overpowers the spring S^2 and draws C^7 against C^2. The current now, instead of flowing from the battery, comes from the dynamo, and the battery is not used as long as the wind blows; but as soon as the wind ceases to blow the electro-magnet M^2 loses its power, the spring S^2 re-asserts itself again, and the current then comes from the battery. If, however, this occasional momentary flicker in the lights or variation in speed of the motor is objectionable, the windwheel may be stopped by a windlass attachment, whereby the wheel is turned edgewise to the wind, or parallel to the vane. But as this change does not occur very often, in the most cases it would not be objectionable. On the other hand, if the motor or lights are not needed, then turn the switch, to which I have just referred, the other way, having it so arranged that by so doing you disconnect C^4 from C^3, and at the same time connect C^4 with C^1 and C^5 with C^6. This being done, as soon as the wind blows sufficiently hard to bring the voltage up to one hundred and twenty, the electro-magnet M^2 overpowers the spring S^2 and connects C^7 with C^2; this allows the current from the dynamo to flow to and charge the battery H, as C^4 is now connected with C^1 by the hand switch to which I have referred. Moreover, the resistance R^2—which was put in for the purpose of preventing the lamps from being burned out in the event of the wind rising—is also short-circuited by the same switch. Thus whenever the wind blows, from the time the motor and lamps are turned off till they are again switched on, it is charging the battery. But as soon as the wind allows the electro-motive force to fall below the required pressure, the electro-magnet M^2 loses its power, and the spring S^2, re-asserting itself, opens the battery circuit and prevents it from discharging.

The working of this plant is highly satisfactory and is almost entirely automatic. The only attention it requires is the brushes of the dynamo need adjusting once or twice a week. All the bearings are self-oiling and consequently only require attention once in about three weeks.

While speaking of the storage of electrical energy, let me say that acting upon the advice of experienced storage battery men, I decided to use a large number of small cells rather than a small number of large cells; and by so doing I am satisfied that more ampere hours can be drawn off from the battery. I use fifty-one cells of the Faure type, having a nominal capacity of ninety ampere hours.

Now in regard to transmission I wish to say that in most countries there would be only occasionally an instance where it would be desirable to have the power or lights any great distance from the windwheel. In my case it was only necessary to place the wheel and dynamo three hundred and fifty feet distant from the battery, motor and lights, with which they are connected by copper wire one-tenth of an inch in diameter.

The only question to be considered regarding the transmission of the current a greater distance is the size of the line wire and the electro-motive force of the current, one or both of which should be increased.

With reference to the utilization of the current thus derived, it is evident that it can be used for any purpose for which any direct current of electricity is employed. The current from the plant which I am describing, I use to run a one-horse power motor for domestic purposes such as churning butter, sawing wood, etc., and for lighting a dwelling-house, within which are twenty sixteen candle-power, one hundred-volt, incandescent lamps.

As it would be next to impossible to give an accurate answer to the questions regarding energy and cost, especially since the conditions affecting both are so varied, I trust it will be satisfactory to state the expense of my own plant, and the energy it develops, and from these data draw the best deductions possible. In the first place, the position of my wheel is unfavorable. It stands in a valley running north and south and the most prevalent wind is from the west. The valley is about a quarter of a mile in width, and there is a hill on either side rising to the height of three hundred and fifty feet. But regardless of the unfavorable position of my wheel, I am able to run the one-horse motor, to which I have already referred, on an average, about six hours out of every twenty-four, and besides this, light six sixteen-candle power lamps four hours each evening. The motor and lamps together would be equivalent to running the motor alone for about eight hours out of every twenty-four. Among the many conditions affecting the amount of energy which it is possible to obtain from such a plant is one which must be taken into consideration, and that is the size of the dynamo best suited to a given size of wheel. Of course the larger the dynamo the less hours out of the twenty-four it will run, the wheel being the same size in both cases; but just how large to have the dynamo in order to store the most ampere hours of electrical energy or to produce the most horse-power hours of mechanical energy, would require a very expensive and extensive investigation; but it is safe to say that it would be advisable to use a dynamo a little larger than a one kilowatt machine with a sixteen-foot steel wheel. Then by using a larger dynamo and larger cells of battery than I have, and by placing the wheel on an elevation or in a flat, level section of country, I think it is reasonable to conclude that nearly double the amount of energy which I store might be produced.

In regard to "What would be the cost of one horse-power hour?" of course a great deal depends upon the first cost of the installation, as it requires a very little attention afterwards. This being the case, the cost per horse-power hour depends a great deal upon the cost of material and labor in the country in which the plant is installed. Consequently the most practical answer I can give to this question is to state what one horse-power hour costs me, giving the price of labor and material in the country where I put in my plant, and then by comparing these expenses the cost per horse-power hour may be closely estimated in other countries:—

Windwheel, vertical shafting and footgear..........	$150
Pulleys, countershaft and belting..................	25
3,000 feet of lumber in tower and building..........	25
Building tower, dynamo room and hanging shafting..	50
Storage battery..................................	125
One kilowatt dynamo	125
One one-horse power motor......................	90
Automatic switch and regulator	10
Total cost................................	$600

The average rate of interest on money in this country being six per cent. per annum, the interest on this investment would be $36 per year. Allowing $14 more per year for oil, insurance and taxes, the annual expense would be $50.

(To be continued.)

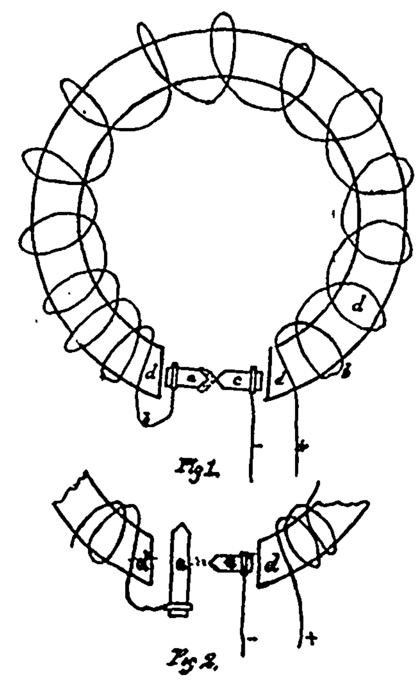
For THE CANADIAN ENGINEER.

THE DIRECT CURRENT ARC IN A MAGNETIC FIELD.

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

Some time ago the writer made a series of investigations concerning the action of the electric arc in a magnetic field, which is probably original, as the author, after extensive search, has not been able to find any references bearing directly upon this subject.

Photographs were prepared to accompany the article, but all the plates used in taking the negatives were "fogged," so that that desirable assistance to the effects obtained must needs be omitted. The apparatus used is indicated by Fig. I.; *d* is the magnet of soft iron, *b* the coils for energizing the same, *a* is the anode and *c* the cathode. The coils were arranged so as to produce three strengths of field, viz.: 250, 500, and 1,000 c.g.s. lines per square centimeter. The electrodes were plain $\frac{1}{2}$-inch cored carbons.



THE DIRECT ARC IN A MAGNETIC FIELD.

The first test was the starting of the arc uninfluenced by magnetism. It burned quietly, with the carbon anode assuming the usual crater-like form. The distance between electrodes being about $\frac{5}{16}$ inch, the heated currents of air caused it to move from side to side. The current was 9.5 amperes and 51 volts.

Then the arc was started, influenced by the field, having a strength of 250 c.g.s. lines, the carbons being so placed that the axis of the arc was parallel to the lines of force. It was very noisy, and the arc spread to the outer edge of the anode (leaving the inner core untouched), in the form of an inverted cone, numerous points of light brighter than the rest of the arc being seen, while the flame rotated in the direction of the flow of current in the coil. The carbon was consumed very slowly in proportion to what was burned in the uninfluenced arc, and the apparent temperature of the arc seemed one-half of the uninfluenced arc. The resistance in the gap between the electrodes decreased so that the current passing was 11.2 amperes and 47 volts. (The primary voltage was 110 volts, current from an incandescent circuit being used, with stationary *water* resistance interposed to reduce the voltage.) The arc at the cathode narrowed down to a very fine point, never wavering, and remaining in the same place.

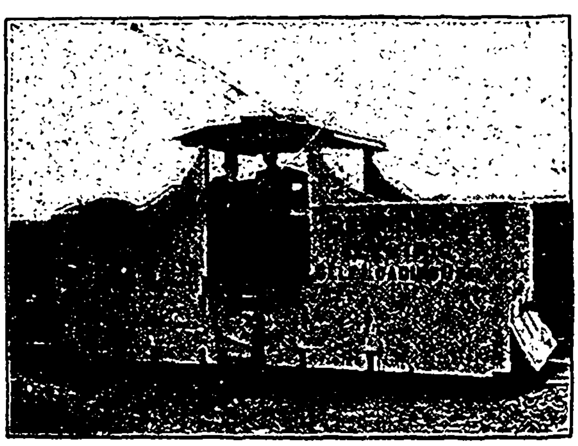
The field was increased to 500 c.g.s. lines, and the effects were only augmented, the rotation being more rapid, the noise louder and the resistance decreased until 14 amperes at 40 volts were passing. The field was then increased to 1,000 c.g.s. lines and the noise became a roar, the arc curled out and around the anode's outer edge, yet maintaining a point at the cathode; the current became 20 amperes at 34.5 volts; its rotation was no longer visible, and the points of light dispersed over the edge of the anode multiplied until it bore a resemblance to "stipple" work.

The positive carbon was then placed as shown in Fig. 2, and the arc started. While influenced by the field of 1,000 c.g.s. lines, the arc started around the anode until it reached the other side farther away from the cathode, making a line of the bright points mentioned; the distance between the electrodes being about three-eighth inch, the current from 10 to 14 amperes fluctuating rapidly, and the volts from 50 to 47.

No claim to accuracy is made, as the apparatus used was crude, and time was limited. Further investigations will be made, which will throw more light on the subject

REYNOLDS' ELECTRIC SELF-LOADING CAR.

There has been turned out of the car works of the Rathbun Co., of Deseronto, Ont., recently, an electric self-loading car, which is a remarkable specimen of mechanical ingenuity, and bids fair to work a revolution in the method of cleaning the streets of all large cities. This car is the invention of A. Jackson Reynolds, of Montreal, formerly of Worcester, Mass. A



brief inspection of this car, which is illustrated above, shows that it is 22 feet in length, 8 feet wide and 9½ feet high, very compactly and strongly built. It is fitted with the usual equipment of a trolley car. Contrary to general use, the brakes, motors, etc., are all situated above the wheels and axles, so as not to impede the full action of the brush. The operating platform on which the hands stand while directing the motion of the car and broom is 8 x 5 feet, and so placed as to protect them from being touched by the dust thrown from the revolving brush or broom. This large brush, which has been specially manufactured for this purpose, makes five revolutions to each one of the car wheels. It works much on the same principle as a carpet sweeper, and will throw the dust a distance of twenty-five feet, and will pick up thirty-eight cart loads without stopping. The broom, which is fastened to solid heavy axles, is so arranged that it always fills the case in which it is contained, a simple device changing the size of the latter to suit the changes made by the wear of material. The broom acts as well one way as another, steel deflectors being so arranged that it can be run backward without any change of machinery. The action may be reversed instantly, so as to throw the dust one way or the other as may be desired. The broom may be extended so as to cover the whole street outside the car-track if necessary. For removing snow the car may be constructed as long or wide as may be required. For dumping purposes the floor is constructed in sections. The car can be unloaded in thirty seconds, one man doing the whole work by a lever. The inventor claims that this car will work a revolution. It not only sweeps the dust from the streets, but it conveys it outside the city, thus saving the labor of hundreds of men and horses. When, therefore, it is seen that five or six cars of this description can not only sweep the streets, but carry off all the rubbish, it is easy to see that a great saving of expenditure may be expected if it answers the expectations of its inventor. Mr. Reynolds informs The Canadian Engineer that he has received an offer of $50,000 for the right to manufacture and use these cars in Ontario. In operation the cars are used to clean the whole street except a narrow strip at each side from which the dirt is swept towards the tracks by the usual horse brooms. The car sweeper can be run as fast as seven miles per hour with good results, and at a cost of less than one dollar per mile.

THE DRY DOCK AT KINGSTON, ONT.*

BY HENRY F. PERLEY, M. CAN. SOC. C. E.

To provide for the repairing of craft on the Great Lakes, the Government of Canada in 1889 commenced construction of a dry dock at Kingston, Ont., which was brought to completion in 1892, the plans and specifications for which, excepting the details of the pumping plant and engine house, were prepared by the writer. After an examination of several sites had been made, that known as "Power's Ship Yard" fronting on the harbor, was selected, and purchased on reasonable terms. In addition to the property thus acquired, the lower portion of Union street, which had been closed some years previously under an arrangement for the construction of a dry dock, was ceded by the city to the Crown, which thus became the possessor of a frontage of 400 feet on the harbor, a frontage having deep water at but a little distance from the shore. The site is situated between Gore and Union streets, having the shops of the Kingston Locomotive Works on one side, and those of the Kingston Foundry Company on the other. When taken possession of, the site was encumbered with several buildings, the remains of an abandoned marine railway, an old wharf, and the work that had been executed on a proposed dry dock and abandoned, all of which had to be removed.

In determining the dimensions of the dock, it was judged that they should exceed by a small amount those of the locks on the Welland Canal, so that any vessel which could pass through them could be admitted to the dock, and a length of 280 feet on the floor and 48 feet width of entrance were adopted. During construction, representations were made that the width of the entrance was not sufficient to admit some paddle-wheel

* From a paper read before the Canadian Society of Civil Engineers.

steamers plying on Lake Ontario, and it was increased to 55 feet, such change involving the widening of the body of the dock, increasing the size of the caisson and the dimensions of the caisson chamber. After cleaning the bottom in front of the site, an earthen coffer-dam was placed, the material (clay) composing it being obtained from the channel of the Cataraqui through the marsh above the highway bridge. This dam failed when the work was about one-third completed, but the break was easily filled and the work resumed.

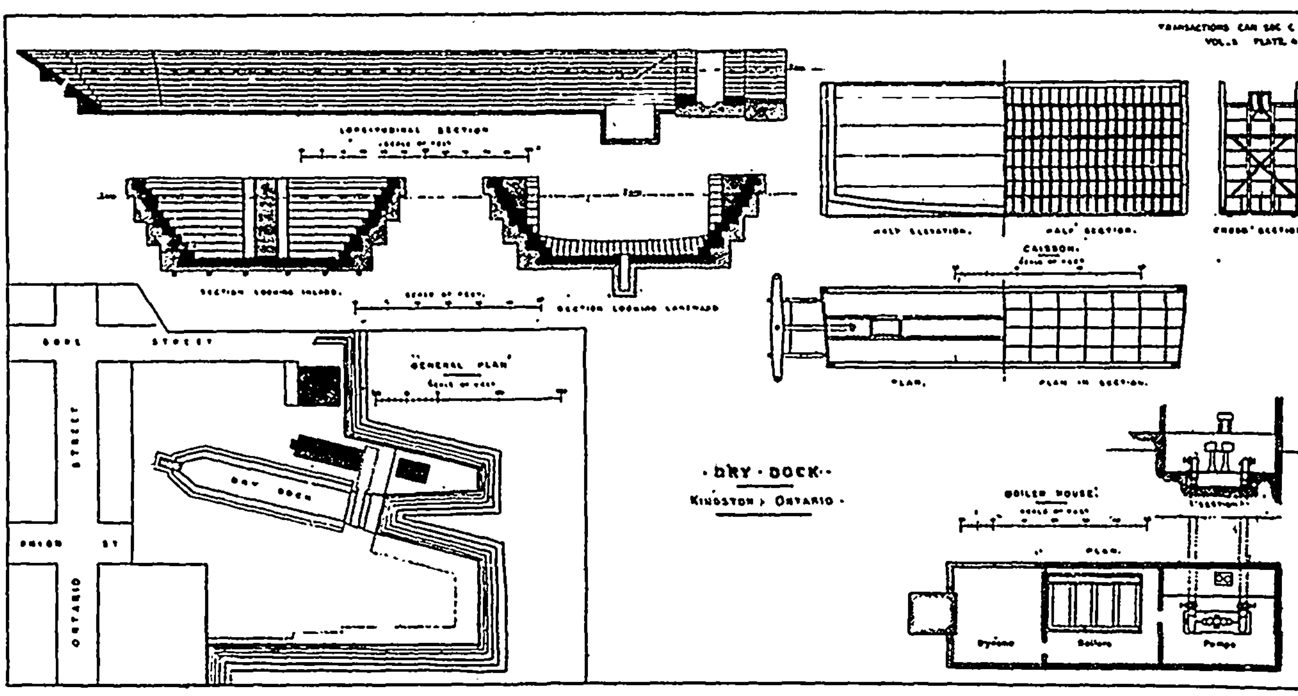
The dock is buit't of limestone obtained from quarries at Belleville, and fully up to the requirements of the specification, which demanded that the ashlar in the altars, except in two instances, should be built of stone 2 feet 8 inches in height. As stretchers could not be less than 4 feet in length, with a bed not less in width than 1½ times the rise, the smallest stone that could be used weighed over three tons. The coursing of the sidewalls was carried through the body of the work, the whole with quarter-inch joints, and dressed with the fine end of a Bouchard hammer. The backing consisted of large and well-shaped stones of such thickness that *two* courses were equal to *one* course of face-work. The floor is of stone, the central 6 feet carrying the keel-blocks being raised 6 inches above the dock bottom. The foundation of the engine house, chimney and machinery were carried up from the rock, and the floors paved with stone. A quantity of concrete was used, composed of 6 parts of broken stone, 1 part clean, sharp sand, and 1 part of Portland cement. The whole of the masonry was laid in a compound of *one* of Portland cement to *two* of sand, mixed and used as required, each course being grouted up and filled full with the compound. All joints were lipped for 4 inches from the face with a compound of 1 of cement to 1 of sand, and neatly pointed and finished off when green. Only Portland cement was used in the work, and a constant testing was carried on during construction. Samples were taken from every *tenth* barrel as delivered, and tested for fineness by the whole sample passing through a 2,500 sieve. Briquettes of neat cement, after remaining for twelve hours in the air and seven clear days in water, gave an average tensile strength of 445 lbs. per square inch. The quoins of the outer face of the inner invert and side walls are of grey granite, all remaining stones in the invert being of limestone. The granite and limestone quoins facing on the caisson berth, and of the walls on either side, are worked with a projection of ¾ inch, and a full width of 12 inches, and set absolutely perpendicular and in a true plane, the faces being finely axed and rubbed down, for on these meeting faces depends the tightness with which the caisson fits, thus preventing leakage when the dock is empty. An extension of the caisson-berth forms a chamber into which the caisson is drawn to admit a vessel. Along each side of the bottom are heavy cast iron rollers placed at intervals, on which the caisson rests and travels when being moved.

The width of the inner invert is 55 ft., and of the outer invert 57 ft., this difference being necessary to permit the caisson being floated into its berth. They are built to a radius of 193 ft., and the stones forming them are cut with radial joints. The lowest point in the inverts is 15 ft. 6 ins. below zero, or the assumed average low water level of the lake, 22 ft. below coping level, and 4 ft. 6 ins. above the floor of the dock. Outside the outer invert is an apron of stone 20 ft. in width and 2 ft. lower than the centre of the invert, in which are placed granite blocks on which the caisson can rest if at any time it is found expedient or necessary to effect repairs in the caisson berth or chamber, or to dock a vessel longer than the floor of the dock, or, in other words, a vessel of 310 ft. in length. Under the foundation of the dock bottom are arterial drains, by means of which the leakage from the lake is carried to and discharged by the auxiliary pump, when the dock is empty. Access is had to the dock floor by steps on either side at the entrance end, and on either side of the timber slide at the head. In the floor at the lake end is a rudder well, 24 ft. long, 3 ft. wide and 12 ft. deep, which has proved of much service, as it permits an easy removal and replacing of a rudder. Sixteen (16) cast-iron mooring parts, set in and filled with concrete, are placed around the dock, together with six heavy, double purchase capstans. On the dock floor are cast-iron keel-blocks capped with hard wood, placed at intervals of 5 ft., and 32 bilge-blocks at 10 ft. centres, which are operated from the dock coping. The dock is filled through a culvert 4 ft. in diameter, the mouth of which is outside the entrance works, and the discharge over the inner invert, the whole being submerged 6 ft. below zero, and controlled by a 4 ft. cast-iron valve. Provision has been made whereby, in an emergency, filling can take place through the emptying culvert, which is also 4 ft. in diameter and controlled by a valve. The caisson chamber and berth is connected by a 12-in. pipe with the auxiliary pump, so that either can be emptied in the event of the stop logs being put in place.

The engine-house, which comprises an engine-room, boiler-room and dynamo-room, is of stone. The chimney —also of stone, and 90 feet in height—is placed partly within and partly without the building. Over the engine and dynamo-rooms the roof trusses are of wood, and over the boilers of iron, the party walls being carried up to the roof as a safeguard in case of fire. The major portion of the floor of the engine-room is 6½ feet below zero, or 13 feet below coping level, and on it is placed the pumping plant, which consists of two vertical 18-inch centrifugal pumps, one right-handed, the other left-handed, having discs 4 feet 8 inches in diameter; each operated by a vertical, high-pressure engine, having cylinders 18 inches in diameter, and a stroke of 18 inches. The pumps are connected directly with the engines and are in line, and by means of clutches they can be geared together so that *one* engine can drive both pumps, or an engine can drive the opposite pump. The suction pipes, which are 22 inches in diameter, are furnished with foot-valves, and are led through the engine-room floor to the pumps, all joints being absolutely water-tight. The pumps discharge through 22 inch pipes, the centres of which are 9 feet below coping level, or 2 feet 6 inches below zero, and when the lake is at that level, the pumps operate against a head of that height. To prevent inflow when the pumps are not in use and the dock is empty, each discharge pipe is provided with a 22-inch valve.

