The Trouve electric lighting system requires no steam engines, no gas motors, and no accumulators. This apparatus is the one in use for the great work at Port de la Reunion, where it is adapted for the divers' bells, and has been in operation day and night for six months. It is also used at Dunkirk, and can be used wherever a reliable light is needed; for instance, in the turrets of war vessels, where no light heretofore would resist the vibrations caused by the firing of the guns, and after each shot all lights were extinguished. Recent experiments at Villeneuve resulted in the acceptance of this new system of lighting, and all ports are to be supplied with it.

ELECTRIC LIGHTING OF THE GREVIN MUSEUM.

Since April last the electric light has been used in the Grevin Museum instead of gas. The plant, which was furnished by the Edison Company, is very complete, and gives an example of all the cases in which this new mode of lighting may be applied.

Upon approaching the Museum, the visitor can judge of the effect produced over a wide space in open air, for two Cance lamps illuminate the boulevard and are seen from afar. These are the only arc lamps employed, all the others being incandescent ones. In the quite long corridor that leads to the entrance of the Museum, there are but three lamps. Here one's eyes have to rest, and prepare themselves to visit the interior. The light is sufficient to allow one to find his way and to distinguish all the better, over the door at the end, a window that is lighted by means of three lamps placed upon a silvered glass reflector. Finally, in the interior, the winter gardens, landscapes, halls, theatrical scenery, the jewels of the dancers, etc., show how the electric light can adapt itself to all exigencies. We have proof, besides, that it can be put in almost anywhere, even in an old building where nothing has been prepared to receive it, and which is situated in the most frequented business locality in Paris.

The machines are placed in the basement, and an aperture has been made in the wall, so as to put the room that contains them in communication with the vaults. These latter already contain a large number of tableaux that are much admired by the visitors, and here is another added that is none the less interesting. The steam generator is not visible, but is in a neighboring hall. To the right of the motor, and against the wall, is seen a Bourdon lubricator. Upon coming from the boiler the steam traverses this, and thus becomes charged with the lubricant necessary to keep the rubbing parts in good working order. In the rear, opposite the visitor, is situated a switch board for the different circuits that start from the dynamo at the left (Fig. 2). We shall now pass rapidly in review the principal elements of the plant.

The boiler, which was constructed by Collet & Co., produces 2,200 pounds of steam per hour. Its heating surface is 65 square yards, and the grate surface is 2 square yards. It occupies a ground area of 5¾x7 feet, and does not exceed a yard in height. This type of multitubular generator is of very original construction, by reason of the arrangements adopted for grouping and fixing the vaporizing tubes. The extremity of these is slightly conical in shape, and they are closed by conical plugs, against which they are pressed by a long bolt that traverses them. It thus becomes very easy to remove or replace a tube. The tubes communicate with each other through vertical boxes provided with partitions and internal tubes of thin sheet iron, thus permitting the steam to be freely disengaged without carrying along any water. A special drier placed upon the top of the boiler perfects the drying, and water is thus prevented from entering the engine. The product of this boiler may be estimated at 9 pounds of dry steam per pound of coal burned. The motor was constructed by Messrs. Lecouteux & Garnier. The piston is placed vertically at the top of the frame, and distribution is effected by means of a circular valve. Its power is that of 50 horses. It is very carefully constructed, and all its parts are so grouped as to occupy as small a space as possible. The total height is 8 feet, and the greatest width 4. As the velocity is 300 revolutions per minute, all the parts subject to friction are of steel, and adjusted by grinding. The regulator is something new, and is of the builder's inventing.

It is not visible upon the engine, since it is mounted upon the internal part of the fly wheel, which serves at the same time as a driving pulley. It is shown in Fig. 1. It is based upon a displacement of the eccentric, which is mounted, as usual, directly upon the shaft of the fly wheel; and, as may be seen at E, it contains an aperture that allows it to move in a straight line at right angles with the shaft. In this motion it is guided by a slide fixed upon the fly wheel, and is connected by two stiff rods with a weight on the one hand, and, on the other, with a piston filled with oil that has the effect of a hydraulic brake. Finally, the weight is kept in a given position by means of a spring, A. When the engine is running, it is clear that the weight will, through centrifugal force, tend to get so much the

