modating 5,000 subscribers. This switch board is now being manufactured at the Company's shops in Montreal, and will be of iron frame board of the most modern description, and will cost in the neighborhood of $50,000. The Company have also to duplicate the construction work done in Toronto during the past twelve years, and complete it inside of the next two years. The Company have now 3,843 subscribers in Toronto, and they are about combining the Toronto Junction service with that of the City, and they also purpose building another branch Exchange at the eastern end of the City. The Company also now have in use 3,406 miles of over-head wire, strung on 97 miles of poles."

ASSOCIATION OF EDISON ILLUMINATING COMPANIES.

THE thirteenth convention of the above association was held at the Rossin House, Toronto, on August 9th and 10th. Upwards of forty delegates were in attendance, among whom were Mr. Frederic Nicholls, manager Toronto Incandescent Electric Light Co., Mr. John Langton, Canadian Works Edison General Electric Co.; Mr. M. D. Barr, District Manager Edison General Electric Co., Toronto, W. S. Andrews, General Superintendent Canadian Works Edison General Electric Co.

The proceedings, as on former occasions, were conducted behind closed doors, so that it is not possible to furnish our readers with a report of the meetings.

In view of the presence of the President and legal counsel of the General Electric Co., it may be presumed that the relation of the Edison Illuminating Companies to the General Electric Co., was up for consideration.

The Toronto Incandescent Electric Light Co., exerted itself most successfully on behalf of the entertainment of the visitors, who were treated to a moonlight excursion and luncheon, a drive round the city, etc.

The following are the officers elect for the ensuing year:

President—John J. Beggs, New York.

Vice-president—Frederic Nicholls, Toronto.

Secretary—W. J. Jenks, New York.

Treasurer—Wilson S. Howell, Orange, N. J.

Executive Committee—C. P. Gilbert, Detroit; C. L. Eager, Boston; E. R. Weeks, Kansas City; W. D. Marks, Philadelphia, Pa.; Samuel Insull, Chicago.

The place of next meeting will be chosen by the Executive Committee.

THE STEAM PUMP.*

The idea entertained by many engineers that water is raised by suction is erroneous, as, properly speaking, there is no such principle as suction. Water or other liquids are raised through a tube or hose by the pressure of the atmosphere on their surface. When the atmosphere is removed from the tube there will be no resistance to prevent the water from rising, as the water outside the pipe, still having the pressure of the atmosphere upon its surface, forces water up into the pipe, supplying the place of the excluded air, while the water inside the pipe will rise above the level of that outside of it proportionately to the extent to which it is relieved of the pressure of the air. If the first stroke of a pump reduces the pressure of the air contained in the pipe from 15 pounds on the square inch to 14 pounds, the water will be forced up the pipe to the distance of about 2¼ feet, since a column of water an inch square and 2¼ feet high is equal in weight to about one pound. Now if the second stroke of the pump reduces the pressure of the atmosphere in the pipe to 13 pounds per inch, the water will rise another 2¼ feet. This rule is uniform and shows that the rise of the column of water within the pipe is equal in weight to the pressure of the air upon the surface of the water without.

The distance that a pump will draw or lift water, as it is termed, is about 33 feet, because a column of water of one inch area 33 feet high weighs 14.7 pounds, but pumps must be in good order to lift 33 feet, and all pumps must be air-tight. Pumps will give better satisfaction lifting from 22 to 25 feet.

There are many things to be considered in locating a steam pump, such as the source from which the water is obtained, the point of delivery, and the quantity required in a given time; whether the water is to be lifted or forced directly into the boiler, or raised into a tank 25, 20 or 100 feet above the pump.

When purchasing a steam pump to supply a steam boiler, one should be selected capable of delivering one cubic foot of water per horse-power per hour.

No pump, however good, will lift very hot water, because as soon as the air is expelled from the barrel of the pump the vapor occupies the space, destroys the vacuum, and interferes with the supply of water. As a result of all this the pump knocks. When it becomes necessary to pump hot water, the pump should be placed below the supply, so that the water may flow into the valve chamber.

The most necessary condition to the satisfactory working of the steam pump is a full and steady supply of water. The pipe connections should in no case be smaller than the openings in the pump. The suction lift and delivery pumps should be as straight and smooth on the inside as possible.

When the water contains chips, shavings or sawdust, a strainer should be placed on the lower end of the pipe.

When the lift is high, or the suction long, a foot valve should be placed on the end of the suction pipe, and the area of the foot valve should exceed the area of the pipe.

A suction air chamber is a great advantage to the pump when the lift is high.

The area of the steam and exhaust pipes should in all cases be fully as large as the nipples in the pump to which they are attached.

The cylinder of steam pumps should in all cases be oiled before starting in the morning or stopping at night.

Stuffing boxes on the piston and valve rods should in all cases be kept well filled with soft and moist packing, as, if the packing is allowed to become hard and dry, it will flute the rods, inducing leakage and necessitating repairs.

The air vessel on the delivery pipe of the steam pump should never be less than five times the area of the water cylinder.

When the pumps are standing still, idle or out of service, in cold weather, all the drain, drip and pet-cocks should be left open.

* From a paper read by President Crowley at the late meeting of the N. A. C. E., Jersey City.

THE SPEED REGULATION OF CENTRAL STATION ENGINES.

By W. H. BOOTH.

IN *Cassier's Magazine* for May, an article appears under the above heading from the pen of W. S. Aldrich. Mr. Aldrich considers the desirability of some form of governor for steam engines, the action of which shall not be due to speed of the engine, but shall be controlled by the work to be done. There may not, it is true, appear to be much difference in the distinction here drawn, but there is very much more than at first sight is evident. In all ordinary governors there is a position of the governor which corresponds with the normal engine speed. When, by reason of load reduction, the engine begins to run faster, the governor takes up another position, being said technically to rise. In thus rising, it is made to act upon the throttle valve or other means of reducing steam supply, and it thereby prevents an indefinite acceleration; but is clear that the reduced steam supply can only be maintained by the governor being at a supernormal height, and, of course, this implies that the engine also will be above its proper speed. If a 2 per cent. increase of speed caused the governor to have such a motion that it cut down the steam supply below that necessary to run even at normal speed, there would be no steadiness of action whatever, for as soon as the engine ran slow, say 2 per cent., the governor would then turn on an excess of steam, and the fluctuations would never cease. Such a case demands that the effect upon the valve be made less by a re-adjustment of the connecting gear between governor and throttle. In the Corliss gear the same fault is introduced, for the position of the tripping cam depends entirely upon the height of the governor, and an earlier cut-off can only be secured by an addition to speed. Many years ago a Lancashire firm introduced a method of absolute governing, which combined the instant partial action of the governor upon the throttle valve, with a further mechanism for varying the cut-off valve, which was so devised, that whenever the engine revolved above or below its normal speed, certain wheel gear came into action, and through a differential motion changed the cut-off valve until the engine came back to its normal speed, the governor also resuming its normal height, and thus there was never for long any departure from best