The auxiliary pump and engines are placed on the upper or higher portion of the engine-room floor. This pump, which is an 8-inch horizontal centrifugal, has a maximum lift of 31 feet 6 inches, and discharges 3 feet above zero. It is operated by a pair of vertical, high pressure engines, having 12-inch cylinders and 12-inch stroke, which are also used to move, by means of intermediate gearing, the caisson into and out of place. On the lower floor of the engine-room is a "Knowles" fire pump, the steam cylinder being 15 inches, and the water cylinder 10 inches in diameter, both having a stroke of 21 inches. This pump can be used in the event of the auxiliary pump being disabled. A delivery pipe is carried to the outside of the building, having a proper cap for attaching *four* lines of 2½-inch fire hose. A "Knowles" patent duplex boiler feed pump, with steam cylinder 6 inches, and water cylinder 4 inches, and stroke 7 inches, is placed in the boiler-room. The boilers—four in number—are of the cylindrical, multi-tubular type, set in brick work, with all the fittings and appliances for their successful working. They are 14 feet long and 5½ feet in diameter, each containing 84, No. 9, W. G., lap-welded, charcoal iron tubes, 3½ inches external diameter, and furnished with domes 3 feet high and 2½ feet diameter. The shells and ends are of three-eighths steel, the longitudinal seams being lapped and double riveted, the circumferential seams lapped and single riveted. Before acceptance they were subjected to a cold water test of 180 pounds per square inch, the working pressure being set at 100 pounds. Two of these boilers supply steam enough for the main engines. The smoke flue runs along the front end of the boilers, where connection is made with the uptakes, and is carried to and through the party wall of the dynamo-room, when it is led downwards and under the floor to the chimney. A boiler of the drop flue type, 9 feet high and 4 feet in diameter, with 250 1¼-inch by 18-inch flues, with circulating tubes, is placed in a corner of the boiler-room, and supplies steam to the auxiliary engines, which can also take steam from the main boilers. A travelling crane to lift three tons has been placed in the engine-room, and with it any part of the engines or pumps can be handled for repairs.

The dock is closed by a caisson, built of steel, which may be described as an irregular rectangular box with parallel sides and inclined ends, measuring 57 feet in length on the inner face, and 59 feet on the outer; 11 feet 10 inches in width, and 21 feet 6 inches in height. Two keels, 4 by 8 inches dimensions, run the whole length of the bottom, on the outer edges of which are inserted at regular intervals 4 by 4½ inches shear steel bars, properly bent, their places in the keels being truly planed to the required curvature. The keels rest on the rollers in the caisson berth and chamber, and the curved bars, which project somewhat beyond the sides of the keels, are for the purpose of preserving the parallelism of the caisson while being moved. The lower 3 feet is of cellular construction for strength and stiffness, and composed of ½-inch plates and 3 × 3 × ⅝ inch angles. All angles for the sides and ends are 3 × 3 × ½ inch, and for the reverse bars 3 × 3 × ⅜ inch. The cross-beams up to the lower dock are 4 × 4 × ½ inch angles, and above 3½ × 3½ × ½ inch. Under the lower and upper floors, Z beams 5 × 3$\frac{1}{16}$ × 2¾ × ½ inch, were used. The upright posts are 6 × 3 × ⅝ inch channels, and the diagonal braces 4 × 3 × ½ inch angles. The plates in the bottom and first row on the sides and ends are ½ inch in thickness, and those above diminish to ¼ inch in the top plate, which is finished with a 9 × ⅜ inch bulb. The floor plates are ½ inch in thickness. All outside plates were planed on their edges, and lapped 2½ inches in the work and were single riveted. Where required, filling pieces were placed between the plates and the frames, to make up for the difference in the thickness of the plates, and voids between the plates and the frames. For the movement of the caisson a hauling bar 13 feet 4 inches in length is connected by means of a 4-inch pin, the outer end projecting 7 feet 9 inches, and carrying a yoke 17 feet 8 inches in length, attached by a 4-inch pin, the outer ends being supported by two hinged brackets coupled with parallel motion bars. For ballasting purposes *two* 6-inch sluice valves are placed in the outer face above the line of the upper floor, to which are attached 6-inch cast iron pipes leading to within 4½ feet of the bottom. At the bottom of the inside face a 4-inch valve is placed to drain the caisson when the dock is empty; and the caisson can also be emptied by a No. 5 pulsometer. The cellular bottom is filled with concrete, and the further permanent ballast is supplied by the requisite amount of stone. On the outer faces are riveted 6 × 6 × ½ inch angles, which carry the white oak meeting faces, which are secured in place by ¾-inch bolts. The caisson weighs 255,000 lbs., and when the lake is at zero its displacement is 358 net tons. It is moved into and out of place by wire ropes, which pass over traversing grooved wheels secured to the masonry at the dock end of the chamber, and over spirally grooved drums keyed on a horizontal shaft at the head, which is actuated by the auxiliary engines.



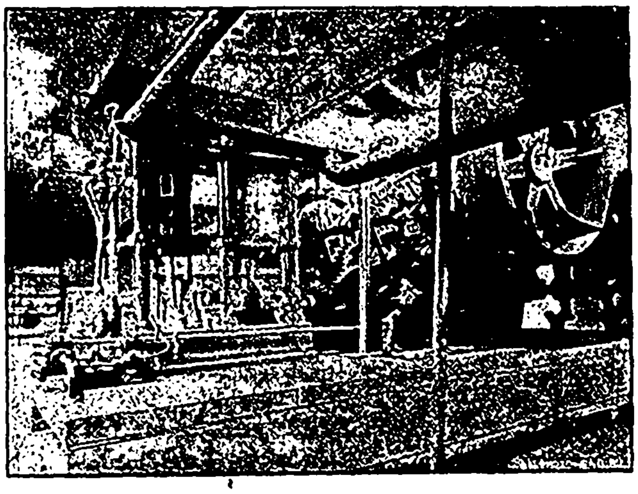
The dock at zero contains 2,100,000 gallons of water when unoccupied by a vessel, and can then be emptied in 75 minutes, the pumps and engines making 175 revolutions per minute, each pump thus throwing 14,000 gallons per minute. Through the filling culvert the dock can be filled in 55 minutes. A large portion of the dock property as it stands to-day is made ground, the area being enclosed by crib-wharfing of the usual type, and filled with the materials excavated in grading the site, and from the dock pit.

The cost of the dock may be placed as follows:

Land	$ 20,000
Dock proper	365,000
Pumps, engines, etc	26,000
Engine house	26,000
Caisson	18,000
Engineering and contingencies	42,000
Total	$497,000

GEAR FOR A JAPANESE SUBMARINE CABLE STEAMER.

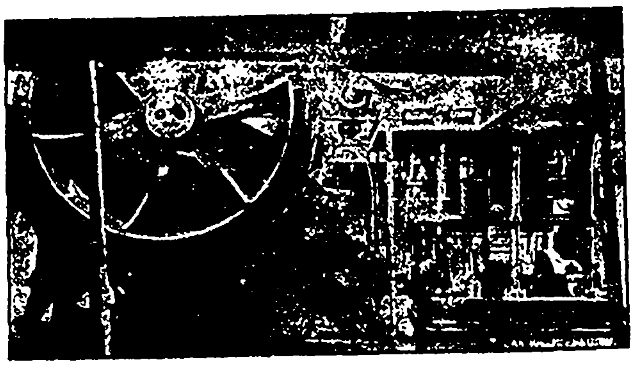
A few months ago the Japanese Government entrusted Johnson & Phillips, electrical engineers and contractors, of London and Old Charlton, England, with the construction of a combined picking up and paying out gear, together with outfit and stores for their new Submarine Cable-Laying Vessel, of which the following is a description: The gear as shown in the photographs which we reproduce, is very compact and has been constructed principally of steel so as to combine strength with lightness, the weight all told being only about 21 tons. Although specified to pick up under a strain of 25 tons at 175 lbs. pressure, the gear on official trial showed itself equal to a much greater power compared with the gear by the same makers fitted on the "John Pender," "Great Northern," "Chiltern," "Electra," "Magneta," "Recorder," "Relay," "Cita de Milano," and many other steamers; it is equally powerful as the three first named and twice as powerful as the others, while at the same time it is infinitely more compact and lighter than any that have gone before. The gear stands on a strong steel girder bed on the main deck, and the drums, etc., project through a hatch in the spar deck, and this is fitted with covers which form the driving platform for the machine. The gear has overhung drums 6 feet 3 inches diameter by 2 feet 6 inches wide, internally geared, and running loose on a fixed shaft carried on two steel frames, and is arranged for four speeds. The motive power consists of one vertical compound engine having cylinders 12 inches and 24 inches diameter by 14 inches stroke, capable of developing 265 h.p. without the use of the condenser, in conjunction with which it will, however, generally be used. The engine is fitted with link motion reversing gear and also with automatic bye-pass valve for admitting high pressure steam to low pressure cylinder for starting. The crankshaft is geared to the first motion shaft of the machine by means of a double helical bevel gear. When it is desired to pay out without steam power the only moving portion of the machine is the drum, which is readily controlled by the brake.



To enable the drum to revolve independently of any other part of the gearing, provision had to be made for sliding the drum pinions out of gear, and as it was essential to keep the drums close up to the frames, these pinions have been arranged to draw through the frames. This has been effected in a very neat manner by the makers, two large holes being cut in the frame plates and a large pocket casting fitting into these carrying bearings each side of the frames, so that the pinions which gear into drums run between two bearings, the arms of the drum being set back to allow for this outer bearing, and this arrangement ensures a very substantial job. These pinions are put into and out of gear by means of a combination of handwheels, screws and bellcrank levers. All wheels are arranged to draw out of gear when necessary, so that only the particular

set required needs to be in gear. The brake straps are of steel plate fitted with elm blocks. The lower parts of the straps have large cast-iron eyes attached to them, and these are kept in position by means of a shaft 3½ in. dia., which passes through both frames.

The braking power is applied by means of right and left hand screws working in nuts attached to the upper parts of the straps, the screws being actuated by means of hand wheels from the starting platform, and when the straps grip the brake drum the pull is transmitted to the machine frames (through the before-mentioned eyes and shaft), and thus to the deck of the vessel. A water service is provided for the brakes, the water being distributed by means of a small Worthington pump. Each drum is provided with two "knives" for fleeting the cable on the drums to suit either an inside or outside lead as the case may be.



There are three sheaves at the bows 51 inches diameter by 11 inches wide, the two outer ones being *V* section and the middle one *U* section. These sheaves are of steel with gun metal bushes, and they are arranged to run loose on steel shaft fixed in blocks carried on four steel girders, which are built into the ship for a distance of several feet, being connected to the beams and to the steel deck, thus ensuring a very substantial job. Each sheave is provided with a cast-iron "whisker" or guard at each side to prevent the cable from coming off. The two outer whiskers carry davits with a cross-bar for convenience in launching mushrooms, grapnels, etc. The side plating of the ship is carried out to meet these castings, thus giving the bows a very neat appearance.

This stern gear has but one sheave, which is 38½ inches diameter by 11½ inches wide, and is fitted with gun metal liner, to run loose on a shaft fixed on blocks carried by rolled girders. These girders are attached to the deck by means of special castings which also serve to secure the necessary stopper hooks.

The cable machine is placed just aft of the foremast, and between it and the bow-sheaves are placed the two dynamometers (one for each drum), for the purpose of registering the strains that come upon the cables or grapnel ropes. To effect this, a set of leads consisting of *A* frames and sheaves is placed at a certain distance on each side of the dynamometer, so that when a strain comes upon a cable or rope, the moving part of the dynamometer is raised, the distance raised being the measure of the strain according to the weight of the moving part.

The dynamometers are also of Johnson & Phillips' approved design, consisting of cast iron footstep, with steel cylinders on which a cast iron sleeve slides, and to this sleeve the sheave is attached, and also two side rods which carry a crosshead some distance above. To the crosshead is attached a piston-rod with piston which works on the outside of the steel cylinder, which is filled with oil, and the piston being a loose fit, acts as a dash pot to steady the movement. The top of the steel cylinder is, of course, fitted with a packed gland.

For the CANADIAN ENGINEER:

CANADIAN TIMBERS.*

At the outset the lecturer said he would endeavor to indicate in as few words as possible, from the engineer's standpoint, the properties or nature of the common kinds of Canadian timbers as to strength, durability, etc., the purposes for which they are now employed, and their possible future uses, how they may be prepared, seasoned, stained, manufactured, etc., their varieties, relative abundance, values, etc. He would also indicate the characteristics by which to distinguish the different kinds of timber from others with which they might be confounded, and the means of identifying the various trees producing them. A considerable part of the lecture consisted of a brief summary of points such as the above in regard to the timber afforded by each of the principal trees of Canada, while its photograph on the screen was being looked at by the audience. Dr. Bell also took advantage of the opportunity to point out the more obvious characteristics by which to distir ish the growing trees themselves from one another, which even many Canadians cannot do in all cases.

But before proceeding with this division of his subject, the lecturer gave a short general sketch of the forests of the Dominion. His remarks on the areas of the forests of different parts and on the northern limits of each of the principal trees, were illustrated by a large map thrown upon the screen. In the course of many years travel in our forest regions east of the Rocky Mountains, he had taken pains to trace the boundaries of each species, so that they were now shown with considerable accuracy on the map. Our forests extended much further north than was commonly supposed. Forests were found throughout the greater part of the Labrador peninsula, in which they extend all the way to Ungava Bay on Hudson Straits. Both shores of Hudson Bay are timbered for more than half their length. On the west side the tree-line strikes northwestward from Seal River to the mouth of the McKenzie beyond the Arctic Circle.

All our trees ranged southward into the United States, so that if a person stood at any point in our forest, he might find around him all the trees whose boundaries lie to the northward. The Banksian pine was the only tree whose geographical distribution was almost wholly within the Dominion.

Referring to some general principles of distribution, Dr. Bell said in North America it was found that each species of our trees attained its greatest perfection near the centre of the area it occupied, both as regards the lateral extension and the breadth of the belt. Our trees, east of the Rocky Mountains, might be divided into five groups; a northern consisting of about a dozen species of very extensive range; a middle group of many species, including most of the trees of Ontario and Quebec; a southern, embracing a considerable number of trees found only in the southern portion of the lake peninsula of Ontario, and a western group of a few species growing principally in the prairie regions.

*Report of a lecture delivered before the Applied Science Graduates' Society at McGill University, 2nd April, 1896, by Professor Robert Bell, B.A. Sc., M.D., LL.D., and published exclusively in THE CANADIAN ENGINEER.

A knowledge of the range of each of our trees, together with that of the various qualities of their timber, is of importance to the engineer, as it will enable him to select the most suitable wood for any work at a given locality, taking into consideration relative cost and adaptability. Time did not permit the lecturer to go into much detail in reference to the characters of Canadian timbers on such points as transverse strain, tension, resistance to transverse and longitudinal compression, etc., and, in any case, we had a positive knowledge of only a few kinds based on experiments made in Canada. Figures showing these particulars in regard to a good many timbers have been published by Troughton, Haswell and others, but the authors give only the common names of the different kinds, which are not always the same, and the engineer is, therefore, liable to mistake the identity of the timber he may be dealing with. To avoid this, the scientific name of the trees should be given. One of the laboratories of this department of McGill is furnished with admirable apparatus for testing timbers, and Professor Bovey and Cecil B. Smith, C.E., have already experimented with Douglas fir, white pine, red pine and one of our spruces, and they are proceeding with other kinds. The results so far attained are published in the Transactions of the Canadian Society of Civil Engineers.

Although absolute results may be obtained for the particular samples of any kind of timber tested, these results cannot be depended upon for all other samples of wood passing under the same name, especially if we are not certain of the botanical species. Much depends upon the properties peculiar to the particular sample tested—such as whether it be taken from a young or an old tree, whether green or seasoned, the part of the tree used, as heartwood, sapwood, near the butt or high up, the way it is cut relatively to the rings of growth, the size and nature of the knots and other imperfections. Still good average data have been obtained and the results have often proved different from what we might have guessed without actual tests, some woods having proved relatively much stronger in various ways than we had supposed. The general results of the different tests are valuable in enabling the engineer to discriminate among such different woods as may be valuable for a given purpose, and to select the one combining the greatest number of the qualities required.

In rapidly comparing the more characteristic qualities of the principal Canadian timbers, the following were among those which Dr. Bell noticed. He mentioned them in the approximate order of their geographical range from north to south, and not according to any botanical classification.

Tamarac or American Larch possesses most of the characters of the larch of northern Europe. The tree is tall and slender in proportion to its diameter, which is sometimes upwards of two feet; is one of our longest lived trees; wood, dense, strong, durable and elastic. Admirably adapted for railway ties, from its resistance to compression, its durability, and from the fact that it holds the spikes well. Valuable for shipbuilding, being used for both knees and planks, and also for small spars. Suitable for flooring and for some parts of wooden bridges, also for fuel and making paper pulp. As strong and tough as most white oak. Abundant everywhere in our northern coniferous forests. Grows to a large size on the northern tributaries of the Ottawa and along the rivers flowing from the east, south and west into James' Bay. Unfortunately, our tamaracs have been suffering greatly during the last few years from the ravages of the imported larch saw-fly over an immense region, extending from the Ottawa valley northward to James' Bay, and north-eastward far into the Labrador peninsula.

White Spruce and Black Spruce are the most numerous and widely diffused of our coniferous trees. They do not differ very much from each other in the quality of their wood. The white is the larger tree, and its wood is generally whiter, softer, and less resinous than that of the black. Neither tree attains the size nor the age of the white pine. The largest specimens of the white spruce are to be found in the rich bottom lands of the Athabaska district. The wood may be used for most of the purposes for which white pine is employed. but it is harder, more elastic, and more liable to split. It is not so durable as tamarac, or even white pine; is much employed for railway ties, and for all the commoner building purposes. In the maritime provinces it is used for building schooners and other small vessels. Both species have tall tapering trunks, which answer for spars. The "red" spruce of the lower provinces appears to be only a variety of the black. It is, however, rather larger and straighter in the grain, and is preferred for shipbuilding. It was formerly abundant all around the shores of the Bay of Fundy, and hence is often called "bay spruce." The great future use of the spruces, which constitute the principal part of our vast northern woods, is for the manufacture of paper pulp, of which these ever reproducing forests will furnish an inexhaustible supply.

Banksian Pine.—One of the most abundant of Canadian trees, and yet but little known on account of northern habit. It is also called "pitch pine," "Jack pine," and, erroneously, "scrub pine." The wood resembles the southern red pine, is rather resinous and has a coarse grain; but when polished, it looks well in bedroom furniture, or in panels. Is not so durable as white or red pine. It grows to a good size in the central part of its distribution—say in the valley of the upper part of the Albany River, where it attains a diameter of twenty inches or more, with trunks which would furnish two or three saw logs tolerably free from branches.

Balsam Fir.—An abundant tree in a portion of our northern woods, but it does not range nearly so far north as the spruce. In favorable situations it attains a diameter of two feet, but is generally much smaller. The wood is soft, white, has a coarse grain, and is not durable. May be used for indoor work instead of white pine. It has not a resinous odor, and is, therefore, used for making milk pails, butter tubs, etc.

White Cedar.—The most durable of Canadian woods; soft, easily worked and very light. The trunks are often large, sometimes four feet in diameter at the ground, but taper rapidly, are prone to twist, and the largest trees are generally unsound or hollow in the centre. Used for all possible purposes, where durability and lightness, but not hardness, are required. Is much employed for telegraph poles, fence posts, block pavements, shingles, boat building, etc. Its durability under exposure to moisture and heat is much in its favor for railway ties, but it is too soft to long hold the spikes on curves, but it is often used on straight parts of the track. The geographical boundary of this tree has some curious features. From Seven Islands in the Lower St. Lawrence, its north limit runs westward to the southern part of James Bay, and thence in the same direction to the north-western sources of the Albany River, from whence it drops southward and runs along the east side of Red River into Minnesota. On the Atlantic side its boundary also drops southward, crossing the other tree-lines at right angles, and leaves out Nova Scotia and Newfoundland, although the conditions there appear to be as favorable for it as they are in Gaspe and New Brunswick, where it grows in great perfection. In the south it seeks the swamps and cooler situations, but in the north it prefers warm ground, the brinks of cliffs and the margins of lakes and rivers, or any other situation where it may absorb moisture from the air. It grows more abundantly on a limestone substratum than on the crystalline rocks, and hence the Manitoulin Islands and the Indian Peninsula afford large supplies of white cedar for export.

(Concluded in next issue.)

MOTOR-CYCLES AT THE IMPERIAL INSTITUTE.

The Executive Council of the Imperial Institute, London, Eng., has made arrangements with the Motor Car Club, whereby an international exhibition of motors and their appliances (" horseless " carriages, cars, self-propelling and other vehicles, and cycles, and stationary motors) will be held at the Institute during the months of May, June, July and August. The particular aim of the exhibition will be the display of the most recent developments in self-propelled traffic. The exhibition will include examples which may be received from the United Kingdom, the Colonies or India, and from foreign countries.

The Motor Car Club have secured, amongst others, the following motor vehicles and launches from the continent: 1 omnibus, 1 victoria, 1 phæton, Peugeot, Paris; 1 tramway and tender, 2 vis-a-vis, 1 tricycle, 2 stat. petroleum, 1 launch, Cannstatt; 1 carriage, Lutzmann; 2 De Dion tricycles (oil), 1 De Dion steam carriage, 4 electric carriages (2 makers), 1 Duncan Surberlie bicycle, 2 Benz carriages, 1 motor horse, Daimler; 1 quadricycle, Cannstatt; 1 omnibus, 2 carriage frames, with motor comp., Panhard et Levassor, Paris. Also exhibits of specimens of Pradier, Hollier, Rogers, Plant and Serpollet. From America they have secured five Kane-Pennington victorias and cycles, and others are expected. In England, they have received, in addition to the Acme motor carriages, promises of an electric carriage from Messrs. Thrupp & Maberley, an electric carriage from Messrs. Offord, an oil motor carriage from Messrs. Roots & Venables, electric carriages from Mr. Bersey, an oil motor carriage from Messrs. Windover, one from Messrs. L'Hollier, one from the Britannia Company, and many others. During the season, valuable monetary prizes to the value of £1,000 are to be given for new designs and inventions. Eminent engineers and experts will adjudicate upon the merits of the respective exhibits.