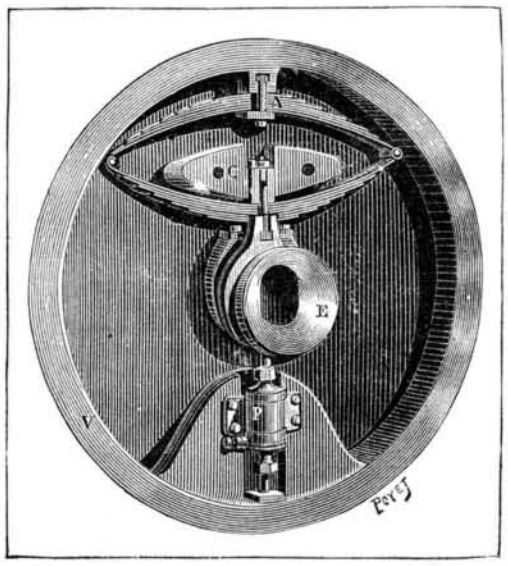

Fig. 1.–THE LECOUTEUX REGULATOR.

farther from its original position in proportion as the velocity is greater. It carries along the Canquel eccentric with which it is connected, and this motion has the effect of modifying the radius of eccentricity, and consequently the operation of the valve, that is to say, the periods of admission, compression, and expansion of the steam. The effect of the spring is to bring back the weight to its normal position as soon as the velocity diminishes; and all abrupt motions are avoided through the effect of the piston brake. This regulator has given good results.

The dynamo machine is of the Edison system, with straight electro-magnets. It is of recent construction, and is the only type of the kind that at present exists in Paris. Its velocity is 900 revolutions per minute, and under such conditions it is capable of supplying 400 16 candle lamps, the constants of which are from 100 to 110 volts and 0·75 a., or ¾ ampere. Its total height is 5 feet, and its greatest width, inclusive of the transmitting pulleys is 7.

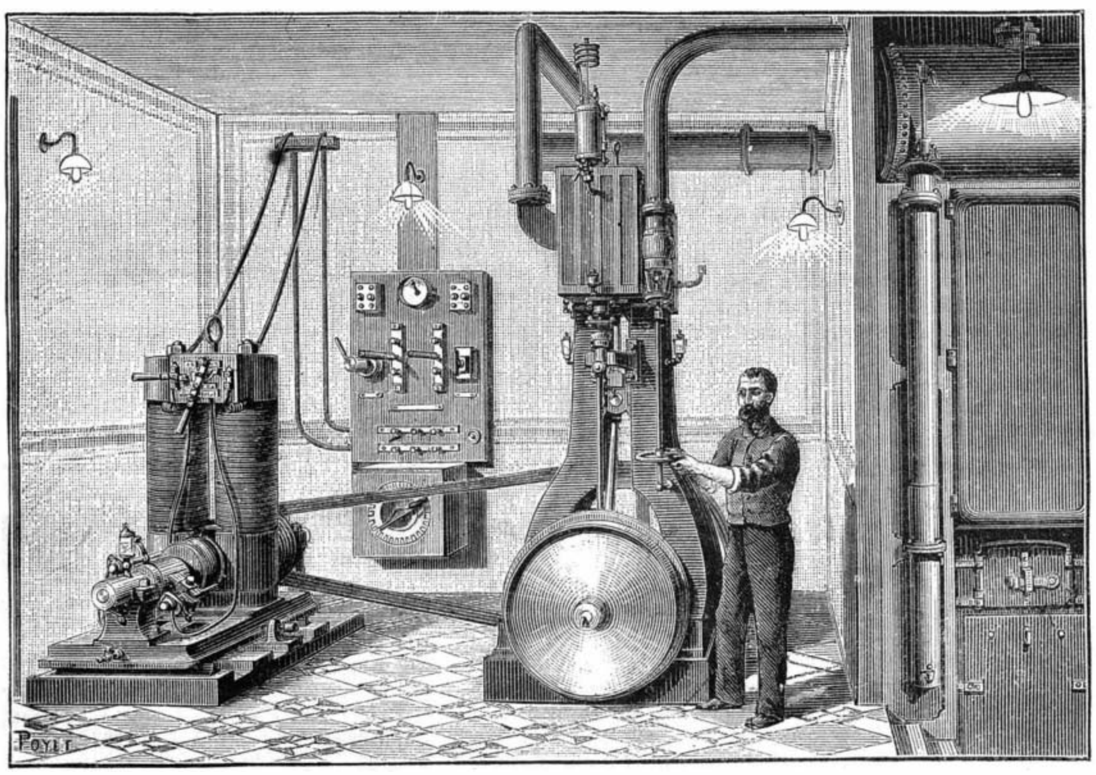

Fig. 2.—ELECTRIC WORKS OF THE GREVIN MUSEUM.