CONSUMERS are beginning to complain of the conduct of the nail manufacturers. It appears that while the makers were charging $2.55 for wire nails, and $2.30 per keg for cut nails, they were selling in Europe for $1 less than in the United States. One result of this discrimination was that nails were purchased for exportation, shipped across the Atlantic and then shipped back again, and after paying 20 cents each way, in freights across the Atlantic, they were sold below the price charged by the pool to domestic consumers. The nails in question escaped the payment of the American duty, on account of their American origin, the packages not having been broken on the other side of the Atlantic. The total cost of the returned nails, including all charges, was $1.90 per keg, at the outside, while nails sold by the pool for domestic use then, cost $2.45 now, thanks to an increased duty of 15 cents per keg, since put on by the United States Congress; the price is $2.55 at Pittsburg. The pool has taken steps to prevent a repetition of this operation by cutting off the supply.

THE summer convention of the Canadian Society of Civil Engineers, to be held in Toronto on the 17th, 18th and 19th of this month, bids fair to be an interesting gathering. At the time of going to press the programme has not been issued, but it will include an excursion around Toronto harbor, with an inspection of the harbor works and filtering basin; and one day will be devoted to an excursion to Niagara Falls, including an inspection of the great electrical works there. Particulars as to railway fares, etc., may be obtained from Prof. C. H. McLeod, secretary, 112 Mansfield street, Montreal.

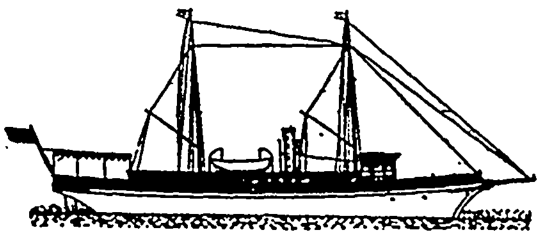
FIRES OF THE MONTH.

April 29th—A. Campbell & Co., Trent and Lisgar streets, Ottawa. Loss, $3,500.——May 1st—Bethany, Ont., F. W. Galbraith, sawmill.——May 6th—T. Dawson, sawmill, Renfrew, Ont. Loss, $3,000.——May 3rd—Steamer "Eva" and steam yacht "Nona Ray," Lindsay, Ont. Total loss. "Eva" valued at $1,500.——May 6th—Toronto Lead & Color Company, Brush Corset Company, Bay street, Toronto. Damages $8,000; insured.——May 6th—Peuchen & Co., wood acid mfrs., Toronto; damages, $400; insured.——May 7th—Toronto & Hamilton Sewer Pipe Works, Hamilton, Ont.; damages, $1,500.——May 8th—Imperial Lumber Co., Ltd., Warren, Ont., sawmills; loss, $60,000.——May 7th—Samuel Mathers, grist mill, Stony Point, Comber, Ont.; damages, $4,000.——May 8th—F. W. Humdall, wooden ware mfr., Toronto; damages, $1,500.——May 8th—C. E. Bumstead, Keppel, Ont., sawmill; loss, $1,500.——May 11th—Hawkesbury Lumber Co., Hawkesbury, Ont., sawmills; loss, $50,000.——May 12th—R. Thomson Lumber Co., Toronto sawmills, and lumber at Katrine, Ont.; loss, $50,000.——May 12th—Moore's sawmill, Loch Lomond Road, N.B.——May 12th—Willert's sawmill, Dashwood, Ont.——May 12th—Cox's sawmill, Centreville, Ont.; damages, $2,000; insurance, $1,000.——May 14th—Meldrum & McAllister, flour mills Peterboro, Ont.; loss, $150,000.——May 15th—D. A. Saunders' sawmill, Norwood, N.S.; loss, $4,500; insurance, $2,300.——May 15th—Sutherland's sawmill, Denmark, N.S.; two engines and other machinery burned.——May 17th—Smith's Brick Works, Stratford, Ont.; machinery a total loss; damages, $3,000.——May 17th—King Milling Co., Sarnia, Ont.; loss, $30,000. J. S. Loughead & Co., hub and spoke works; loss, $40,000.——May 15th—A. C. & C. W. Elderkin, Advocate Harbor, N.S.; saw mill——May 18th—D. Langille's sawmill, Meager's Grant, Halifax county, N.S.; total loss.——May 18th—Steamer "Cuba," St. Catharines, Ont.; $2,000 damages, chiefly to electric plant and pony engine.——May 18th—Floradale, Ont., Eby's saw and planing mill; mill and lumber destroyed.——May 20th—J. Stewart, flour mills, Barrie, Ont.; partially insured.——May 24th—Nemoixe Pineau, saw mill, Acadiaville, N.B.——May 28th—Jasperson & Co., flour mill, Kingsville, Ont.; loss $22,000, insurance $6,000.——May 25th—The Rathbun Co., Deseronto, Ont.; loss estimated at $200,000 to $215,000, and the total insurance at about $120,000. Cedar mill stock loss, $50,000; insurance, $30,000. Flour mill stock, including the elevator and bran house, loss $100,000, of which about $75,000 is on the buildings, about $150,000 is on the stock in the elevator, and the remainder on the stock in the flour mill and bran house. The insurance is $60,000. THE CANADIAN ENGINEER joins the business world generally in expressing its regret at so serious a loss to this well-known company, and hopes that business will be carried on at once with its old success.——Thackery's saw mill, Ottawa; damage to engine and boiler, $800.——May 26th—Mundell's furniture factory, Elora, Ont.; loss $12,000.——May 29th—R. H. Klock & Co., saw mill, Aylmer, Que.

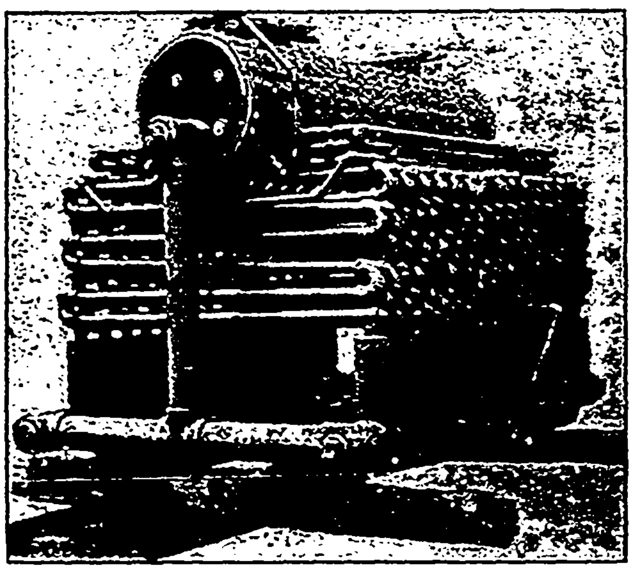
A CANADIAN-BUILT YACHT.

A NEW TYPE OF BOILER FOR THE "MILTONIA."

A representative of THE CANADIAN ENGINEER visited the shipyard of Davis & Sons, Kingston, Ont., the other day and found a very busy scene. This establishment is working to its full capacity, and among the craft it is turning out this year is a yacht which deserves more than a passing notice.

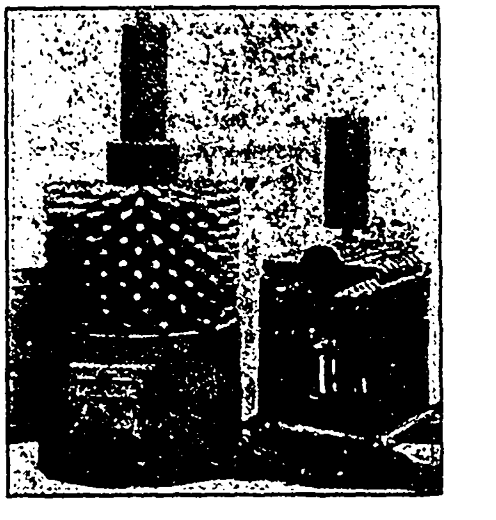


This steam yacht, the "Miltonia," of which the above is an outline illustration, is being built for A. E. Knopf, 36 Spruce street, New York. The drawings of the boat, engine and boiler are from the pen of R. Davis, senior member of the firm. She was designed by M. R. Davis, who superintended the construction of hull and cabins, and also the engine patterns. The engine and boiler were built under the superintendence of John H. Davis, the junior member of the firm. The hull is 70 feet long over all, 60 feet load water line, 12 feet 3 inches beam, 5 feet 9 inches depth of hold, and 3 feet 10 inches draught, with a displacement of 28 tons. Her frames are double, spaced at 18 inch centres; moulded 4 inches at keel and 3 inches at the top; 1½ inch flitch double, and bolted together with 800 bolts with nuts. The keel and keelson are both 6 by 8 inches, well bolted through from bottom, and clinched. The clamps and shelf are 2 by 6 inches, all bolted with screw bolts. All the timber is white oak of the very best quality. The cabins are of the trunk style, finished with Pennsylvania cherry, with two cabins, one cook-room, one wash-room, one Bishop's w.c. The cabin seats are made to draw out, so as to be of use for beds on a cruise. The windows are all to be of plate glass; all door trimmings are brass. The upholstery and carpets and window curtains are to be made in the best manner and of the best material. The greatest care will be used in the construction of the machinery. The engine is a fore-and-aft compound, with cylinders 7 and 14 inches, by 10 inch stroke, fitted with Marshall's reversing gear; consequently the cylinders are close together, making the engine only 32 inches long. The working parts are made from forged steel, including the crank and shaft. The propeller is phosphor bronze. The



BOILER OF THE STEAM YACHT "MILTONIA," DESIGNED AND BUILT BY DAVIS & SON.

boiler is a water-tube, originated with the builders. The steam coils are made of 1¼-inch pipe, extra heavy, taking water from a 4-inch double-thick manifold pipe running all around the bottom, from thence leading to a steam pump 20 inches in diameter and 6 feet long. The bends are made with plugs screwed in opposite each pipe, so as any pipe can be looked through at any time in any part of the boiler. This is an improvement of great value in a pipe boiler, and overcomes a fault made much of by some of the builders, who claim the great advantage of looking in through any tube.



PORCUPINE BOILER, BUILT BY DAVIS & SON.

This boiler is constructed under the supervision of the Government inspector, which is a sufficient guarantee of good workmanship. It will weigh 6,800 lbs., holds three barrels of water in steaming order, and tested to 400 lbs. cold water pressure. It will be allowed 175 lbs. steam working pressure, and occupy a space 4 feet 9 inches wide by 6 feet long and 5 feet 2 inches high. It will be fed by a Worthington duplex feed pump and one injector, with all necessary mountings of a superior quality. This type of boiler is now used by the firm in their 33-feet boats, which are in popular use here. This machinery will exert 180 horse-power, and drive the "Miltonia" 14 miles an hour. She is to be ready this month.

AN HONOR TO A CANADIAN.

At the annual convention of the National Electric Light Association, held in New York last month, a signal honor fell upon Canada in the election of Frederic Nicholls, of Toronto, as president of that important organization. The leading electrical journals of the United States contained highly complimentary references to Mr. Nicholls. The *Electrical World* said of him:

"Mr. Nicholls was born in England in 1856, and finished his education at Stuttgart, Germany, coming to Canada shortly afterward. For several years he has been actively engaged in directing electrical enterprises in his adopted country, and with great success. He organized the first and only company in Canada that adopted the underground system of electric light distribution, and is prominently identified with other Canadian enterprises. Those concerns of an electrical character with which he is connected are the Canadian General Electrical Company, of which he is vice-president and general manager; the Toronto Electric Light Company, as director; the Brantford Street Railway Company, as president; the Peterborough Street Railway Company, as vice-president; the London Electric Light Company, as secretary, and the Toronto & Scarboro Railway Company, as director. In addition to these Mr. Nicholls is a director in mining, insurance, publishing and other companies of Canada, and notwithstanding the duties of his many positions, he is always able to give time to the affairs of the National Electric Light Association. He is a regular attendant at the conventions of that organization, and is deeply interested in its work and welfare. Prior to his election as president of the association, Mr. Nicholls performed successively the duties as a member of the executive committee, and as second and first vice-president. The association is indeed fortunate in selecting as its official head a gentleman so well qualified to direct its affairs, and one who at the same time enjoys the confidence of his official associates and of the members of the body."

In giving a portrait of Mr. Nicholls the *Electrical Engineer* also paid a high tribute to his abilities, saying among other things:

"The new president of the National Electric Light Association is one of the most representative men to have reached that place of honor and distinction. Of good English birth and German education, he has been a good many years in Canada; while his business relations with the United States have always been intimate, and his friends in this country are innumerable. Mr. Nicholls has long been an active and loyal member of the Association, and was early picked out as an officer for the body. He is not only deeply interested in the success of local plants, in which he has placed large sums of money, but as an electrical manufacturer turning out perhaps the largest variety of electrical apparatus made by any single concern under the British flag, he is able to look calmly and fairly at the commercial questions of the industry, from the standpoint of the seller and the buyer alike. His judgment is sound and shrewd, and he can take long views as well as swift actions. As the vice-president and general manager of the Canadian General Electric Company, Mr. Nicholls is held in high esteem in manufacturing circles in Canada, where he is also distinguished as being with tongue and pen a foremost advocate of a protective system for the Dominion."

To these comments it may be added that Mr. Nicholls may be called the pioneer of trade journalism in Canada, being one of the founders of the *Industrial World*, the predecessor of the *Canadian Manufacturer*, which also he edited and managed with his usual ability and success till his retirement from trade journalism two or three years ago.

MINERAL PRODUCTION OF CANADA.

The following statement of the mineral production of Canada for the year 1895 has been issued by the Geological Department These figures are subject to revision in a bulletin to be issued later on:

PRODUCT.	Quantity (a)	Value (a)
Metallic.		
Copper (b) ....lbs.	8,789,162	$ 949,229
Gold	......	1,910,921
Iron ore ....tons	102,797	238,070
Lead (fine, in ore, etc.) (c)..........lbs.	23,075,892	749,966
Mercury..........	......	2,343
Nickel (fine, in ore, etc.) (d)..........	......	1,360,984
Silver (fine, in ore, etc.) (e)..........ozs.	1,775,683	1,158,633
Total metallic	......	6,370,146
Non-Metallic.		
Asbestos ....tons.	8,756	368,175
Baryta .... "	8	168
Chromite .... "	3,177	41,301
Coal .... "	3,512,504	7,774,178
Coke (f) .... "	53,356	143,047
Fire clay .... "	1,329	3,492
Graphite .... "	220	6,150
Grindstones.......... "	3,919	31,532
Gypsum .... "	226,178	202,608
Limestone for flux.......... "	34,579	32,916
Manganese ore .... "	125	8,464
Mica	......	65,000
Ochres ....tons.	1,339	14,600
Mineral water ....galls.	707,382	111,048
Moulding sand..........tons.	6,765	13,530
Natural gas (g)	......	423,032
Petroleum (h) ....bbls.	802,573	1,201,184
Phosphate (apatite) .... tons.	1,822	9,565
Precious stones	......	1,650
Pyrites .. ..tons.	34,198	102,594
Salt.......... "	60,018	180,417
Soapstone .... "	475	2,138
Structural Materials and Clay Products.		
*Bricks	......	1,800,000
*Building stone..........	......	1,200,000
Cement, natural ....bbls.	73,169	69,482
" Portland .... "	61,475	111,680
Flagstones.. ....sq. ft.	80,005	6,867
Granite..........tons.	19,188	90,199
*Lime	......	900,000
Marble ....tons.	200	2 000
Pottery	......	125,600
Roofing cement	......	3,153
Sands and gravels (exports)......tons.	277,162	118,359
Sewer pipe	......	257,045
Slate	......	58,900
Terra-cotta, etc..........	......	195,123
*Tiles	......	200,000
Total non-metallic..........	......	$15,875,197
Total metallic..........	......	6,370,146
Estimated value of mineral products not returned	......	254,657
1895 Total	......	$22,500,000
1894 "	......	$20,900,000
1893 "	......	19,250,000
1892 Total	......	$19,500,000
1891 "	......	20,500,000
1890 "	......	18,000,000
1889 "	......	14,500,000
1888 "	......	13,500,000
1887 "	......	12,500,000
1886 "	......	12,000,000

* Estimated.

(a) Quantity or value of product marketed.
(b) Copper contents of ore, matte, etc., at 10¾ cents per lb.
(c) Lead contents of ores, etc., at 3¼ cents per lb.
(d) Nickel contents of ore, matte, etc., at 35 cents per lb.
(e) Silver contents of ore at 65¼ cents per oz.
(f) Oven coke, nearly all the production of Nova Scotia.
(g) Gross return from sale of gas.
(h) Calculated from inspection returns at 100 galls. crude to 38 refined oil, and computed at $1.49⅝ per bbl. of 35 imp. galls. The barrel of refined oil is assumed to contain 42 imp. galls.

The ton used is that of 2,000 lbs.

EDUCATION NECESSARY.

Editor CANADIAN ENGINEER:

SIR,—In these days of close competition and business rivalry, the man who possesses a good education has a great advantage over the one who does not. This statement will, no doubt, appear self-evident to anyone who will seriously consider it. Many who look at only one side of the question recall to their remembrance some who have attained positions of trust and profit, and, perhaps, even eminence, with little, if any, education, while others, who have had a good education, have failed from a worldly standpoint. They are inclined to doubt the wisdom of spending their time, money and labor on something which they are not certain will inure to their benefit. Why did some succeed and others fail? Some may reply that those who succeeded had luck. He who succeeds will never admit that luck helped him. He will tell you that he took advantage of an opportunity, and that by earnest endeavor and hard work he proved his worth to his employer; that he always looked after his employer's interests and never shirked the performance of a duty because he was unfamiliar with it, preferring to work and study outside the regular hours rather than to admit that he could not master it. Such a man will always succeed; he will be found to be self-reliant, and to possess strong opinions, an unyielding will and a spirit that overcomes all difficulties. Any kind of an education is sure to be of benefit at some time or other, but that which is best suited to further one's business interests would naturally be preferred. The educated man is becoming a more important factor than ever in the world's progress, and he who would succeed can make no better beginning than by acquiring an education. The many excellent courses offered by our various schools and journals, leave no person an excuse for saying that he is not able, or has not the means to learn.

YOUNGSTER.

METAL IMPORTS FROM GREAT BRITAIN.

The metal imports to Canada from Great Britain during the month of March, 1895 and 1896, and the three months ending March, 1895 and 1896, were valued in sterling as follows:

	Month of March. 1895.	Month of March. 1896.	3 mos. ending March. 1895.	3 mos. ending March. 1896.
Hardware and cutlery	£4,963	£6,228	£12,510	£16,322
Pig iron..........	1,034	748	1,243	3,781
Bar, etc..........	537	645	2,828	3,067
Railroad	900	1,111	900	1,963
Hoops, sheets, etc..........	1,659	877	4,524	3,249
Galvanized sheets	2,977	1,312	5,849	5,333
Tin plates..........	7,245	8,165	23,191	31,134
Cast, wrought, etc., iron ..	3,458	3,642	6,936	9,566
Steel	3,200	5,469	8,850	17,554
Lead	1,738	702	2,609	2,870
Tin, unwrought	1,708	1,584	5,468	2,671
Cement	630	4,081	660	4,511

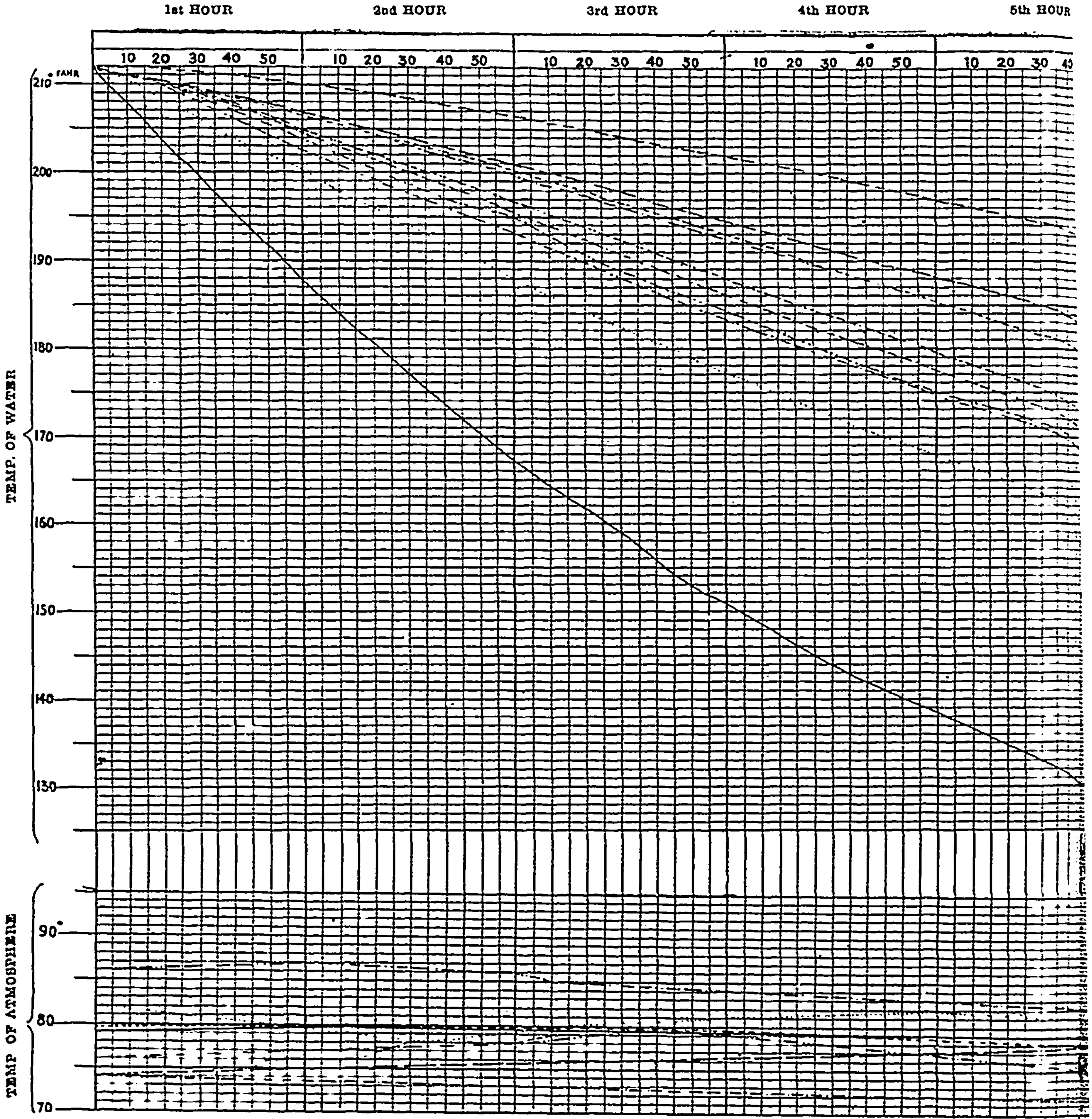
WE note in the Owen Sound *Sun* an interesting paragraph on the recent railway patent of V. A. Emond, of Quebec, which we described in our May issue. The writer mentions that a pamphlet appeared about thirty or forty years ago which outlined such a system of rollers and rails. We would be pleased to have further information upon the subject. Have any others of our readers seen this pamphlet?

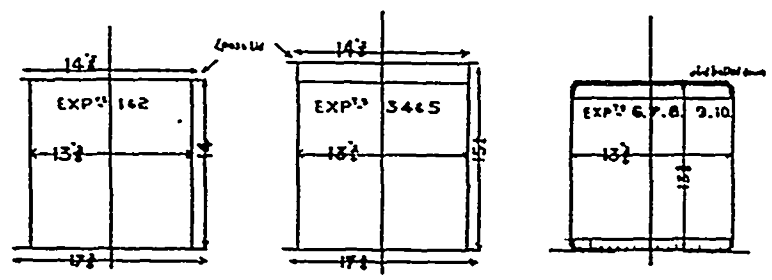
CANADIAN PACIFIC RAILW[AY]

(MECHANICAL DEPARTMENT)

DIAGRAM OF EXPERIMENTS WITH BOILER COVERINGS.

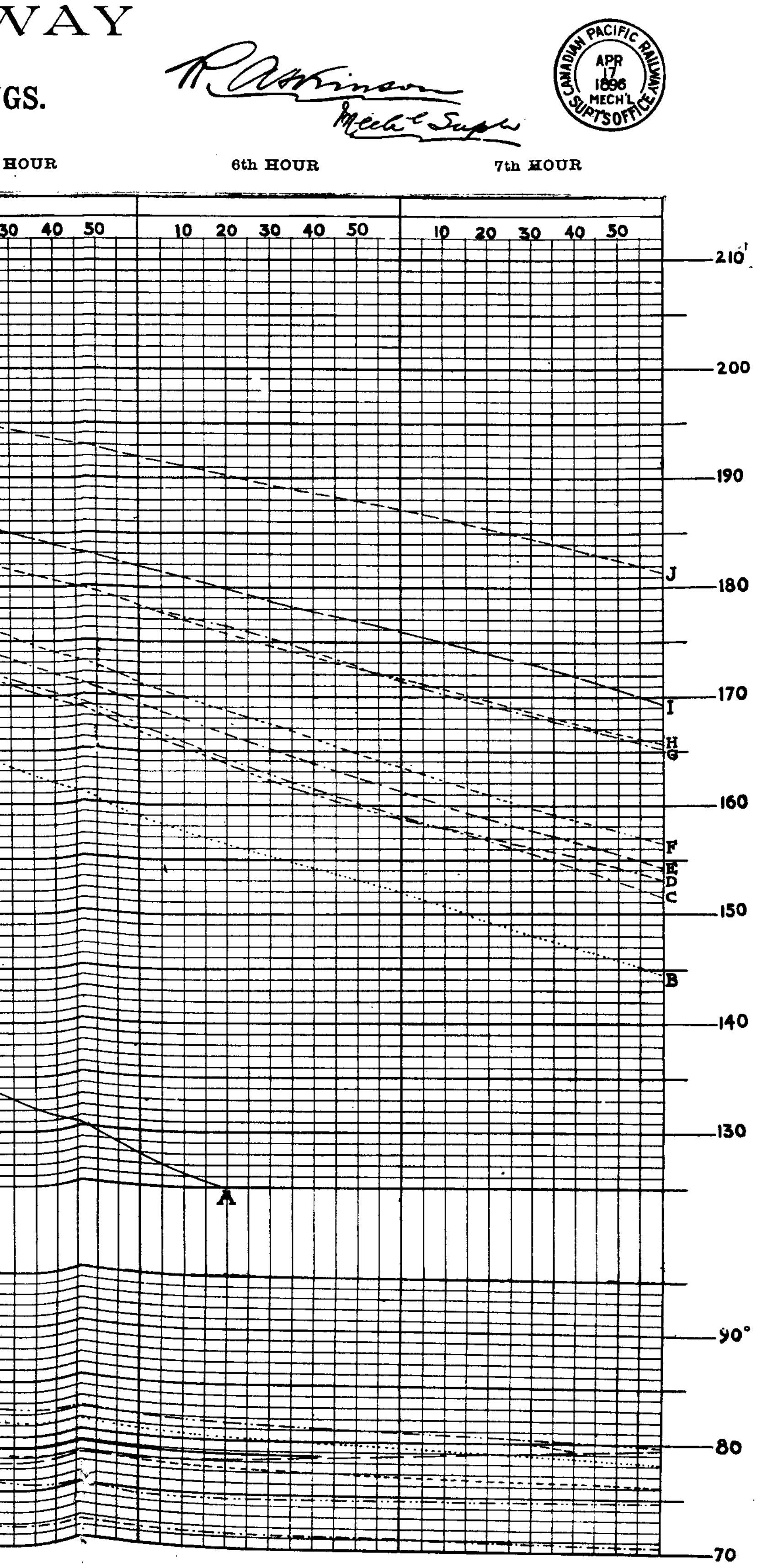
(Reproduced from Canadian Pacific Railway Company's Chart.)





The order in which the experiments were made and the materials tested were as follows:—

1st	Expt.	Tank	uncovered	
2nd	"	"	with air spaces of $\frac{7}{8}$ in. next tank, wood lagging $\frac{7}{8}$ in. thick, and outer coat of Russian iron..................	H
3rd	"	"	same as in 2nd Expt., but with Asbestos woven cloth $\frac{3}{4}$ in. thick, inserted in the $\frac{7}{8}$ in. space, and placed next tank	I
4th	"	"	covered with Plastic Asbestos Compound, and outer coat Russian iron Comp. $1\frac{1}{2}$ in. thick	
5th	"	"	covered with Sectional Magnesia Blocks, and outer coat Russian iron Comp. $1\frac{1}{4}$ in. thick	G



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6th Expt. Tank covered with Patent Mineral Composition, and outer coat Russian iron Comp. 1½ in. thick C

7th " " covered with Plastic Asbestos, taken off C.P.R. Boilers, and outer coat Russian iron Comp. 1½ in. thick.............. B

8th " " with air-space of 1⅜ in. next tank, air-tight iron coat 1/16 in. full thick and outer coat Russian iron Comp. 1½ in. thick.......... E

9th " " covered with Patent Mineral Composition Comp. 1½ in. thick.................... F

10th " " covered with Mica Boiler Covering..Comp. 1⅛ in. thick .... J

The position of the various coverings on the chart may be found by the corresponding letters.

EXPERIMENTS WITH BOILER COVERINGS.

The accompanying chart is a reproduction of a diagram of experiments with boiler coverings made by the Canadian Pacific Railway Co. to test the values of various compounds as non-conductors of heat.

The whole question of the insulation of steam heat and the consequent economy of power and coal has been greatly neglected in this country, and a careful examination of the chart referred to and consideration of the results obtained and their significance, will be of great interest and value to engineers and steam users. In England and the United States increasing attention has been given to the whole question, and elaborate and voluminous reports of scientific trials of numerous non-conductors have lately been published. Various methods of testing these coverings have been adopted, the most general being the measurement of condensed steam in the form of water which has occurred in a given time under the competing coverings. In the case of the C.P.R. trials, however, it will be seen that water at 212° was used, the relative value of the coverings as non-conductors being determined by the number of degrees of heat which escaped through the different substances and the consequent cooling of the water in a given time. A reference to the chart shows that ten experiments were made. It will not be necessary, however, to refer to all of them, as the results of some were so unimportant, as in experiments 4, 6 and 9, as to render them of little interest or value. It is only necessary to say that the trials were made under as nearly similar conditions as possible, as will be seen by the diagram of the atmospheric temperatures during the tests. The readings were taken from thermometers passed through the coverings and down into the body of the water.

The chart shows the loss of heat in the uncovered tank up to the 5th hour only, and to make a fair comparison the others should be taken for same time. The temperature at beginning of each test was 212°, and the following table shows the temperature at end of fifth hour, the loss in five hours, and the loss in the fifth hour :—

	Loss in 5 hours.	Temp. at end of 5th hour.	Loss in 5th hour.
Bare tank................	84°	128°	11°
Asbestos compound	53°	159°	9°
Magnesia blocks...........	33¾°	178¼°	7°
Wood lagging and air space	"	"	"
Asbestos and wood	30°	181°	6°
Mica....................	20°	192°	5°

The mean temperature of the surrounding atmosphere during the 5th hour may be taken as having been 78°.

The fairest comparison of the merits of the coverings is made by considering the loss of heat in one hour per degree of difference of temperature between the tank and its surrounding atmosphere.

The following table shows this worked out :—

	Mean temp. during 5th hour.	Difference between tank and atmosphere.	Loss in 5th hour.	Loss in 5th hour per degree of difference of temperature.
Bare tank	133½°	55½°	11°	.198
Asbestos comp............	163½°	85½°	9°	.105
Magnesia blocks	181¾°	103¾°	7°	.0674
Wood lagging and air space	181¾°	103¾°	7°	.0674
Asbestos and wood........	185°	107°	6°	.056
Mica	194½°	116½°	5°	.0428

The following table shows the value of the coverings as compared with the bare tank.

Amount of heat which escapes from the bare tank was

1.88	times	greater	than	through	the	Asbestos compound.
2.92	"	"	"	"	"	Magnesia blocks.
2.92	"	"	"	"	"	Wood lagging and air space.
3.53	"	"	"	"	"	Asbestos and wood.
4.62	"	"	"	"	"	Mica.

Mica shows by far the best result as a non-conductor of heat, and saved

245	per cent.	as much	heat	as the	Asbestos compound.
157	"	"	"	"	Magnesia blocks.
157	"	"	"	"	Wood lagging and air space.
130	"	"	"	"	Asbestos and wood.

The extraordinary differences here shown will doubtless be a matter of considerable surprise, but it is impossible to doubt the accuracy of the figures, and some other explanation must be sought.

It will be seen that asbestos cement, which is in very general use, particularly on marine boilers, showed infinitely the worst results. There seems no room for doubt that this is largely attributable to the fact that it is a solid composition, and lacks one of the most vital requirements of successful non-conductivity, *i.e.*, "diffused air." That the air must be diffused or separated into minute cells is strikingly illustrated in experiments 2 and 3. In the first, wood and air space of ⅞ inch next to the tank, as used on locomotive boilers, the loss per degree of difference of temperature was .0674°. When the same air space was filled or packed with asbestos fibre the loss dropped to .056°. In the case of mica, the air theory appears to have been carried to the furthest possible extent, the whole covering forming a veritable air cushion, each leaf or film of mica being separated from the next by minute corrugations, the whole mat presenting the appearance of a porous flexible quilt. The value of this ingenious arrangement was amply proved in the experiments in question, when the loss per degree in difference of temperature was only .0428°. That this is one of the most important qualities of a covering has long been recognized, and a large number of patents have been granted for devices intended to obtain it. But in nearly every instance it has been at the expense of the material. Hair felt, which is so largely used in low pressure work, is almost useless under high temperatures, crumbling and cracking, and in some cases igniting, although of itself it encompasses a large portion of the desired air. In other compositions, which are extremely light and porous, vibration or concussion disintegrates them in a comparatively short time, so that the difficulty of finding a substance which would resist all of these dangers has been great. It seems therefore that the great difference in the values of the coverings tested by the C.P.R. is due largely to the manner in which the valuable properties of diffused air as a non-conductor have been utilized. The differences shown between the best of the coverings in this trial are the more remarkable when it is remembered that the nearer the limit is reached, the greater the difficulty of showing substantial differences of value becomes.

The rapid increase in the use of high pressure steam has an important bearing on the question of loss by radiation and the utilization of the best means of minimizing it is an object of prime importance. That this loss is much larger than the majority of steam users realize, is certain, otherwise uncovered boilers or steam-pipes would be unheard of, and the rapid replacing of inferior coverings by the best that could be obtained would be accomplished as soon as possible in all our factories and shops. The following table will give some idea of what the loss of power has been found to be from uncovered steam-pipes with the steam at 75 lb. gauge pressure:—

2	inch pipe..	1	horse power	loss	for	every	132	feet long.
4	"	1	"	"	"		75	"
6	"	1	"	"	"		46	"
8	"	1	"	"	"		40	"
12	"	1	"	"	"		26	"

About 90 per cent. of this waste is easily prevented by a proper covering of the pipes. When it is considered that this loss occurs at the comparatively low pressure of 75 lbs., it is apparent that with steam at 130 lbs. and 140 lbs. and higher, the loss becomes very serious, and the necessity for preventing as much of it as possible is a matter of urgent importance.

The accompanying diagram very clearly demonstrates what can be done in this direction by the use of various compositions, as it clearly shows the qualities and capabilities of each. It is possible that the question might arise as to whether the great differences between these substances would still be found had the trials of the C.P.R. Company been made with higher temperatures than 212°.

It appears, however, from published reports of trials made some months ago by the engineers of the Boiler Inspection and Insurance Company of Canada, that these differences did exist; that company subsequently issued a special circular on the whole matter, as one of particular interest to steam users. It is stated further that the Grand Trunk Railway Company have lately concluded a series of trials, on a large scale and under high steam pressure, of a number of boiler coverings, including the best of those tested by the C.P.R. and the Boiler Inspection Company, the difference between them being even more marked. As no data, however, is as yet available of these trials, it is impossible to speak of them with accuracy. It is encouraging to notice the increasing attention the whole subject is receiving, and in view of the imperative necessity for observing the strictest economy in power and coal and the prevention of all unnecessary waste, it is to be hoped that our manufacturers will not be slow to avail themselves of every improvement and device calculated to achieve that object.

THE BALDWIN-WESTINGHOUSE ELECTRIC LOCOMOTIVE.

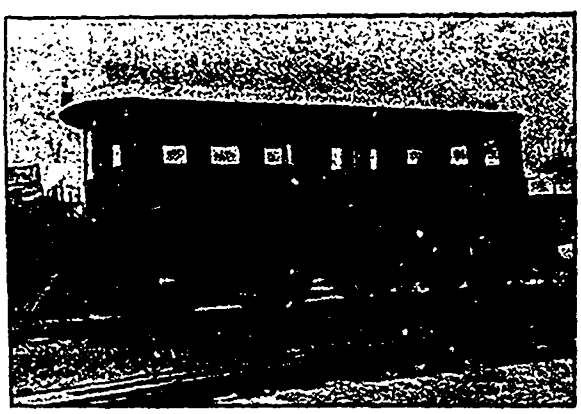
The latest *debutant* among electric devices for superseding steam locomotives on railways has just been completed by the Baldwin-Westinghouse combination. The illustrations published herewith show the "locomotive" and trucks previous to the placing of electrical apparatus. In describing this engine the builders say:—

This electric locomotive is the 1,000 horse-power size of the series of electric locomotives which the Baldwin and Westinghouse combination have arranged for standards. The sizes range from 100 horse power to 1,600 horse power, and are for different purposes, smaller sizes being used for mines and light tramways, and the larger for tunnels.

These locomotives are built under patents owned and controlled by the Baldwin Locomotive Works and the Westinghouse Electric and Manufacturing Company.

The principal feature of the new system of construction is the use of geared motors. This permits the construction of locomotives that are easy to repair, reasonable in cost and simple in construction. Before the subject was taken up by the Baldwin-Westinghouse combination, electric locomotives had been built for mine work and for tunnels; but the attempt had been made to give them the appearance of steam locomotives, with the result that the locomotives were neither handsome in appearance nor handy and serviceable for the railroad company. All electric locomotives necessarily have the driving gear underneath the floor, as there are no boilers, smoke stacks, steam domes, etc., as is usual in steam locomotives, hence the superstructure of the electric locomotives may be made in any form, but it has been found upon investigation and inquiry among railroads that they would prefer that the superstructure be made ample in size to receive railroad freight, that is, freight belonging to the road itself, which is often shipped from one point to another on the road, and receive baggage, mail and wrecking apparatus, replacing frogs, chains and jack-screws, crow-bars, etc. Furthermore, an order has been recently issued on some roads that a light locomotive will not be sent out on the line unless an entire train crew be put on the engine. The reason is that in case of wreck the fireman and engineer are often killed and the locomotive becomes an obstruction in the track with no one to flag it. In a recent case of this kind, the locomotive turned over owing to a bad piece of track, the fireman and engineer were killed, and only by mere chance a passenger train was saved from being wrecked by it.

The large superstructure which has been asked for by the railroad companies has been provided for this reason among others. For freight engines, a lookout is placed on top, so that the conductor can see back over the train, and bunks are provided for trainmen instead of in the caboose. The latter then becomes a place simply for the rear flagman. This is considered to be a better railroad practice. On steam locomotives there is always a lack of room for the necessary apparatus that is carried for use in case of wreck, such as extra couplers, etc., and therefore much of this apparatus has to be carried in the caboose. On the electric locomotive, there being none of the machinery above the floor there is ample room to provide racks for such tools as are always carried somewhere on any important train.



Most people are accustomed to a steam locomotive appearance and naturally expect that the electric locomotive will look something like it; but there is no reason why this should be, and if the electric locomotive had been built first, the steam locomotive with its numerous projections and stacks and protuberances would have seemed to be a very queer looking machine. Those who have built electric locomotives with the peculiarly shaped superstructures have found that such are not acceptable to railroad companies, and hereafter a plain car-like body will be given in case of duplicate orders. In other words, those who have built electric locomotives, attempting to retain something like the appearance of a steam locomotive, have found they have made a mistake. In some cases the attempt has been made to give them the appearance of Ericson's monitor. This also is not only found to be very expensive, but serves no useful purpose, inasmuch as the sloping ends simply interfere with the repair of the machinery and do not give useful space.

The power of this locomotive to travel at high speed is somewhat greater than that of the standard engines on the Pennsylvania railroad which haul the limited trains. When moving at a freight-train speed it will haul more than the heaviest consolidation engines of the Pennsylvania road. For the reason that the power of the electric locomotive is not determined by the power of the locomotive itself, but by the power of the central station, it is evident that there is practically an unlimited supply, hence there is not the limitation to long runs with electric locomotives that there is in the case of steam locomotives, where the grates become clogged after a short run. A large steam locomotive can often generate a thousand horse-power for fifteen or twenty minutes, and then time must be provided for cleaning the fires. In the case of the electric locomotive, 1,000 horse-power can be developed indefinitely, as it is only dependent upon the central station.

The speed of the electric locomotive is dependent upon the gearing; that is, the velocity of the armature which revolves is more than sufficient to run the locomotive at more than 120 miles per hour, and has to be geared down, so that the wheels of the locomotive will revolve slower. By making the reduction of the gearing suitable, the speed may be made almost nothing. This locomotive with a gearing of ½ to 1 is perfectly adapted to run from 70 to 100 miles an hour, and with a gearing of 4 to 1 is adapted to pull heavy loads at a freight train speed. It is not necessary to change the size of the driving wheels, for the reason that all parts are perfectly balanced, and they can run smoothly at almost any speed at which it is safe to drive a locomotive. These wheels are forty-two inches in diameter, and are larger than are used on Pullman cars. It is, of course, necessary that the trucks under locomotives of this kind should be more durable and much stronger than trucks under ordinary Pullman cars, and therefore these trucks are made just like locomotives in themselves. They have the best material and workmanship that it is possible to get, and all parts are fitted in the same way as for the best grade of steam locomotives. In addition the trucks are given all of the construction that is necessary to make them ride as easily as a passenger car; that is, they have swinging bolsters, triple elliptic springs and springs for the axle boxes. This locomotive is about 38 feet over the pilots, about 9 feet 6 inches wide and 13 feet 6 inches high. The weight in working order is 150,000 pounds.

One of the peculiarities of electric locomotives is that all of the weight is available to furnish adhesion to the rails, and all axles are driven. In the case of this locomotive there are four axles, all of which are driven by electric motors. In the case of a steam locomotive of the ordinary type there are four axles on the tender, two axles on the truck and two driving axles, or eight axles, only two of which are driven. The total weight of the steam locomotive, including its tender, is about 200,000 pounds, of which about 70,000 pounds, which is on the driving wheels, is available for adhesion, or only about 35 per cent. In the case of the electric locomotive, the whole weight, or 100 per cent., is useful, so that this locomotive weighing 150,000 pounds total, has about twice as much hauling capacity as the 200,000 pound steam locomotive.

It is interesting to see that electric locomotives of the new Baldwin-Westinghouse type, when constructed with all the essential parts for driving the machine and for the convenience of the train men, do not weigh as much as is necessary to give them the proper adhesion. In the case of this locomotive, the weight of all the essential parts is but about 100,000 pounds, and in order to get the necessary weight to keep the drivers from slipping, cast-iron floor plates are put on about five inches thick; in other words, about twenty-five tons of cast iron has to be added. This shows one of the greatest improvements of this type of electric locomotive over others, where they have used gearless motors, which have been discarded for all street car work owing to their excessive weight. These gearless locomotives are so much heavier that the essential parts weigh enough to give the necessary adhesion; but as these ~ .ttial parts are made of expensive material, such locomotives cost a great deal more. An example of this kind is found in the difference of cost between the locomotives used on the Baltimore & Ohio tunnel, which was about $50,000 each, and this locomotive, which will do the same work and can be built for less than one-third of that amount.