Three circuits start from the dynamo and run to the switch board in the rear of the engine room. One of these serves to supply 54 basement lamps, 28 of which are of 16 candle power and 26 of them 8 candle. These light the "History of a Crime," the "Burial of a Chartreuse," "Mr. Pasteur's Laboratory," the "Ruins of Ischia," etc. The other goes to the upper stories, where are located the offices, the sculpture, modeling, and dressing rooms, etc. Finally, the third goes to the ground floor, where it subdivides into secondary circuits that all start from a tableau near the cloak room. Two of them supply the Cance lamps, and for this reason traverse resistances formed of two German silver wire bobbins, that permit of regulating the current when it starts from the tableau.

Each of the other secondary circuits is especially designed, either for the chandeliers of the halls of the ground floor, or for one or several of the groups placed therein. Each part is thus rendered independent, and, according to the hour of the day and the needs of the service, it is possible to light up at the proper spot by means of a communicator placed at the origin of each circuit. Besides, it is possible to put out any one lamp by unscrewing the plug of the circuit cutter placed alongside of it.

The total number of lamps now in service is 170 of the type A and 204 of the type B, representing in all 4,350 candles. The force of the machine permits of lighting more if necessary, either for the service of the museum, or for lighting up neighboring establishments.

This plant has merited a notice because it shows perfectly the facility with which the electric light adapts itself to lighting of all kinds, and particularly the advantages that can be obtained from it from a decorative point of view.—*La Nature.*

The Recession of Niagara.

Sir Charles Lyell, in 1841 and 1842, estimated the gradual recession of Niagara Falls by the undermining of its brink at the rate of about 1 foot per annum. Recent investigations of the subject by a commission for the establishment of a State reservation at the Falls have, however, shown that this and other estimates are more or less erroneous. A map, based on surveys of the Falls made in 1883 by Mr. Thomas Evershed for the New York State Surveyor, has shown that in the forty-one years ending 1883 the annual rate of maximum recession has been 6⅙ feet. For the eight years ending 1883 this rate is given as 16½ feet, so that the rate of recession has been higher of late. These results were obtained from the Canadian Fall, while the American Fall was found to have receded at the rate of 10 inches per annum during the forty-one years ending 1883. It has been shown by the surveys that these two falls were once united; and that, supposing the rate of recession to continue, the Niagara gorge will be cut through in some 10,000 years. Lyell's estimate was 35,000 years. Of course these attempts to calculate the cutting of the entire gorge, which terminates at the heights near Lake Ontario, assume that the hardness of the shale and lime rocks, volume of water, and height of the fall, continue much the same as they are now.

An Iron Cement.

Usually, certain proportions of pulverized sal ammoniac in crystals, sulphur, iron filings or drillings, and urine or water has been deemed as quick and adhesive a cement for two iron surfaces as any that could be made. But this mixture sets slowly and requires days—or weeks—to get in its perfect work. The object of this cement is to oxidize the surfaces of the iron so that close contact will unite the rust, and thus hold the two surfaces as one. Natural specimens of oxidizing of iron as cement are not uncommon. Almost all specimens of bog iron ore show aggregations of iron by rust; sometimes quite large masses being held in one firm embrace by this means; the writer saw in Nova Scotia lumps of bog iron ore aggregated by rust so that there was a conglomerate globe of separate globes of at least thirty inches diameter. In fact, the "rusting" of joints is an old trick with mechanics.

But in place of sal ammoniac let the jointer use chloride of lime, one of the common disinfectants, and the fixity of the joint will surprise him. Two joints of three inch cast iron pipe, with flanges sufficiently wide to take in ¾-inch bolts, were secured with a mixture (in the usual proportions) of cast iron filings, water, and chloride of lime. The actual proportions were: fine filings, 10 parts; chloride of lime, 3 parts; water, enough to mix to a paste. These joints were bolted together after the mixture was placed between them, and after being left one night, when broken apart the cement scaled off a portion of the solid iron of one of the flanges.

This cement has stood the action of sixty pounds of steam in a pipe connection to a steam boiler where rubber glands and canvas and white lead failed.