This locomotive is known as class "8,4-200 E," which is a modification of the Baldwin Locomotive Works classification for steam locomotives. The "8" signifies that it has eight wheels; "4," that there are four motors; the "200,' that the motors are 200 horse-power, and the "E" indicates that there are four axles which are driven by power.

Switching locomotives are made exactly the same in the underneath part, but differ in the superstructure. There is a cab either in the centre or at the end, the cab being much shorter than the locomotive. In case the cab is at one end, an electric crane is put on the other end, so that each switcher becomes a wrecking locomotive or traveling crane, and it is expected that the income that can be derived from having traveling cranes that can be used as switchers would be more than sufficient to pay the extra cost of the crane work. Where the cab is placed in the centre, the ends are provided with hand railings and furnished with platforms on which the men can ride in making up trains, instead of being compelled to ride on the steps in dangerous positions, as is now the case with steam switchers.

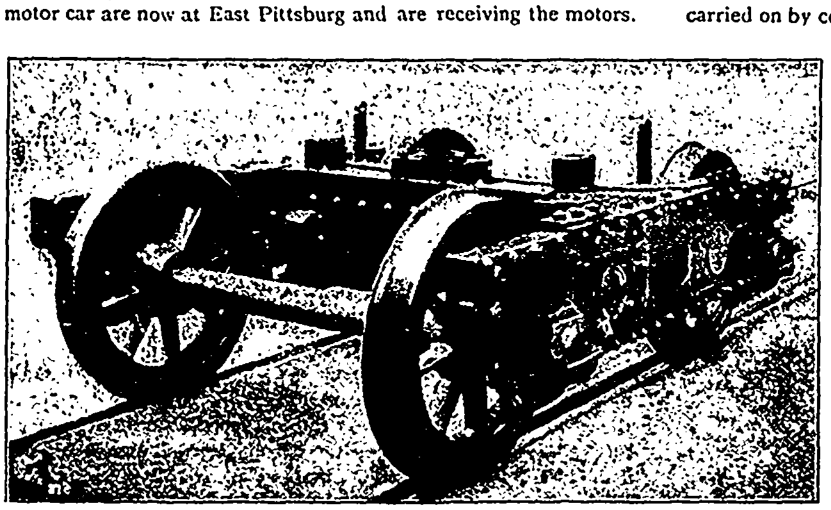
The mine locomotives are quite different in construction. They are generally made with six drivers connected in a rigid frame, and surrounded by a light sheet-iron cab. The rack locomotives are designed to climb grades up to 45 per cent., such as is used on the Pike's Peak railroad, where the gear or rack is laid between the rails and the locomotive climbs by means of the spur gear, which is driven by electric motors and fits in the rack.

The whole series of these standards has been designed and will soon be shown in illustrated catalogues, which will give the hauling capacity and all the details of construction.

These locomotives may be run on any system, whether the Tesla, the electro-magnetic or button system, the overhead trolley or third rail. They can be used either with the plain direct current or the alternating current, or the multiphase. The best method for operating tunnels and yards, or in any case where there is a heavy current, is the electro-magnetic or button system, and all these standard locomotives will be fitted to run with that system. These 1,000 horse-power locomotives will have the apparatus provided also to run by an overhead trolley, and for this purpose a considerable section of the Turtle Creek railroad is now being fitted with overhead wires for the trolley system and with the buttons for the electro-magnetic traction system. The length of the equipped line will be about a mile and a half.

The Pennsylvania Railroad officers are much interested in these experiments and are assisting in every way possible to have them carried out to the best advantage. They hope to learn such facts as they cannot learn from the Mount Holly branch, which was equipped by the Baldwin-Westinghouse combination last year.

Within a short time a motor car suitable for elevated railroads and suburban lines will be received at East Pittsburg from the Baldwin Locomotive Works, and will be equipped to run both on the Tesla system and with the direct current. The trucks for this motor car are now at East Pittsburg and are receiving the motors.



This motor car will be beautifully finished in the interior, with seats for passengers similar to those used on the Manhattan Elevated Railroad, and will in every way be equipped for service on the Manhattan road.

Also in the course of construction is a special electric locomotive for use with the most improved multiphase or Tesla system It will be used for exhibit and experiment at East Pittsburg. This equipment is simply the experimental equipment to be used at the Westinghouse Electric and Manufacturing Company's works at East Pittsburg, on the Turtle Creek branch of the Pennsylvania.

In addition to these locomotives, the Baldwin-Westinghouse combination are constructing electric locomotives for other purposes at Philadelphia One of the most interesting is a heavy 200 horse power mine locomotive for West Virginia.

Since it has become generally known that the Baldwin Locomotive Works and the Westinghouse Company were combined to take up seriously this matter of electric railway equipment, the number of enquiries as to the cost and feasibility has greatly increased, and this has compelled the publication of a catalogue that will give the information directly.

The delay since the formation of the combination in getting the apparatus ready has been found necessary in order that the designs might be simple and practicable. It is one thing to arrange a locomotive to do work, and quite another thing to arrange a series of standards that will be so flexible as to be applicable to almost all conditions. This line of apparatus has been devised so that it can be readily understood and comprehended by any practical man. There are no hidden parts, but everything is exposed in such a way that after a little explanation any steam locomotive engineer can understand the uses of the different devices.

All of the rheostats, switches and wiring that were formerly placed under the car and out of sight on electric locomotives, are, in this class of apparatus, put above the floor, where they can be readily reached and examined. Instead of having about 100 wires going through the floor and fastened along the sills in exposed positions, there are in this locomotive only four cables, which are protected by a lead covering. All of the wires that ordinarily form a network under the floor are now placed above the floor in a case which holds not only the rheostats, but forms the controller itself.

On a steam locomotive an engineer has to operate about twenty handles, keep watch of the fireman, the height of the water in the boiler, the steam pressure, besides looking on ahead; while on this electric locomotive there are but three handles: the reversing switch, the controller, and the air-brake handle, so that the attention of the engineer can be confined to the track ahead.

The air brakes are operated in the usual way by a pump, which is driven by an electric motor The machine is practically noiseless, and is placed under the floor of the locomotive. The headlights are illuminated either by electricity or oil.

LITERARY NOTICES.

The announcement of the Faculty of Applied Science of McGill University, Montreal, contains novel features, and calls attention to the new departures which the college is enabled to make through the munificence of W. C. McDonald. In another column an advertisement will be found, which shows that four new professors are to be added to the staff of that thoroughly progressive and popular institution.

The International Correspondence Schools, of Scranton, Pa., have established a very successful system of technical education carried on by correspondence in any part of this continent, and have obtained quite a number of students in Canada. This institution, the methods of which are explained by circular, has made steady progress, and is well worth the attention of those who wish a technical education at a moderate cost.

The Engineering Society of the School of Practical Science, Toronto, has issued in neat pamphlet form the papers read before the society in the past college year. Much credit is due the students' committee, which edited the publication, for the painstaking and business-like way in which it is turned out.

The Canadian Society of Civil Engineers has issued from its rooms, 112 Mansfield street, Montreal, the charter, by-laws and list of members of the society in an attractive pamphlet. A table is included, giving all the officers of the Society during the past ten years.

The Penberthy Injector Co., of Detroit, Mich., publish a little monthly of their own called the *Penberthy Bulletin*. The subscription is only sixteen cents a year, and a sample copy will be sent to any engineer giving his address and by whom employed.

The *Coiled Spring* is the name of an interesting little four-page monthly issued by the Page Wire Fence Co., Walkerville. Ont. It is sent free to any farmer or other fence user interested who will send his address to the company.

The Packard Electric Co., of St. Catharines, Ont., are sending out to their friends monthly a vest pocket memorandum book, "Daily Notes," which is exceedingly neat, and is free from advertising features, save for the mark Packard on the back cover. It is most convenient and pleasing.

Catalogues are not always models of the printer's art, but those of the B. F. Sturtevant Co., of Boston, Mass., leave nothing to be desired in this respect. "The Sturtevant Forges" is the title of a pamphlet which is all that the printer's art can make it, while "Ventilation and Heating" is a very handsome volume in brown cloth and gilt. The illustrations are numerous, and the principles of ventilation are exhaustively explained.

The Report of the Board of State Engineers for Louisiana, U.S., reaches us with the compliments of the board. The works constructed to retain the Mississippi River within its banks are enormous, and the numerous pages of statistics and diagrams in the report give a good idea of the importance of these works.

It would appear that the accident in Victoria on the 26th May, in which nearly seventy people lost their lives by a trolley car breaking through a bridge, was due to the negligence of the city authorities, as the bridge had been condemned. It will be remembered that a short time ago the Victoria city fathers dismissed the engineer because they thought they knew more about his work than he did. Damages of a million dollars would not be out of the way in this case, if hanging is out of the question.

MINERAL PRODUCTION OF THE UNITED STATES IN 1894-95.

COMPILED FOR "THE MINERAL INDUSTRY," BY RICHARD P. ROTHWELL, EDITOR OF THE "ENGINEERING AND MINING JOURNAL."

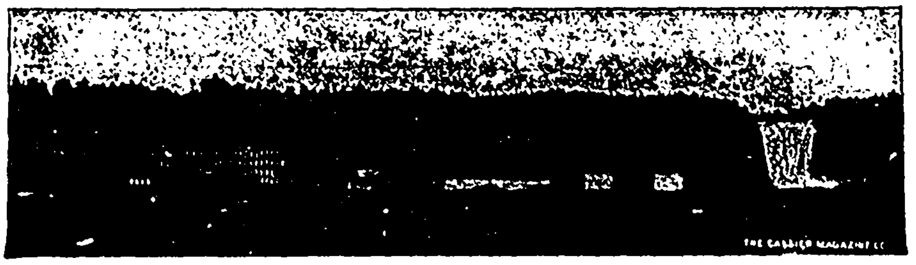
No.	Products.		1894. Quantity.	1894. Value at Place of Production.	1895. Quantity.	1895. Value at Place of Production.
	NON-METALLIC					
	Abrasives -					
1	Corundum and emery	Short tons	1,120	$ 109,500	385	$ 56,400
2	Garnet	Short tons	1,000	35,000	2,065	93,350
3	Grindstones	Short tons	29,989	257,596	36,389	290,378
4	Millstones	Short tons	297	4,447	105	8,525
5	Tripoli and infus. earth	Short tons	1,663	22,825	1,788	26,049
6	Whetstones	Short tons	1,735	84,450	1,609	78,303
7	Alum	Short tons	72,000	2,160,000	75,000	2,225,000
8	Antimony ore	Short tons	165	9,075	1,083	37,905
	Asbestos and talc –					
9	Asbestos	Short tons	325	4,350	1,010	11,400
10	Fibrous talc	Short tons	50,500	505,000	66,500	665,000
11	Talc and soapstone	Short tons	21,044	401,892	18,885	361,353
12	Asphalt	Short tons	4,198	75,654	14,300	300,000
13	Bituminous rock	Short tons	34,199	148,120	43,778	143,456
14	Barytes	Short tons	23,758	95,032	20,255	99,020
15	Bauxite	Long tons	10,732	42,928	14,145	56,580
16	Borax	Pounds	13,140,584	919,841	13,506,356	742,850
17	Bromine	Pounds	379,444	98,655	394,854	102,662
18	Cement, natural hydraulic	Bbls., 300 lbs.	7,813,766	4 455,928	7,694,053	4,597,285
19	Cement, Portland	Bbls., 400 lbs.	611,229	1,209,446	749,059	1,430,089
20	Clay, refractory	Short tons	3,375,738	4,050 885	b3,750,000	4,500,000
21	Clay, kaolin	Short tons	24,552	185,169	30,910	258,431
22	Coal, anthracite	Short tons	a52,010,433	80,879,404	a58,362,985	89,948,699
23	Coal, bituminous	Short tons	a117,865,348	103,758,967	a138,079,466	125,489,488
24	Coke	Short tons	8,495,295	12,654,558	9,927,348	15,258,935
25	Cobalt, oxide	Pounds	6,550	8,843	6,400	8,640
26	Copperas	Short tons	14,897	104,100	14,118	69,846
27	Copper sulphate	Pounds	b60,000,000	2,016,000	45,000,000	1,350,000
28	Chrome ore	Long tons	2,653	35,125	....	....
29	Feldspar	Long tons	18,704	83,465	22,195	104,082
30	Fluorspar	Short tons	6,400	58,304	4,000	36,440
31	Graphite	Pounds	770,846	34,689	392,008	17,640
32	Graphite, amorphous	Short tons	165	1,252	1,100	4,700
33	Gypsum	Short tons	301,536	910,831	298,572	974,219
34	Iron ore	Long tons	11,880,000	20,790,000	16,950,000	29,662,500
35	Lime	Bbls, 200 lbs.	b56,750,000	28,375,000	b60,000,000	30,000,000
36	Magnesite	Short tons	1,370	7,864	2,200	14,700
37	Manganese ore	Long tons	11,735	74,890	14,883	92,044
38	Mica, ground	Pounds	829 500	35,957	750,000	31,956
39	Mica sheet	Pounds	9,900	11,103	6,200	6,400
40	Mineral wool	Pounds	5,776	58,936	6,742	69 481
41	Monazite	Pounds	750,000	45,000	1,900,000	114,000
42	Natural gas	....	....	13,000,000	....	12,000,000
43	Paints, mineral	Short tons	47,593	1,011,182	47,084	1,086,767
44	Paints, vermilion	Short tons	91	111,209	118	118,190
45	Paints, white lead	Short tons	87,242	8,445,174	92,000	8,740,000
46	Paints, zinc oxide	Short tons	22,814	1,711,275	22,690	1,588,300
47	Petroleum (crude)	Bbls., 42 gals.	48,527,336	40,762,962	50,652,025	42,547,701
48	Phosphate rock	Long tons	952,155	2,856 465	831,498	2 577,643
49	Marls	Long tons	225,000	607,500	217,700	587,790
50	Precious stones	....	....	150,000	....	150,000
51	Pyrites	Long tons	107,462	466,466	81,000	353,560
52	Salt, evaporated	Bbls., 280 lbs.	11,798,659	5,586,326	12,521 498	5,844,348
53	Salt, rock	Bbls., 280 lbs.	2,341,922	784,063	1,367,638	518,740
54	Silica, sand and quartz	Long tons	477,670	418,612	523,640	553,128
55	Slate, roofing	Squares	611,776	2,007,321	645,361	2,062,239
56	Slate, other manufactures	Square feet	4,395,125	399,758	3,786,599	369,062
57	Stone, limestone (flux)	Long tons	3 544,393	2,126,636	3,390,000	2,542,500
58	Stone, marble	Cubic feet	6,331,279	3,576,853	6,942,533	4,086,261
59	Stone, onyx	Cubic feet	1,450	29,000	800	10,750
60	Sulphur	Long tons	441	7,056	12,000	192,000
61	Other building stones	....	....	b30,000,000	....	33 000,000
	Total non-metals	....	....	378,877,939	....	428,266,385
	METALS.					
62	Aluminum	Pounds	817,600	490,560	900,000	495,000
63	Antimony	Short tons	220	39,200	433	68,847
64	Copper	Pounds	353,504 314	33,540,489	386,453,850	36,944,988
65	Gold	Troy ounces	1,923,619	39,761,205	2,265,612	46,830,200
66	Iron, pig	Long tons	6,657,388	71,966,364	9,446,308	108,632 542
67	Lead, value at New York	Short tons	160,867	10 585,048	156,854	10,132,768
68	Quicksilver	Flasks, 76½ lbs.	30,440	1,095,840	33,978	1,313,589
69	Silver, commercial value	Troy ounces	49,846,875	31 403,531	46,331,235	30,254,296
70	Zinc spelter	Short tons	74,004	5,209,882	81,858	5,942,890
	Totals metals	....	....	194,092,119	....	240,615,120
	Est. products unspecified	....	....	5,500,000	....	5,000,000
	Grand total	....	....	578,470,058	....	673,881,505

(a) Bituminous coal includes brown coal and lignite. The anthracite production is the total for Pennsylvania, Arkansas and Colorado. (b) Estimated.

In sending in the foregoing valuable statistics, Mr. Rothwell says: "The mineral and metal production of the United States in 1895, here recorded, was the largest in the history of this or any other country, and is an exhibit worthy the attention of economists and law makers. The economic details published in the 'Mineral Industry' volume show that the United States is rapidly attaining the point where it will be the greatest exporter of minerals and metals of all the commercial nations."

MONTMORENCY FALLS ELECTRIC PLANT.

Next to Niagara Falls, the Falls of Montmorency, eight miles below the famous city of Quebec, are the most historic as well as the most picturesque in America, and at both places the wonderful water powers are being used to solve most interesting practical problems in electricity. In *Cassier's Magazine* for May, C. C. Chesney gives an instructive account of the electrical plant at Montmorency Falls, which has been referred to briefly in past issues of The Canadian Engineer. At Montmorency, the water makes a perpendicular plunge of 275 feet over the face of the rock, or over 100 more of a fall than at Niagara.



DISTANT VIEW OF MONTMORENCY FALLS.

The transmission and distribution of electrical power here is by alternating currents. In 1889 the Montmorency Electric Power Company established, in connection with a small arc plant then in existence for lighting the City of Quebec, a small incandescent plant of 100-horse power capacity, using 2,000-volt alternating machines. There was a loss of 50 per cent. in transmission, and was continued till 1894, when a change of management brought to the service of the company the experience and ability of Frank Badger, jr., as general manager, and Louis Burran, as electrician, to whom the final success of the plant is largely due. They decided to increase the capacity of the old dam to a minimum of about 12,000-horse power, and a short tunnel was run through the rock connecting the dam with the wooden flume which runs along the face of the bluff 1,500 feet to the gate house on the brow of the hill. From the gate house, a steel riveted tube of 72 inches diameter, and 1,100 feet long, is carried down a steep incline to the power-house, where the pipe line terminates in a steel receiver which supplies the water to the turbines. Of these wheels Mr. Chesney says. "Owing to the extremely high head and the great velocity at which the wheels must necessarily run, they were required to be very simple, stronger and more compact than is the general rule. The wheels adopted are the 'Little Giant' turbines, manufactured by J. C. Wilson & Co., of Picton, Ontario. The noticeable feature of these wheels, besides their simplicity, is the almost entire absence of lateral or end thrust, so frequently found in the ordinary types. They have two sets of buckets, keyed on the same shaft, and the buckets are so formed that whatever end thrust there may be from the one set is counteracted by that of the other. The particular size installed at the Montmorency Falls has a capacity of 700 horse-power and runs at a speed of 600 revolutions per minute. The 'Little Giant' turbine is comparatively little known outside the Dominion of Canada, but some idea of its simple and compact nature can be gained from the fact that this 700 horse-power wheel is only 21 inches in diameter and has an extreme length not exceeding two feet."

We may here leave Mr. Chesney's article to add a few words regarding the "Little Giant" wheel, of which we give three illustrations on the next page. The makers of these wheels have twenty of them installed at Montmorency Falls. Most of these, we may state, are horizontal wheels, eight of them being capable of developing a combined power of over 3,700 horse-power.

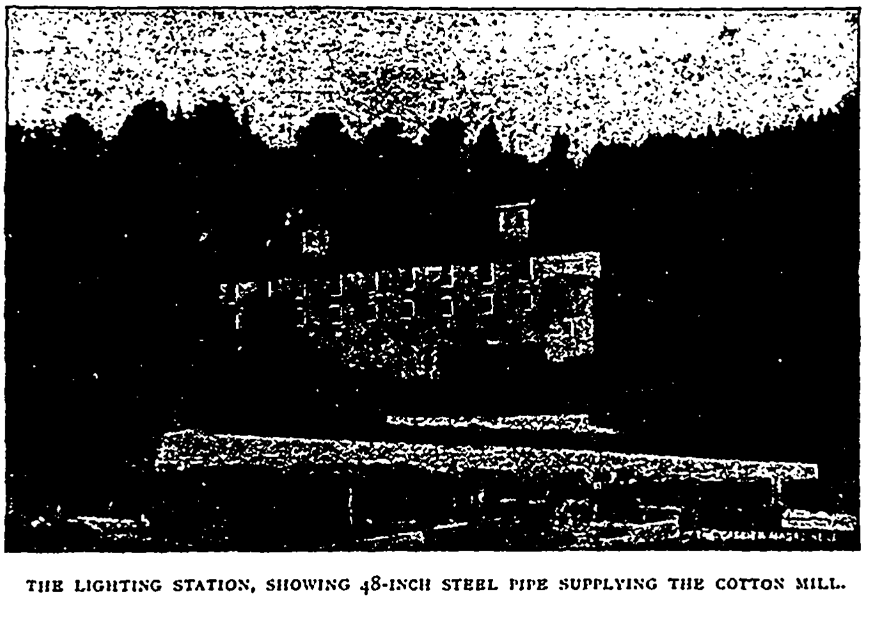
Cut No. 1 shows the wheel mounted on horizontal shaft and complete, ready to attach supply spout and draft tube. This is the standard type of case used for J. C. Wilson & Co.'s horizontal wheel. Of course, the style of housing very frequently is altered to suit the requirements and the conditions under which the wheel is expected to run.

MONTMORENCY FALLS, SHOWING GATE HOUSES NOS. 1 AND 2.

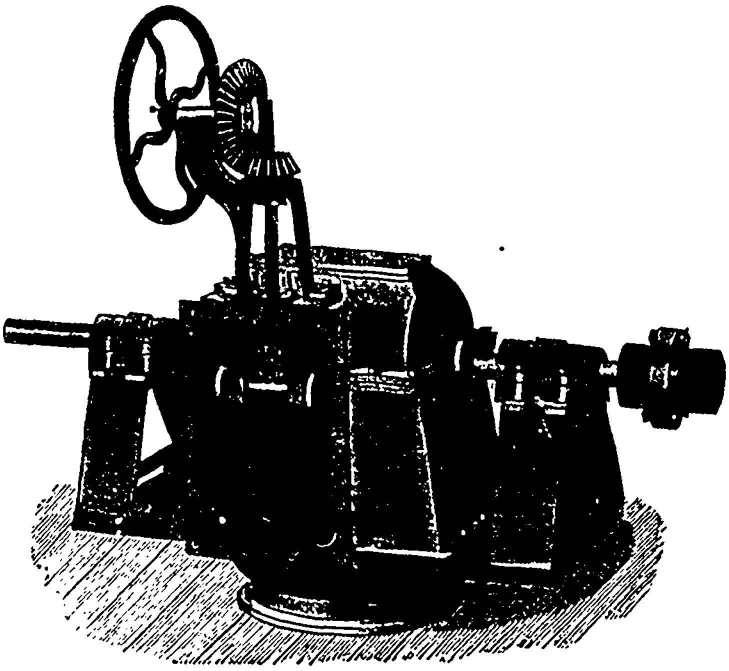
Cut No. 2 shows the case cap removed, thus showing wheel buckets exposed for inspection. This can be done in a few minutes time by simply removing the flange bolts, and in taking off cover it does not disturb the stuffing boxes or bearings, and should any foreign substance get into the buckets it can be easily removed.

Cut No. 3 shows one of the "Little Giant" wheels set with belts attached which drive a small electric plant. In the past year we have sold a number of horizontal turbines for driving electric plants, pulp mills, flour and saw mills. The largest of these was a thirty-three inch diameter wheel, which works under a head of 28 feet, developing over 200 horse-power.

The generating station at Montmorency is a two-story building standing on the hillside above the Quebec, Montmorency and Charlevoix Railway. The first floor is devoted to the turbines and

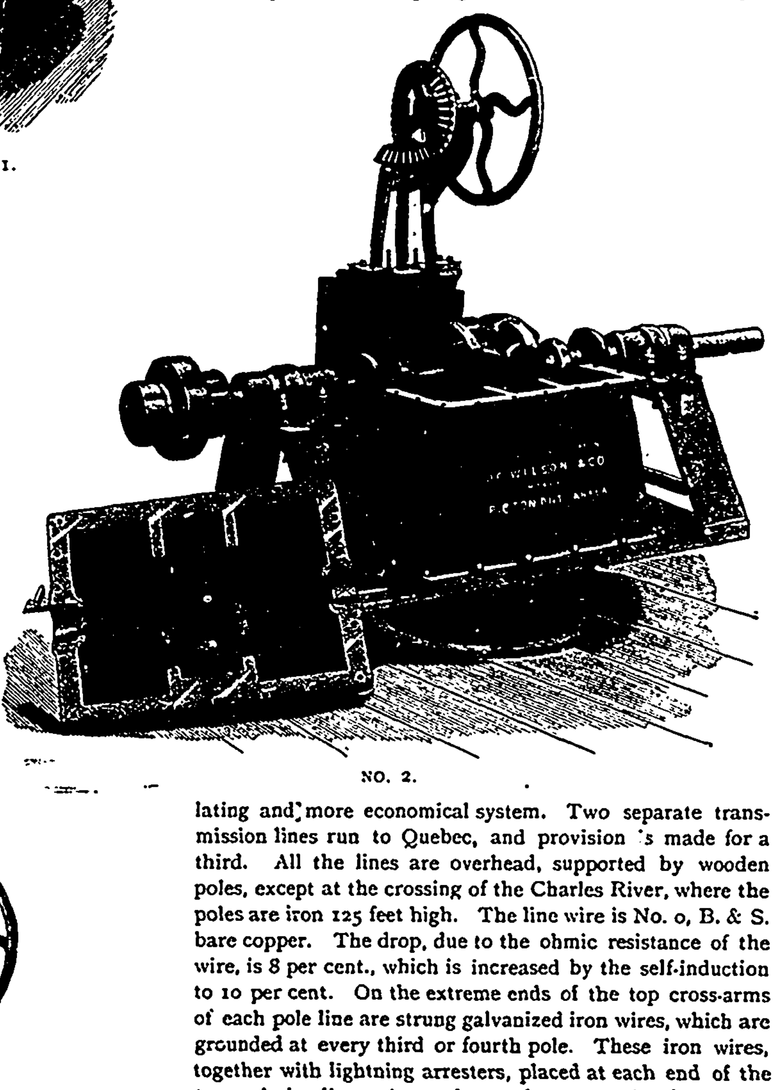


THE LIGHTING STATION, SHOWING 48-INCH STEEL PIPE SUPPLYING THE COTTON MILL.



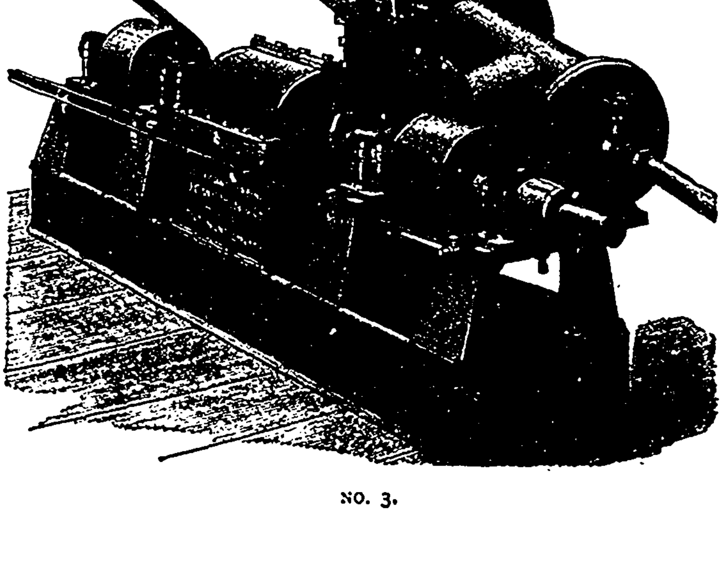
"LITTLE GIANT" WATER WHEEL, NO. 1.

the gate mechanism. Along one side of the room the numerous wheels are arranged in a row from which belts are driven, at an angle of 45 degrees, to the dynamos on the floor above. The water is taken from the receiver in this room, and is discharged partly into the tail race emptying into the St Lawrence, and partly into the 48-inch steel pipe which supplies water to the wheels in a neighboring cotton mill. The dynamos occupy the second floor, and the room is very skilfully planned. While the single phase system is simple and reliable, it lacks range and flexibility; it lacks a motor which fills the commercial requirements of power distribution, and it lacks means of convertibility into direct currents for railway and other work. The multiphase systems developed within the last few years supply the required flexibility, while the induction motor supplies the missing elem·:t for commercial power, extending its uses beyond what has been realized by the direct current motor; and when the two or three-phase rotary transformers are brought in, we have an almost ideal system for long transmission as well as central station work. The particular system here adopted is the S. K. C. (the Stanley-Kelly-Chesney), as applied by the Stanley Electric Co., of Pittsfield, Mass., whose machines are manufactured in Canada exclusively by the Royal Electric Co., Montreal and Toronto. The generators are in the north side of the dynamo-room, and the bed plates of the machines are fixed by lag-screws set into the timbers which form the insulating cap, and which were boiled in paraffine to remove all moisture. Each generator delivers alternating currents, differing in phase by 90 degrees, to two independent circuits at an electromotive force of 5,200 to 5,700 volts, which force can be varied within these limits by rheostats placed in the fields of the generators. The frequency is 66 periods per second—that is, the current is reversed about 8,000 times a minute. This frequency was selected in preference to 133 periods per second (16,000 alternations); for, while the loss in the core of the transformers was increased from 20 to 30 per cent., and the regulation of the generators from a total of 2 per cent. to a total of 3 per cent., the self-inductive drop in the transmission line was such an important factor that the lower frequency was considered preferable, as giving, on the whole, a better regulating and more economical system. Two separate transmission lines run to Quebec, and provision 's made for a third. All the lines are overhead, supported by wooden poles, except at the crossing of the Charles River, where the poles are iron 125 feet high. The line wire is No. 0, B. & S. bare copper. The drop, due to the ohmic resistance of the wire, is 8 per cent., which is increased by the self-induction to 10 per cent. On the extreme ends of the top cross-arms of each pole line are strung galvanized iron wires, which are grounded at every third or fourth pole. These iron wires, together with lightning arresters, placed at each end of the transmission lines, give such complete protection from lightning storms, that a discharge in either the generating station or sub-station is practically unknown.



NO. 2.

The lines enter the city in St. Rochs, in the centre of which industrial district is the sub-station. This building contains the company's offices, and the transformer house is part of the structure. The switchboard which here receives the transmission lines contain special high-voltage switches, mounted on marble and fitted with self-enclosing boxes designed to cut off any possible arc that may be formed on opening the 5,000-volt circuits. From the transmission lines, the current is carried to the step-down transformers, where it is transformed into the distributing electro-motive force of 2,000 volts. These are indoor Stanley transformers, arranged on a rack in two tiers, five wide and two deep, and placed so as to admit of free ventilation. They are 50 k. w. and connected in pairs. Each is wound for a primary force of 2,500 volts, and a secondary one of 1,000 volts. The primaries of each pair are connected in series for receiving 5,000 volts, and the secondaries in series for delivering 2,000



NO. 3.

MAIN STEEL PIPE WITH GATE HOUSE IN THE DISTANCE.

volts to the distributing system. This lessens the voltage on any particular coil, and in case of a burn out the other will carry the load for a time. The regulation from no load to full load is about 1 per cent. and the average efficiencies of the entire transformer equipment is 97.8 per cent. under full load, 97.9 under half load, and 97 under quarter load. The transformers are divided into two sets of eight transformers each, with a relay of two which can be cut in or out without stopping the service. The current from the secondaries is carried to the bus bars of the distributing switchboard, whence it is furnished to the city for lighting and power.

The generators are the S. K. C. inductor type of two-phase machines, running at 286 revolutions per minute. Each generator has a capacity, at 5,700 effective volts, of 100 amperes. They are the largest inductor machines ever built, and it is claimed they are the first practical machines ever constructed for such a high initial electromotive-force. The armature is stationary, consisting of two sets of laminated iron rings, connected by steel rods four inches in diameter On the inner surface of each laminated armature ring are fifty-six grooves for receiving the armature coils. The weight of this portion of the machine is 42,580 pounds. The field or exciting coil is circular, 94 inches in diameter, and wound on two copper bobbins, each 4½ inches wide, with a copper strip four inches wide and .026 inch thick. It is insulated between the layers with a special oilcloth which is practically indestructible at temperatures under 150° C. Every turn of the winding being practically in contact with the moving air, there is no possibility of overheating in any portion of the coil. The copper bobbin, absorbing all discharges, prevents any excessive rise of electromotive-force on the coil, which might be caused by opening the field circuit under full charge There are, in all, 56 armature coils, 28 for each phase The coils are small and were wound in a lathe. Each coil was tested with 15,000 volts, and the insulation of the completed armature with 12,000 volts. The inductor, the only moving part of the machine, is a steel casting 43 inches long and 84 inches in diameter, on the periphery of which are two sets of polar projections of iron laminæ, 14 at each end. Weight of inductor, including shaft, 28,470 pounds; weight of completed machine, 100,000 pounds.

In order to obtain an electromotive-force following the sine law, the pole faces of the generators made by the Stanley Company are so shaped that their curvature may be described by a formula, which is contained in the U. S. patents issued to the company. A novel feature in these generators is that the entire distributing system is arranged to run in parallel, and to do this the generators must be kept in phase. A defect in any wire, such as a ground or leak, affects all the wires of every line, so that if a second ground occurs the generators between the two grounded points are all short circuited. But to get over this difficulty, the mains from the different machines are kept separate, and the secondaries of the step-down transformers are connected in parallel with the supply mains. The generators are kept in phase by a distinct synchronizing winding. By these means the load can be shifted from one generator to the other by varying the quantity of water on the turbines.

ALONG THE PIPE LINE.

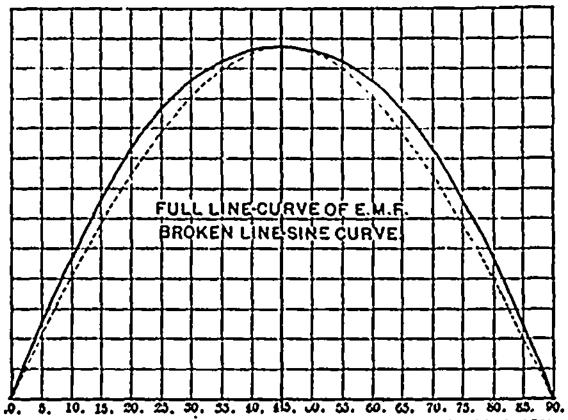
The exciters are two slow-speed direct-current machines of 12 k. w capacity, each sufficient to excite the fields of the three alternators. The shop tests of these dynamos showed the following efficiencies: Full load, 95.1 per cent.; half load, 92.3 per cent.; quarter load, 87 per cent. Rise of temperature after 24 hours run with full load: field coil, 12° C.; armature iron, 20° C.; inductor iron, 7° C.; armature coils, 26° C.; bearings, 21° C. Regulation from no load to full load, 3½ per cent.

The switchboards shown in the engravings need no special comment.

As to the commercial efficiency obtained in this plant, it is interesting to note that, with the generator working at full load, for every 100 k. w. of energy delivered

THE DYNAMO ROOM.

ANOTHER VIEW OF DYNAMO ROOM SHOWING 600 K. W. "S. K. C." GENERATORS.



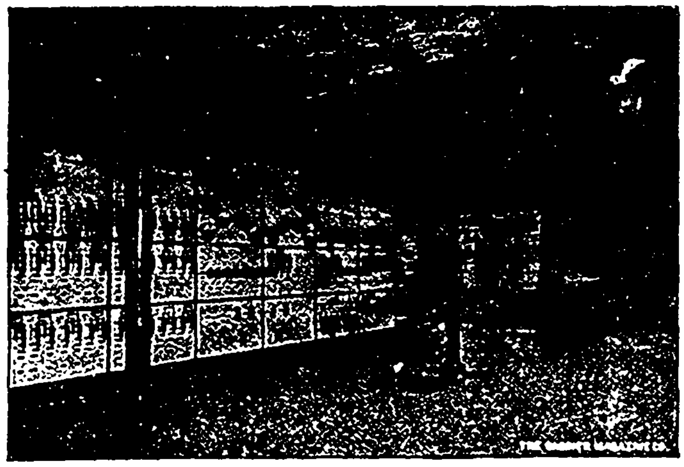
E. M. F. CURVE OF GENERATORS AT MONTMORENCY.

to the pulley of the generator, 95.1 k. w. are delivered to the line at the generating station; 87½ k. w are delivered to the terminal of the step-down transformers, and 86 k w. are delivered to the distributing mains of the sub-station.

All the motors now in use by the Montmorency Electric Power Company are the S. K. C. induction motors. These motors were described by Dr Bell in the January number of *Cassier's Magazine*. They vary in size from one horse-power to 30 horse power, and do all kinds of work, running the tools of carpenter and machine shops, driving the saws and wood-planers of planing mills and handling the freight elevators in various mills and in wholesale warehouses with perfect satisfaction. It is now well understood that the magnetizing current of an induction motor lags behind the applied electromotive-force, and that a lagging current in practice involves considerable loss and expense, by necessitating the use of larger conductors and generating apparatus, while it seriously interferes with the proper regulation of the generators and increases the normal drop of the line.

In the S. K. C. motor the magnetizing current is furnished by condensers; the motor then takes current in proportion to the load. Two condensers are connected in multiple with the fields of the motor, and each has a capacity in amperes at the working voltage practically equal to the no-load current of each field of the motor If there is no distortion of the current wave, the apparent energy taken by an induction motor with condensers is equal to the real energy.

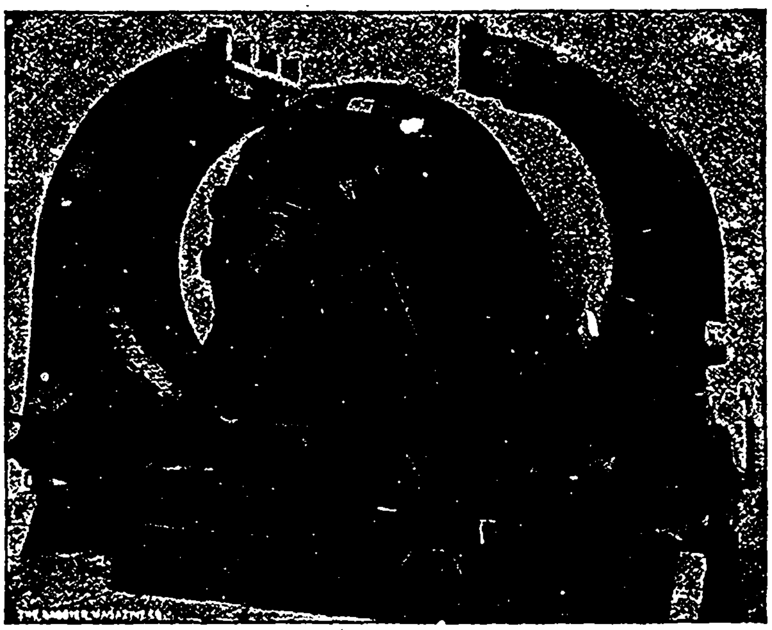
An interesting example of the value of condensers on induction motors is shown in a small plant in New England



THE DISTRIBUTING SWITCHBOARD.

The generator was a 60-ampere two-phase machine, manufactured by a large electrical company, and was furnishing power to a number of small induction motors. The motors were doing all kinds of general factory work and running ten hours a day. The average load on the motors was about one-quarter of their maximum. The amount of current furnished by the generator to the motors was 52 amperes at 1,152 volts. The power factor was 0.505.

When the motors were supplied with condensers, the current was reduced to 28 amperes at 1,150 volts, and the power factor was increased to 0.863. The reason that the power factor was not increased to unity was the existence of harmonics in the curve of the electromotive-force of the particular machine in use.



A 600 K. W. "S. K. C." TWO-PHASE GENERATOR DRAWN APART.

ELECTRIC RAILWAY GRADES.

Editor CANADIAN ENGINEER.

SIR,—Could you inform me, at your earliest convenience, if any comparative statement has ever been published in Canada or in the States giving the various steep grades run up by electric railways? In Montreal, our electric railway goes up hills where the grade varies from five to seven feet in a hundred, and the object of my enquiry is to ascertain if, in the States, electric railways do run up steeper grades than ours.

Yours truly, JOSEPH PERRAULT, Architect.

Montreal, May 15th, 1896.

The grades of the Montreal Street Railway are steeper than those of any electric railway in America or Europe, or, so far as we know, any in the world. It is only where the cable system is adopted that steeper grades exist in the United States, such as at Minneapolis and St. Paul. San Francisco uses the cable for its steeper grades, and Providence uses the "balance" system. Edinburgh, Scotland, recently decided to adopt the cable rather than electricity for its cars, because the grades were too steep; yet the lines there will run over no grades so steep as those of Montreal. The difficulty is not to mount, but to descend in safety. The grades in Montreal on Windsor st. Hill, St. Lambert's Hill and Amherst st., are 10 in 100, and on St. Denis st. for the space of 100 ft. it is 11½ in 100. ED.

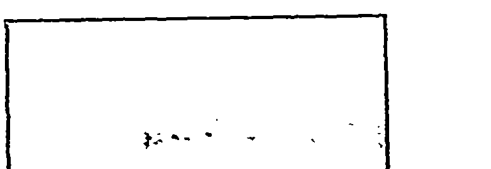
THE BROTHERHOOD OF LOCOMOTIVE ENGINEERS.

The Brotherhood of Locomotive Engineers, which assembled in convention in Ottawa, Ont., on May 14th, is a most perfect example of what can be done by organized labor. The brotherhood stands alone in the perfection of its organization, its wide spreading influence, and its strong financial position. Much of this superiority is due to the high average intelligence of the members, the fact that the labor they supply is skilled labor of a superior class, and that none but men of good moral character are able to retain their membership. During its prosperous career, this society has spent an exceedingly small proportion of its income in promoting strikes. The policy of the organization has been intensely conservative, and its enormous influence is always thrown into the balance in favor of the peaceful solution of industrial complications.

At the formal opening of the convention on May 14th, the chairman of the committee on arrangements, W. B. Prenter, read an address of welcome to the visiting delegates. Mayor Borthwick, Hon. E. H. Bronson, and Rev. W. T. Herridge, made speeches. One of the most noted men present at the opening meeting was the Hon. L. S. Coffin, of Fort Dodge, Iowa, who first organized the Railroad Temperance Association. Mr. Coffin is now at the head of the Home for Aged and Disabled Railroad Employees at Highland Park, Ill. In addition to caring for the aged members of the order, all disabled members who are young enough to profit by it are given a business education at the expense of the institution and are thus rendered self-supporting. This splendid home is maintained by the voluntary contributions of the Brotherhood of Locomotive Engineers, Order of Railroad Conductors, Brotherhood of Locomotive Firemen, and Brotherhood of Railroad Trainmen.

In connection with the Brotherhood of Locomotive Engineers is the Grand International Auxiliary, an organization of women interested in the work of the Brotherhood. At the formal opening of the Auxiliary on May 15th, Mrs. W. B. Prenter read an address of welcome on behalf of the Canadian Lodge. Mrs. Murdock, Grand President, made a splendid speech on auxiliary work. Grand Chief Arthur, Sir James Grant, and others, gave short addresses.

One of the pleasantest features of the Ottawa meeting was the garden party given for the Brotherhood by the Governor-General, Lord Aberdeen, and Lady Aberdeen. The guests were taken to Rideau Hall in special cars, and were presented to Lord and Lady Aberdeen by W. B. Prenter, of the Ottawa Lodge.



GRAND CHIEF ARTHUR, OF THE B.L.E.

A system of insurance is carried on in connection with the Brotherhood. The officers which have been elected for the ensuing term are W. E. Futch, of Brunswick, Ga., president, defeating the late president, A. B. Youngson, and eight other candidates. W. B. Prenter, of Ottawa, secretary, in place of H. Hays. The position of secretary is worth $3,000 a year. Mr. Prenter's acceptance of the position of secretary will necessitate his leaving Canada and residing in Cleveland, Ohio, where the headquarters of the association are.

The Brotherhood has an official organ, the *Brotherhood Journal*, whose editor, C. H. Salmons, is an old railroad man and veteran of the civil war.

Grand Chief Arthur, of the headquarters office, Cleveland, is an elderly man of unassuming manner and most pleasing disposition. He was born in Greenock, Scotland, and came to America when ten years of age. He entered railway work on the New York Central in 1852 as fireman. After 25 months he was promoted to be engineer, and remained in the service of that line until elected to his present position in 1874. Since then he has devoted all his energies to the work and interests of the Brotherhood of Engineers. Before being elected Grand Chief he was for five years Second Grand Assistant Engineer and also Chief of Division 46, Albany, New York. His work has been of great value to Canadian engineers. At the time of the great strike on the G.T.R., in 1877, he visited Ottawa and consulted Hon. Edward Blake, then Minister of Justice, with a view to have amendments made to the Master and Servants' Act, which was, the brotherhood complained, severe on employees and not equally so on railway companies. He was well received, and shortly after his visit legislation was modified to meet the wants of the men. Since that time the same law is in force, and no trouble on the G.T.R. has been experienced.

PECULIAR BEHAVIOUR OF CHARCOAL IN BLAST-FURNACES.

An interesting article on the "Peculiar Behaviour of Charcoal in the Blast-Furnaces at Radnor Forges, Quebec," has recently appeared by J. T. Donald, which has been quoted in the *Iron and Steel Trades Journal*. In October last the Canada Iron Furnace Company sent Mr. Donald a sample of what they termed partly consumed charcoal, containing a large percentage of siliceous matter, and which they stated "had been thrown out at the cinder notch of the furnace in large quantities unconsumed, and showing fibres or threads of a yellow color and similar to mineral wool." It was further stated that "the coal which was made from oak, and apparently basswood and elm, seems unfit for use in furnace work." A very superficial examination was sufficient to show that this charcoal was very peculiar indeed. Its unusual weight at once challenged attention, and a closer inspection showed in the specimen a framework in the form of a fibrous mass not unlike a piece of harsh fibred asbestos. Analysis showed that this fibrous matter amounted to no less than 41·16 per cent. of the coal. The question now was to account for this large percentage of mineral matter. The only explanation Mr. Donald could offer was to suggest that it might be the result of charring wood that had been partially fossilized, for it is well known that such silicified wood is not uncommon. At the same time this suggestion was not altogether satisfactory. It did not cover the fibrous or rod-like structure of the mineral matter. Mr. Donald therefore decided to send portions of the sample to Professor Penhallow, of McGill College, and W. Ferrier, of the Canadian Geological Survey. These gentlemen are authorities in their own departments, the former as a botanist, and the latter as a mineralogist and lithologist. Professor Penhallow, having examined the specimens, reported that "it seems difficult to think that these rods are the result of natural processes of growth." Mr Ferrier said he thought the siliceous matter had not been present in the original charcoal, but that it was slag that the coal had absorbed in the furnace. Then, next, word came from the furnace at Radnor that similar fibrous charcoal had again been ejected from the slag notch, and this while charcoal from a totally different locality was being used in the furnace. The evidence was thus strongly against the view that the siliceous matter was part of the original coal, and in favor of Mr. Ferrier's suggestion. The question was thus again, as it were, thrown back into the sphere of chemistry, and it appeared probable that an analysis of the fibrous matter would settle it. After much care and labor a quantity of fibre, sufficient for analysis and free from the ash naturally present in the charcoal, was obtained. The difficulty in securing a satisfactory sample lay in the fact that the alkali of the true ash caused the fibres to fuse, forming little glassy globules. It was desirable to avoid these, in order that the analysis might show the composition of the fibre itself. The analysis of the fibre is stated in column 2. Column 1 is the partial analysis of a sample of Radnor slag made in January, 1891:

	1 Per cent.	2 Per cent.
Alumina	13.52	18.15
Ferrous oxide	1.44	.51
Manganous oxide	3.48	Traces.
Lime	22.89	35.44
Magnesia	.74	1.47
Sulphuric anhydride	1.52	Traces.
Silica	54.00	42.18
Alkalies, phosphoric anhydride, etc., by diff.	2.41	2.25

It is thus very evident that the fibrous matter of this charcoal is simply absorbed slag. Two questions of interest then arise. They are, first, what were the conditions in the furnace that caused charcoal in large quantities to absorb and retain the liquid slag? and, second, how does it happen that only on two occasions has the production of this slag-saturated coal been observed? The following particulars regarding the furnace are data that must be taken into consideration in any theory put forth to explain the very peculiar behavior of the charcoal under consideration: Four 3½ tuyeres are used. The average pressure of blast is about 5¾ lbs.; the average temperature of blast, 900 deg. F. The quantity of air, as a rule, is 2,638 cubic feet, but at times it has run to as high as 2,287 cubic feet to the minute; cubical contents of furnace from stack-line down is 1,264 cubic feet.

Industrial Notes.

A NEW grist mill is being built at Comber, Ont.

NEW machinery will be placed in the flour mills at Warsaw, Ont.

THE suspension bridge, St. John, N.B., is being repaired and part of the structure renewed.

ROBT. WHITELAW, of Woodstock, Ont., is building a 75-bbl. flour mill at Comber, Ont.

SANDFORD'S flour mill, Fenelon Falls, Ont., is to have new machinery added at once.

R. GRAHAM, foundry, Ottawa, Ont., meets his creditors with an apparent surplus of $11,000.

ST. JOHN, N.B., is examining into the merits of rival fire engines, with a view to purchasing.

F. A. CLARKE, of Berwick, N.S., is building the engine-house for the Coast Railway at Annapolis, N.S.

THE Westville, N.S., Foundry Co. will put in some new machinery and build a warehouse at once.

THE Ottawa *Journal* says that the Ottawa Saw Works (J. Bingham and P. M. Feeny) are to be enlarged.

THE Niagara Central Railway has begun putting in the siding for the acetylene gas works at Merritton, Ont.

THE Hamilton Iron and Steel Co. has been compelled to cease smelting for a time, to make repairs to the plant.

C. B. CHAPPELL, architect, Charlottetown, P.E.I., is in charge of the erection of the new hospital at Glace Bay, C.B.

A NEW saw-mill is to be built at once by Messrs. Bostwick on the site of the one recently burned at Big Salmon River.

JACKSON, COCHRANE & Co., of Berlin, Ont., have bought the wood-working plant of the Smythe Co., of Strathroy, Ont.

W. H. LAMBLY, secretary-treasurer of Inverness, Que., invites tenders for two new steel bridges to be erected in that municipality.

GANANOQUE Wheel Works Co. was offered $40,000 bonus to remove, but the shareholders have decided to remain in Gananoque, Ont.

A PERMIT has been issued to the Hamilton and Toronto Sewer Pipe Co. for rebuilding a kiln at its works on Jackson street, Hamilton, Ont.

THE Dominion Cold Storage Co. has secured a lease of the old drill shed and grounds in Toronto, and will establish an extensive plant at an expense of $150,000.

THE town of Perth, Ont., has not got its waterworks yet: the company now wishes to substitute increased pumping power for a stand-pipe and smaller mains on the side streets.

SMITH'S FALLS, ONT., had a strike recently in the Malleable Iron Works on account of a reduction of wages. The matter was amicably settled, and the men resumed work.

THE by-law to grant a $5,000 bonus to an Ottawa man to establish a grist mill in Kemptville, Ont., was voted on in the latter place a short time ago, and was carried by a majority of ninety.

EXTENSIVE additions to the apparatus of the Winnipegosis salt works are being made by Paul Woods, the proprietor, who intends developing the industry as fast as possible.—*Dauphin Pioneer Press.*

JOHN CROWE, of Montreal, has placed his order with the Babcock and Wilcox Company, Board of Trade Building, Montreal, for one pair of their 250-horse power improved all wrought steel high pressure water tube boilers.

THE Central Bridge and Engineering Co., Ltd., Peterboro', Ont., has been awarded the contract for the York street bridge, Toronto, and has other contracts on hand which will keep the works rushed for the next six months.

E. BEAULIEU, Pembroke, Ont., is building a grist mill. Work begins this month.

THE Ontario Rolling Mill, of Hamilton, Ont., is to put in a steel plant to employ 150 men.

THE machinery of the cotton factory at Dundas, Ont., is being broken up and sold for scrap iron.

THE Central Ontario Ry. is running a siding into the yards at Weddell's Foundry, at Trenton, Ont.

THE town of Renfrew, Ont., together with the adjoining municipalities, proposes to build a hospital.

NORTH BAY, ONT., is to have a sash and door factory; Mr. Johnson, of Bracebridge, is to build it.

THE Brandon Machine Works Co. have the contract to build four boilers for the McRobie chemical engines.

THE Port Credit Pressed Brick Company, of Toronto, and Port Credit, Ont., has sold out to Mrs. H. M. Parker.

CURRIE & Co., Eel River, N.B., are running their new sawmill, which was equipped with a power plant by the Robb-Armstrong Co.

THE Portland Rolling Mills Co. (formerly J. Harris & Co.), St. John, N.B., are well engaged at present and 130 men are employed.

THE village of Westmeath, Ont., will give a bonus of $1,000 to Tucker & Hodges to rebuild their saw mill, recently destroyed by fire.

THE machinery and manufactured stock of the Safety Barb Wire Company has been sold to the Ontario Lead and Barb Wire Company, Toronto.

APPLICATION is made for a Dominion charter for a company to construct a foot passenger, vehicle and trolley bridge over the Niagara at Fort Erie, Ontario.

AN explosion of gas in the boiler rooms of the distillery at Walkerville, Ont., recently injured David Gross, and did severe damage to the boilers and building.

ASSINIBOIA, MAN., advertises that it will give a bonus of $5,000 to a 75-barrel flour mill at Headingly, on the Manitoba South-Western Railway and Assiniboia River. N.S.,

CONTRACTOR McMANUS, of Memramcook, N.B., who has the contract for building the Mill Creek bridge at Campbellton, N.B., expects to have the new bridge completed in July.

JOSEPH BORQUE, of Hull, Que., contractor for the Dominion Reformatory at Alexandria, Ont., has a large force of men at work in the quarries and is excavating for the foundation.

H. P. DAVIES, C. P. Miller, Toronto; C. Sparks, Ottawa; Emilie Davies, Toronto; H. Brumell, Toronto, apply for a Dominion charter as the American Tire Co. Capital, $25,000.

J. MCPHERSON, W. A. Gibson, and W. W. Stuart apply to the Governor-General-in-Council for leave to irrigate 22,000 acres of land on the Elbow River, township of Meridian, N.W.T.

THE smelting works at Tilt Cove, Newfoundland, were recently closed, owing to the boilers having got out of repair; engineers A. Bartlett and T. Davis put the plant in running order in six days.

H. HOGAN, J. Barsalou, A. Desjardins, J. G. Laviolette, M. Barsalou, Montreal, apply for a Dominion charter as the Dominion Glass Co. to manufacture glass and glassware in Montreal. Capital, $20,000.

ROBT. HUNTER, formerly employed by the C.P.R. at Almonte, Ont., has formed a partnership with John Carnochan to carry on the business of the Sparham Cement Roofing Co., in Ottawa, Hull and Aylmer.

H. S. HOLT, A. A. Thibaudeau, W. Strachan, A. Brunet, F. L. Beique, of Montreal, are applying for a Dominion charter as the Montreal Construction Co., Ltd., to build railways, bridges, etc. Capital, $500,000.

W. M. MILLER, of Newark; J. Hume, W. Craig, S. Paterson, and H. C. Paterson, of Port Hope, Ont., are applying for a Dominion charter as the Port Hope Preserving and Canning Co. Ltd. Capital, $20,000.

R. MACGREGOR, A. G. Gourlay, R. B. MacGregor, R. M. Hamilton, J. F. MacGregor, of Galt, apply for a Dominion charter as the MacGregor-Gourlay Co. (Ltd.), to manufacture wood-working and other machinery. Capital, $300,000.

R. C. ADAMS, St. C. MacDougall, A. Paterson, P. Lyall, C. Cushing, W. Strachan, J. P. Cleghorn, S. C. Stevenson, J. W. Withell, J. Withell, George Dawson, Montreal; J. C. Haynes, Boston, apply for a Dominion charter as the Midway Co., Ltd., of Montreal, to carry on a general mining, smelting, construction, manufacturing and transporting business. Capital, $60,000.

The iron bridge being erected in Victoria Park, Berlin, Ont., is a 90-foot cantilever bridge, and a miniature of that in St. John, N.B. The Central Bridge and Engineering Co. of Peterboro' have the contract.

The Masterman Sulphite Pulp Co., Ltd., of Montreal, applies for a Dominion charter to manufacture and deal in wood pulp. Provisional directors: W. Masterman, J. A. Bauden, A. S. Masterman, F. Masterman, W. H. Masterman, of Montreal. Capital, $300,000.

The North American Paper and Lumber Company, Ltd., of Halifax, N.S., is applying for a Nova Scotia charter to manufacture pulp, woodenware and lumber generally. Capital, $2,500,000; provisional directors, H. S. McKay, G. Schenck, E. L. Sanborn, J. M. Marshall, and R. R. McLeod.

The gas holders and other material for the experimental plant to be erected by Mr. Whitney and his associates at Halifax have arrived. It is expected that this plant will be in operation in July, and that shortly after construction can be commenced at Boston by the Massachusetts Pipe Line Co.—*Boston Globe.*

The Goubert Manufacturing Company, of New York, has just opened a western office at 1403 Monadnock Block, Chicago, Ill., which is in charge of E. Webster, well-known in engineering circles, and an expert in the matter of steam appliances, having been for many years with Stillwill & Bierce and the Smith-Vaile Co.

The Safety Barb Wire Co. (limited), headquarters, Toronto, was incorporated in 1894, with an authorized capital of $75,000. Of this sum $40,000 was subscribed and $30,000 paid thereon. All this money was invested in plant, etc. The principal stockholders are Americans, and having found the business unprofitable, they make an assignment to H. Vigeon.

H. Scott, R. Northcote, of Toronto; the Hon. A. W. Ogilvie, Montreal; J. A. Gemmill and A. F. May, Ottawa, apply for a Dominion charter as the Ætna Boiler Co. (Ltd.), of Toronto, to acquire the patents covering the Ætna boiler in Canada and the United States, and manufacture and sell the same. Capital, $20,000.

The Montreal Street Railway Company have placed their order with the Babcock & Wilcox Company, Board of Trade Building, Montreal, for three batteries of their improved all wrought steel high pressure water tube boilers. These boilers are intended to furnish steam for the new 4,000-horse power engine which they have ordered for their William street power house extension.

The Steam Boiler and Plate Glass Insurance Co. of Canada, head office in London, Ont., announces the transfer of its plate glass insurance business to Lloyds' Plate Glass Insurance Company, of New York. The steam boiler insurance branch of the company's business was some months ago transferred to the Boiler Inspection and Insurance Co., of Toronto.

Owing to the marked increase in business since the first of the year, the Penberthy Injector Co. has found it necessary to add a large number of monitor lathes and improved machinery to its equipment, and to put in a new engine to supply additional power required by the increase in plant. The stock department has been moved to another building in order to make room for the additional machinery.

Wm. T. Bonner, general Canadian agent for the Babcock & Wilcox water tube steam boilers, furnishes us the following information regarding the geographical distribution of their orders as given in their last month's sales report:—American sales, 3,374-h. p. in New York, 560-h. p. in Pennsylvania; 400-h. p. in Florida; 169-h. p. in California; 3,350-h. p. in Massachusetts; 250-h. p. in New Jersey, 200-h. p. in Rhode Island; 6,400-h. p. in Illinois, and 6,880-h. p. in Maryland, while the foreign sales were divided as follows:—1,322-h. p. in Russia; 74-h. p. in Norway; 1,353-h. p. in France; 3,453-h. p. in England; 140-h. p. in Belgium; 294-h. p. in Spain; 76-h. p. in Portugal; 126-h. p. in Scotland; 192-h. p. in Germany, 72-h. p. in Holland; 424-h. p. in South Africa; 332-h. p. in Sweden; 52-h. p in Italy, 280-h. p. in Brazil, and 228-h. p. in Madagascar. The foreign list foots up to 8,418-h. p., while the American list amounts to 21,583-h. p., or a total of 30,001-h. p. for the month, of which 7,000-h. p. are marine boilers. The above report does not indicate an exceptional month's business, but it simply represents the extent to which this very popular boiler is now being used. The total number of Babcock & Wilcox boilers now in use aggregates nearly 2,000,000-horse power.

At the regular meeting of the Kingston branch, Canadian Society of Stationary Engineers, held on May 20th, President S. Donnelly in the chair, plans and arrangements were begun for the annual convention of the order to be held in Kingston in August next.

Electric Flashes.

Iroquois, Ont, has decided by a vote of 35 against 29 not to have electric light in the streets.

The Toronto Street Railway Co. is building twenty new open cars in their car shops in Toronto.

The Regina Electric Light and Power Co. has ordered a 500-light alternator from the Canadian General Electric Co.

The Canadian General Electric Company has supplied a dynamo to Kilgour Shives to light his sawmills at Campbellton, N.B.

The contract for an electric light plant at the water works, London, Ont., has been awarded to the Rogers Electric Co., of London.

The Canadian General Electric Co have been awarded the contract for the electrical equipment of the Hamilton Radial Electric Railway Co.

Progress is being made on the Cornwall street railway. Track-laying is going on; wiring has begun and the power house is nearly completed.

W. H. Train, of Burk's Falls, has recently ordered a 500-light increase to his direct current incandescent plant from the Canadian General Electric Co.

The by-law to enable the town of Perth, Ont., to grant a bonus of $5,000 for an electric railway to run between Perth and Lanark, was carried by a majority of 137.

The Petrolea Electric Light and Power Co. are installing a direct current Canadian General Electric Light Co. power plant for pumping some oil wells near their power-house.

Work on the Hull and Aylmer road is progressing favorably. The first four cars will shortly be shipped from the Canadian General Electric Works, at Peterboro', Ont.

Another electric railway is proposed for Hamilton, Ont. It is to run from Gail street to Alberton through Ancaster, the latter towns being asked for a bonus of $15,000 each.

The Gananoque Electric Light and Power Co. has increased their three-wire incandescent plant, by ordering two 600-light machines from the Canadian General Electric Co.

Schultz & Murphy, solicitors, give notice of application for the incorporation of a company for supplying water and electricity to the towns of Sayward, Salmon and Nelson, B.C.

A number of farmers and others in Victoria Co., N.B., are applying for incorporation as the Victoria Telephone Co., L'td. Place of business, Andover, N.B., capital, $25,000.

The Brantford Operating and Agency Co., Lt'd, give notice of a change of name to the corporate name of "The Brantford Electric and Operating Co., Lt'd," and its capital has been increased from $50,000 to $150,000.

The Greenwood City Water Works and Power Company has obtained a British Columbia charter, and will erect an electric plant. R. H. DeGrey, D. McLeod and R. Wood are the provisional directors; capital, $50,000.

A company called the Neepawa, Man., Electric Light and Power Co., incorporated last fall, is making arrangements to take over the town telephone system from the Bell Telephone Company. The rental of the instruments will be reduced.

R. M. Horne-Payne, who is head of the English syndicate which has recently purchased the Victoria (B.C.) street railway, has lately inspected the lines of the Consolidated Electric Railway and Lighting Co. and other properties in British Columbia, which are owned by English capitalists.

The Port Dalhousie, St Catharines & Thorold Railway Co. have recently rebuilt their overhead line, changing from the old Van Depoele over-running system to the standard under-running trolley. Additional motors of the C G E 1,200 type have also been purchased from the Canadian General Electric Co.

D Knechtel, of Hanover, is extending his monocyclic circuit to Carlsruhe, a distance of three and a-half miles, and to Neustadt, a distance of 7½ miles from the power-house. This extension is an interesting evidence of the range over which current may be profitably distributed from a modern alternating system.

The work of constructing the new electric street railway system at Moncton, N.B., is proceeding rapidly. The Canadian General Electric Company have the contract for the apparatus, which includes a 100 K. W. generator and two double motors, C.G.E. 800 equipments. The road is to be in operation by the 1st of July.

E. A. C. Pew has placed orders for 5,000 h.p. in Hamilton, and he says that the power aqueduct from Welland to the Jordan will be at once proceeded with.

The incorporators of the Cornwall Electric Railway are; R. Hooper, D. A. Starr, F. N. Seddall, A. I. Hooper, of Montreal; W. R. Hitchcock, of Cornwall.

Dr. Corbett, of Port Hope, is increasing the depth of his raceway, with a view of obtaining power for an additional 75-kilowatt monocyclic alternator.

The Consolidated Railway and Light Co., of Vancouver, have ordered two additional open cars from the Canadian General Electric Co. The equipments will be of the standard C. G. E. 800 type.

The London Street Railway Co. have placed an order for 12 additional C.G.E. 800 motors with the Canadian General Electric Co. This will make 60 motors of this type operating on the London road.

The Chambly Manufacturing Co., capital $500,000, of which $200,000 is held by the Royal Electric Co., Montreal, will go on with construction at once and will develop an electric power of great capacity.

Markdale, Ont., is to have incandescent light. Power will be obtained from a water power about one mile out of town. The contract for the plant has been closed with the Canadian General Electric Co.

The racing of the water wheel recently wrecked the electric lighting station in Sherbrooke, Que. Five pulleys, four and five feet in diameter, were broken, and the flying fragments did great injury to the machinery.

Sarnia is to have an electric railway: rails are being laid. The railway will extend from Sarnia to Point Edward, and then to Wisbeach, a summer resort on the shore of Lake Huron. The town gave the company a bonus of $10,000.

Thos. Andrews, of Thornbury, Ont., is installing a five hundred light alternating plant to furnish incandescent lighting in Thornbury and also in Clarksburg, distant about one mile. The Canadian General Electric Co. are supplying the apparatus.

Jas. Playfair, of Midland, Ont., has bought from the Canadian General Electric Co. a plant to be installed on the steam barge "Hall." Both arc and incandescent lights will be used; the former for lighting the docks at which the steamer is loading.

The underground wire idea is progressing in Montreal. The Bell Telephone Company is preparing to follow the Lachine Rapids Hydraulic and Land Co. in placing its wires beyond danger of live wire accidents and the damages resulting from sleet and other storms.

The Canadian General Electric Company is supplying a very complete isolated plant for the Montreal General Hospital, consisting of two generators of 40 kilowatts capacity each, and one of 17 kilowatts capacity. These machines will be of the company's new moderate speed multipolar type.

The Canadian General Electric Co. is installing a very compact marine lighting plant on the new steamer "Corona." The generator is a standard multipolar 250-light machine direct, coupled to a vertical marine type engine, constructed at the Peterboro works of the company.

The three-phase plant at Trenton was started up recently, and a regular service will shortly be supplied to the town of Trenton. The line to Belleville, 13 miles distant, is practically completed, and will be ready for operation in a short time. The first motor used in Belleville will be a 75-kilowatt synchronous motor of the C.G.E. Co.'s standard type, from which power will be supplied to operate the arc machines.

The Hamilton Street Railway Company has made a new agreement with the city, by which the company is relieved of mileage payment in return for lower fares, and the percentage on receipts is reduced from 6 to 5 per cent. on the gross amount up to $125,000, and from 6½ to 6 per cent. if the receipts exceed $125,000 and until they reach $150,000, the other percentages to remain as at present. Only a five year extension of franchise was given.

The increasing demand for power from the Toronto Electric Light and Power Co. has necessitated their making an addition to their power house at the foot of Scott street, and the work has now been commenced and will probably be completed in a few months. When this is done the Toronto company will have one of the finest power houses on the continent. The addition to the power house will contain two splendid new engines, with a capacity of 1,500 horse-power each, and a joint weight of 240 tons.

The Lachine Rapids Hydraulic and Land Company has selected the three-phase system of the Canadian General Electric Co. for their new transmission plant. The initial order for the generators covers twelve machines, each of 1,000-horse-power capacity. This will, with one exception, be the largest power transmission plant in the world. A full description of this most interesting installation will be given to our readers in an early issue.

The Montreal Street Railway Company are again making extensive additions to their power plant. An order has been given to the Canadian General Electric Company for a 1,500-kilowatt generator, which will be coupled direct to a 3,000 horse-power Laurie engine. This immense unit, in which the weight of the generator alone will be nearly 100 tons, is similar in style to the direct-connected units supplied to the Toronto and Winnipeg Street Railway Companies. With the addition of the new machine, the capacity of the generators in the Montreal Railway Company's power house will exceed 8,000 horse-power, all of the Canadian General Electric Company's standard types.

The Niagara Falls Electric Light and Power Co. are making extensive additions and changes in their plant, involving an expenditure of over $25,000. A handsome new power-house of pressed brick is in course of erection in a central locality, where an ample supply of water can be obtained for condensing The steam plant will consist of two 200-horse-power compound condensing Wheelock engines. For the incandescent service an order has been given to the Canadian General Electric Co. for two 120-kilowatt single-phase alternators. In case a demand for power arises it is intended to install a 500-volt direct-current power generator. The switchboard is to be of [illegible] marble, and the instruments and their arrangement of the most modern design. A system of three-wire secondary mains is being installed for distribution through the central part of the town. The work is being carried on under the supervision of Geo. Foster, superintendent of the company.

The annual convention of the Canadian Electrical Association will open in the council chamber, Board of Trade building, Toronto, on the afternoon of June 17th. On the 18th and 19th the reading and discussion of papers will take place as follows: "Ocean Cables" (Historical), Chas. P. Dwight, Toronto; "Acetylene Gas" (with demonstrations), Geo. Black, Hamilton; "Meters," James Milne, Toronto; "Consideration and Discussion of the Government Electric Light Inspection Act"; "Some Central Station Economics," P. G. Gossler, Montreal; "Power Transmission by Polyphase E. M. F.'s," Geo. White Fraser, Toronto; "Operating Engines without a Natural Supply of Condensing Water," E. G. Phillip, Toronto; "The Outlook for the Electric Railway," F. C. Armstrong, Toronto. Several of these papers will be illustrated by electric projection of diagrams, and the interest thereby greatly enhanced. On the evening of the 17th a lecture on "Radiant Matter" will be given by James Milne in the rotunda of the Board of Trade building. On the 18th there will be a sail to Lorne Park, dinner at the Hotel Louise, and moonlight excursion in the evening. Another sail round Toronto Island and to Scarboro Heights will be given on the 19th.

A meeting of the provisional directors of the Huron and Ontario Electric Railway Co. was held in Toronto recently, on which occasion M. McNamara, Walkerton, was elected president; Dr. Rollston, Shelburne, vice-president; A. McK. Cameron, Meaford, secretary, and J. M. Roberts, of Dungannon, treasurer. The route of the road was adopted and by-laws for its government passed at the meeting. The road is intended to be about 300 miles in length, and motive power for it will be supplied from electric power stations at Eugenia, Glen Roden, which is close to Durham, Southampton, and Thompsonville, which last mentioned place lies near Alliston. It is said that 3,000 horse-power can be furnished from the Eugenia Falls station. The main line, we are told, is to have some twenty-four stations, as under:—Port Perry, Uxbridge, Sandford, Mount Albert, Sharon, Holland Landing, Bradford, Bond Head, Beeton, Rosemont, Shelburne, Baderos, McIntyre, Feversham, Eugenia, Flesherton, Priceville, Durham, Hanover, Walkerton, Riversdale, Kinloss, Birvie, Kincardine. The spur lines are intended to run, the first from Sharon to Roach's Point and Sutton; another from Sharon to Newmarket; a third from Bond Head to Schomberg; a fourth proposes to touch Eugenia, Kimberley, Meaford, Owen Sound, Southampton, Port Elgin, Tiverton, and Kincardine. Next, the Walkerton spur, running through Teeswater, Wingham, Lucknow, Dungannon, to Goderich. From Lucknow there are to be connections *via* Ripley with Kincardine. Probably the first portions of the line to be built will be from Walkerton to Goderich, and also from Flesherton to Meaford. The provisional directors present at the meeting included the following: A. McKinnon Cameron, of Meaford; J. W. Curts, of Port Perry; A. E. Scanlon, Bradford; H. J. Rolston, Shelburne; Wm. Laidlaw, Durham; Henry Horton Miller, of Hanover; M. McNamara, Walkerton; J. G. Murdock, Lucknow; W. R. Thompson, Teeswater; N. McInnes, Tiverton; A. Malcolm, Kincardine; J. N. Roberts, J. R. Shannon, Goderich; T. Wright, Flesherton; J. Humberstone, Ripley.

Mining Matters.

A find of alluvial gold is reported near Bancroft, Ont.

The gypsum quarries at Mabou, C.B., are in active operation.

Mica mines in Lanark county are again being worked successfully.

A discovery of gold on Burrard Inlet, within three miles of Vancouver, B.C., is reported.

Hamilton, Ont, capitalists are opening up a gold mine within fifteen miles of Port Arthur, Ont.

Granite quarries on the line of the N.& N. W. Railway, Newfoundland, are yielding a superior quality of stone.

The Trail Smelter Co. has closed a contract with the McNeil Coal Co., of Anthracite, N.W.T., for 1,000 tons of coal per month.

The Allison Ranch Hydraulic Mining Co, Ltd., is registered in British Columbia to do a general mining and developing business.

The Bancroft, Ont., *Times* states that three mica mines are being opened up near there by Sheppard & McDougall, of Ottawa.

R. S. McConnell, of the geological survey, is making arrangements for a second series of borings for coal oil in the Edmonton district.

The Ontario Government is now paying a bonus of $1.00 to the miner of an amount of ore mined sufficient to yield one ton when smelted.

The Renfrew county, Ont., graphite mine yields mineral which German experts have just pronounced better than any hitherto known.

H. H. R. Chapman, J. L. Warner, J. Davies, Victoria, are registered in British Columbia as the Georgia Gold Mining Company, Limited Liability.

The local papers report that coal oil has been struck in a boring made by the Standard Oil Company at Verona, on the Kingston & Pembroke Railway, in Frontenac county, Ont.

The nickel deposits in Charlotte Co., N.B., are to be explored. Mr. Leckie, of the Londonderry Co., is going to operate the property for a year. The Offert Nickel Co., of New Jersey, U.S., are spoken of as probable purchasers.

D. A. Gordon, J. W. Steinhoff, J. Anderson, of Wallaceburg, Ont. J. Cooper, Chatham, and J. W. DeC. O'Grady, New York apply for incorporation in Ontario as the Wallaceburg Gas and Oil Company, Ltd. Capital $40,000.

D. McGregor, A. McGregor, of New Glasgow; J. Yorston, of Pictou, G. Mitchell, Halifax, J. McDougald, Westville, are applying for a Nova Scotia charter as the New Egerton Gold Mining Company (Ltd.), of New Glasgow, N.S. Capital, $200,000.

J. J. Kingsmill, E. Mackenzie, H. O'Brien, J. Gunn, G. P. Magann, A. Fraser, G. Curd, J. Dolmage, Toronto, and J. G. Dickson, Shirley, Eng., apply for incorporation as the Anglo-Canadian Mining Exchange, Ltd., to act as mining agents and brokers. Capital, $50,000.

C. W. Callahan, an English mining engineer, was in Rossland recently on behalf of W. McIvor Campbell, who represents an English syndicate, he has bonded the mine City of Spokane for $65,000. The claim is situated on Red Mountain and adjoins the Red Mountain and Virginia claims.

The Le Roi gold mine declared a dividend amounting to $50,000, on May 6th. This makes a total of $150,000 paid in dividends since October last. The "Le Roi" was the first of the British Columbia mines to be put in the market. It was stocked and placed on the market at 10 cents per share In 1893 and 1894 stock had dropped to .06 cents, and in April, 1895, it was a hard sale at .40 cents. In July, 1895, it sold at $1, and in December, 1895, it sold for $4, and now $7.50 is bid and $10 asked. "War Eagle" was placed on the market in February, 1895, at 15 cents; now selling at $2. "Josie" placed on the market November, 1895, at 15 cents; now selling at 75 cents.

The Le Roi Mining and Smelting Co. have just closed a contract with the Canadian Rand Drill Co., of Montreal, for the largest and most extensive air compressor plant ever built in the Dominion of Canada. The specifications call for one cross compound condensing Corliss air compressor of about 450 indicated horse-power. The machine is to be fitted with the latest type of mechanical air valves, which effect a considerable percentage of economy. When in position, the machinery will be used for hoisting and pumping, and to operate about 40 drills at the elevation of the Le Roi mines, which is about 3,500 feet above sea level. The machine is to be built in the new works of the contractors at Sherbrooke. When it arrives at the property it will be put on the Black Bear, which is west of the present shaft house on the Le Roi. The plant will weigh 137,000 pounds.

N L. Libby, of the North Brookfield, N.S., gold mine, has recently returned from North Carolina, where he took three-quarters of a ton of tailings from the mine to Mr. Thies, to be treated by his method of chlorination. Mr. Thies has perfected the system of barrel chlorination, originally devised by Mr. Mears, to such an extent that the cost of treatment by his process is little over $3.00 per ton, while the yield of gold is generally over 90 per cent. of the assay value. Mr. Thies finds by experiment that the Brookfield tailings are well suited to his process; $70 worth of gold was recovered, and the tailings after treatment gave an assay value of only $2 per ton. Mr. Libby also sent 100 pounds of the tailings to F. H. Mason, to be experimented on in his laboratory at Halifax. The result of Mr. Mason's experiments were in all important details practically the same as those of Mr. Thies. The owners of the Brookfield mine have decided to erect a plant capable of chlorinating 400 tons of ore per month, and this new departure in the treatment of gold ore in the province will be the means of giving the gold mining industry a fresh start in Nova Scotia, where in the past everything but free milling ore has been ignored. It has been stated on good authority that the average loss of gold in Nova Scotia has been as much as 30 per cent. of the assay value, and the fact of the Brookfield mine having a legacy from the last company who worked the mine, of a tailing dump containing about 8,000 tons, from which numbers of assays have been made giving from $50 to $90 per ton, goes to prove that this estimate is by no means extravagant.

Railway Matters.

The G.T.R. is now known as the Grand Trunk Railway System.

The T., H. & B. Railway has received $150,000 of the bonus voted some time ago by Hamilton, Ont.

Dale Harris has resigned the managing directorship of the Ottawa and Gatineau Valley Railway Co.

J. W. Munro, of Pembroke, Ont., has secured the contract of building the new C.P.R. station, at Arnprior, Ont.

The temporary Quebec Central Railway bridge over the St. Francis at Newington, Que., has been built by C. C. Smith & Co.

J. H. Crandal, marine railway builder of Halifax, N.S., has the contract for building a marine railway, to cost $30,000, in Ste. Pierre.

The contract for the spur to connect the T., H. & B. with the Toronto branch of the G.T.R. has been given to M. A Pigott, at about $250,000.

The Hudson's Bay and Pacific Railway applies for a Dominion charter to run from Port Churchill to Hudson's Bay, operating by steam or electricity.

Goode & Co., of Chicago, railway contractors, have issued a writ against the T., H. & B. Railway, the Dominion Construction Co. and Engineer Wingate, for $108,000.

J. W. Hendrie, Hamilton, has applied for the appointment of a receiver for the Toronto Belt Line, and for leave to bring an action to compel the G.T.R. to operate the line.

Work is about to begin on the Newfoundland Railway. It is intended to complete the line to Port-au-Basque, a distance of 130 miles, this summer, and 2,500 men will be employed.

A Dominion charter is sought for a railroad to run from Portage la Prairie, Man., to Grand Rapids on the Saskatchewan River, and thence to Hudson Bay, with power to run by steam or electricity, and to build and operate vessels. G. E. Kidd, Ottawa, is solicitor for the applicants.

Application is made for a charter for the Yukon Railway and Navigation Company, from a point at Taku River and Telegraph Creek, or Dease River to Teslin Lake, in British Columbia and the North-West Territories.

The Ontario Government is making an inquiry previous to paying the creditors of the Central Counties Railway for construction between South Indian and Clarence Creek, Vankleek Hill and Hawkesbury.

It is said that the Dauphin Railway has secured running powers over the Manitoba & Northwestern Railway, between Gladstone and Portage la Prairie. One hundred miles of the Dauphin line will be built this season.

It is reported from Spokane, Wash., that D. C. Corbin is going on with the line connecting Northport, Wash., and Rossland, B.C. E J Roberts, C.E., is in charge. A bridge across the Columbia at Northport, costing $200,000, is spoken of.

At the annual meeting of the Phillipsburg Railway and Quarry Company, the following directors were elected: E. L. Bond, president; F. B. Wells, vice-president; Mathew Hutchison, Wm. Mann, J. H. Routh, S. H. Ewing, and James T. Shearer.

The largest of the Quebec Central bridges, that at Beauce Junction, was not injured in the recent floods owing to the fact that a year ago the engineer in charge, J. Berryman, elevated it three feet. Only for this it would also have been carried away.

The annual meeting of the Coast Railway Co. was held in Yarmouth, N.S., May 4th, and the following officers elected: Thos. Robertson, M P.P., president; C W Bergner, Philadelphia, vice-president; J. H. Noblitt treasurer; E S Fraser, Yarmouth, secretary.

Personal

James A. Bell succeeds A. W. Campbell as waterworks engineer of St. Thomas.

W. Haglett has been appointed engineer of the waterworks plant at Kingston, Ont.

Chas. Booth, of Kingston, Ont., has been appointed chief engineer of Westmount, Que.

Sir Charles Rivers Wilson is making a tour of inspection of the G.T.R. System at present.

Wm. Shannon, who held a half interest in the electric light plant in Clinton, Ont., died recently in that town.

T. Ahearn, of Ahearn & Soper, electricians, Ottawa, Ont., has returned with his family from a trip round the world.

A. Dick, late manager of the Joggins Mines, N.S., has been appointed general agent of the Dominion Coal Co. at St. John, N.B.

A. Leofred, mining engineer, who was reported to have been killed in the Sudbury nickel mine accident, has recovered from his injuries.

D. J. McNeil, who was killed in a smash-up on the C.P.R., near Nepigon, Ont., recently, had insurance amounting to $10,000 on his life.

Jno. McKinley, employed in the tannery of W. Tobey & Co., Collingwood, Ont., was caught in the shafting and instantly killed May 19th.

Sandford Fleming, C.E., is one of the delegates from the Ottawa Board of Trade to the British Congress of Chambers of Commerce.

John Kennedy, C.E., chief engineer to the harbor commissioners, Montreal, has returned to the city looking much improved in health from his holiday.

Maurice Walsh, lumber dealer, died suddenly at the Hotel Frontenac, Quebec, May 5th, while paying a visit to his brother-in-law, T. Ahearn, of Ottawa.

Thos. Allan, who had been employed in the locomotive department of the Great Western and Grand Trunk Railways for the past forty years, died in Hamilton not long ago.

W. W. Russell, civil and mining engineer, inspector of weights and measures and chairman of the High School Board, died suddenly at Port Arthur a short time ago.

The employees of the Gurney Scale Company, Hamilton, Ont., have given a handsome sum of money to William Walker, of Dundas, who was injured while at work recently.

Capt. Myres, of Pictou, N.S., was struck by a projecting beam while being locked through the St. Peter's Canal, C.B., and instantly killed.

R. Hodgson, employed by the Pedlar Metal Roofing Co., Oshawa, Ont., was run over and killed by a G.T.R. train at Oshawa recently.

R. C. Campbell Johnston, Vancouver, B.C., has been elected president of the recently formed Association of Mining Engineers in British Columbia.

Percy Domville has been appointed electrical engineer of the Hamilton Radial Electric Railway Company, for the duties of which position he is admirably qualified.

Peter Shearer, brother of William Shearer, superintendent of the James Smart Manufacturing Company, Brockville, Ont., died recently in Brockville. Deceased was formerly a marine engineer.

Smith, Dean & Co., is the title of a new firm of civil and mining engineers that have just established themselves in Rossland, the senior of the firm being H. Badely Smith, until very recently a member of the firm of Keefer & Smith.

E. Morrison, foreman of the Halifax, N.S. waterworks, was presented with a silver service by the employees of the department on the occasion of his recent marriage. An address was read which was signed by the Mayor, city engineer Doane, and the whole staff.

Peter S. Gibson & Son have recently been appointed engineers of the township of York, York county, Ont. They are also engineers for several other municipalities and corporations, as East Gwillimbury township, Vaughan township, Scarboro township, Etobicoke township, villages of Weston and East Toronto, town of North Toronto and others

Marine News.

Fred. Lewis, St. John, has been appointed third engineer of the Government str. "Lansdowne."

The Richelieu and Ontario Navigation Co. directors have decided to run the Tadousac Hotel this summer themselves.

J. R. Donnell, Peterboro', Ont., has recently launched a yacht, the "Mayflower," to be run by an oil motor, where the oil gas is exploded in the cylinder.

C. E. Boyd, Norwich; A. L. Grisdale, Port Colborne; W. E. Tisdale, W. D. Boyd, Simcoe; J. Hursley, C. F. Hursley, Sault Ste. Marie, U.S., apply for an Ontario charter as the Sault Ste. Marie Tug Company, Lt'd; capital, $24,000

Capt. Green's new boat "Bessie" was launched at Pictou, May 19th She was designed by R. McDonald and built by Alex. McDonald, Pictou, N.S. The boiler was made by the Pictou Foundry Co., and the engines by J. D. Fullerton & Sons.

A steam yacht, which is expected to make 16 miles an hour, will be launched in Hamilton about the 1st of June. It was designed by Capt. Melancthon Simpson. The engines, compound condensing fore and aft, and Fitzgibbon boiler, are by the Killey Beckett Co.

Davis & Sons, shipbuilders, of Kingston, are working from 38 to 40 men on repairs and new steam yachts. They shipped a 22-foot launch on the 27th May to W. C. Pelton, of Huntsville, Ont. Another boat, 33 feet long, is to be shipped to R. H. Verity, Muskoka Lake, the 10th of June; another, 33 feet, will be sent to Mr. Garland, of Port Carling, on July 21st; they also have on hand the large 70-foof boat fast approaching completion, to be delivered June 17th.

WORK on the Lambton Mills extension of the Toronto suburban railway will commence at once.

A SECOND deposit of hematite iron has been discovered at Belle Isle, Newfoundland. The deposit is said to contain forty million tons.

AT a special meeting of the Association of Architects of the Province of Quebec, a resolution of regret was passed on the recent death of J B Resther, one of the founders of the association.

IT is said that the mining properties in Rossland camp, Kootenay district, B C, known as the Le Roi, War Eagle, and Iron Mask mines, have been sold to English capitalists. The Le Roi mine brought $5,000,000, the War Eagle $2,000,000, and the Iron Mask mine $1,000,000

THE annual meeting of the Ontario Association of Stationary Engineers was held at Galt on the 1st inst., when the following officers were elected: A. Ames, Brantford, president; T. C. Mitchell, London, vice-president; R. Mackie, Hamilton, treasurer; A. E. Edkins, Toronto, registrar. Board of Examiners - James Devlin, Kingston; J. W. Bain, Toronto; W. Donaldson, Ottawa; Wm. Stott, Hamilton. Various topics relating to the safety and efficiency of steam appliances were discussed, and a resolution passed authorizing the association to carefully enquire into all explosions of boilers at the expense of the executive of the association J Devlin, Kingston, A. M Wickens, Toronto, and A. E. Edkins, Toronto, Ont, were appointed a committee to secure a Dominion charter.

OF MUCH INTEREST—TO US.

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