PARIS EXPOSITION—LARGE ENGINE.

The main dynamo rooms of the Electrical Palace contain a number of large engines which drive the generators used for the lighting and power of the Exposition. The German section has four large engines, three of which are of the upright type, double and triple expansion; the fourth is a cross-compound of the horizontal type. The illustration shows the engine built by the Nuremburg Machine Company. It is vertical compound and is connected directly, on one side, to a large dynamo of 1,000 kilowatts, which gives alternating current at 5,000 volts, and on the other to a smaller direct current generator of 350 kilowatts. The engine, of the two-crank type, gives normally 1,400 horse power at 94 revolutions per minute, with a pressure of 147 pounds per square inch. It is provided with a water jet condenser. The diameters of the steam cylinders are 34½ and 53¼ inches, with a 27-inch stroke. The engine is bolted to a bed-plate, which consists of two parts; each part is cast in one piece with two bearings. The shaft has a coupling at each end for connecting with the dynamos. The weight of the engine, without fly-wheel, is about 1,320 tons. The fly-wheel shown on the right, between the engine and dynamo, is provided with teeth around the periphery, engaging with electrically-driven turning gear; the latter is driven by a direct current motor which gives 10 horse power at 600 revolutions; the motor can give a complete revolution of the shaft in about five minutes. The large dynamo on the left is of the three-phase type, built by Lahmeyer & Company, of Frankfort; it has the field magnets fixed around the periphery, and the armature, on a large exterior frame, completely encloses the field magnets. The diameter of the rotating part is 18 feet 3½ inches, and the diameter of its center of gravity 15 feet 6¼ inches. The fly-wheel consists of four pieces held together by bolts and wrought iron rings; to this the magnet-cores, of wrought iron, are bolted; they are provided with wrought iron pole-pieces. The magnets are wound with copper ribbon, insulated with paper, and are excited by the small dynamo mounted on the outer end of the shaft. The exterior crown or armature is built up of laminated iron, held in a cast iron frame, and the two end-plates, with their arms, consolidate the whole. The dynamo on the other side is a multipolar direct current generator, with 12 poles.

Method of Reckoning Time in Spain.

The Queen Regent has signed a decree establishing the method of accounting time in the kingdom, the decree to take effect January 1, 1901, viz.:

(1) In all railway, mail (including telegraph), telephone, and steamship service in the Peninsula and the Ballearic Islands, and in all the ministerial offices, the courts, and all public works, time shall be regulated by the time of the Greenwich Observatory, commonly known as Western European time.

(2) The computation of the hours in the above-mentioned services will be made from the hour of midnight to the following midnight in hours from 1 to 24, omitting the words tarde (afternoon) and noche (night), heretofore in customary use.

(3) The hour of midnight will be designated as 24.

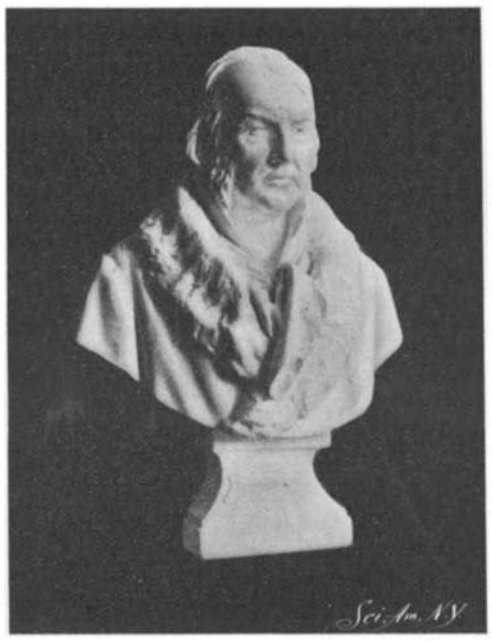
(4) The interval, for instance, between midnight (24) and 1 o'clock will be designated as 0·05, 0·10, 0·59.

THERE are 13,000,000 acres of primeval forests in Cuba.

SOME LIVING LAMPS.

BY CHARLES F. HOLDER.

Some years ago Dr. Raphael Dubois, of Paris, presented the writer with a photograph of the bust of Claude Bernard, which possesses an unusual interest, having been taken by the light of a phosphorescent insect—an elater—by M. E. Becqueral. The experiments and their details which led up to this were very interesting, but in this connection it is sufficient to say that the picture was produced after an exposure of an hour to the rays of light of this small insect. Later M. Becqueral succeeded in taking a successful picture in twenty minutes, and another in two minutes; all of which is suggestive of the possibilities of the light produced by animals.



PHOTOGRAPH OF BUST OF CLAUDE BERNARD, TAKEN BY THE LIGHT OF A PHOSPHORESCENT INSECT.

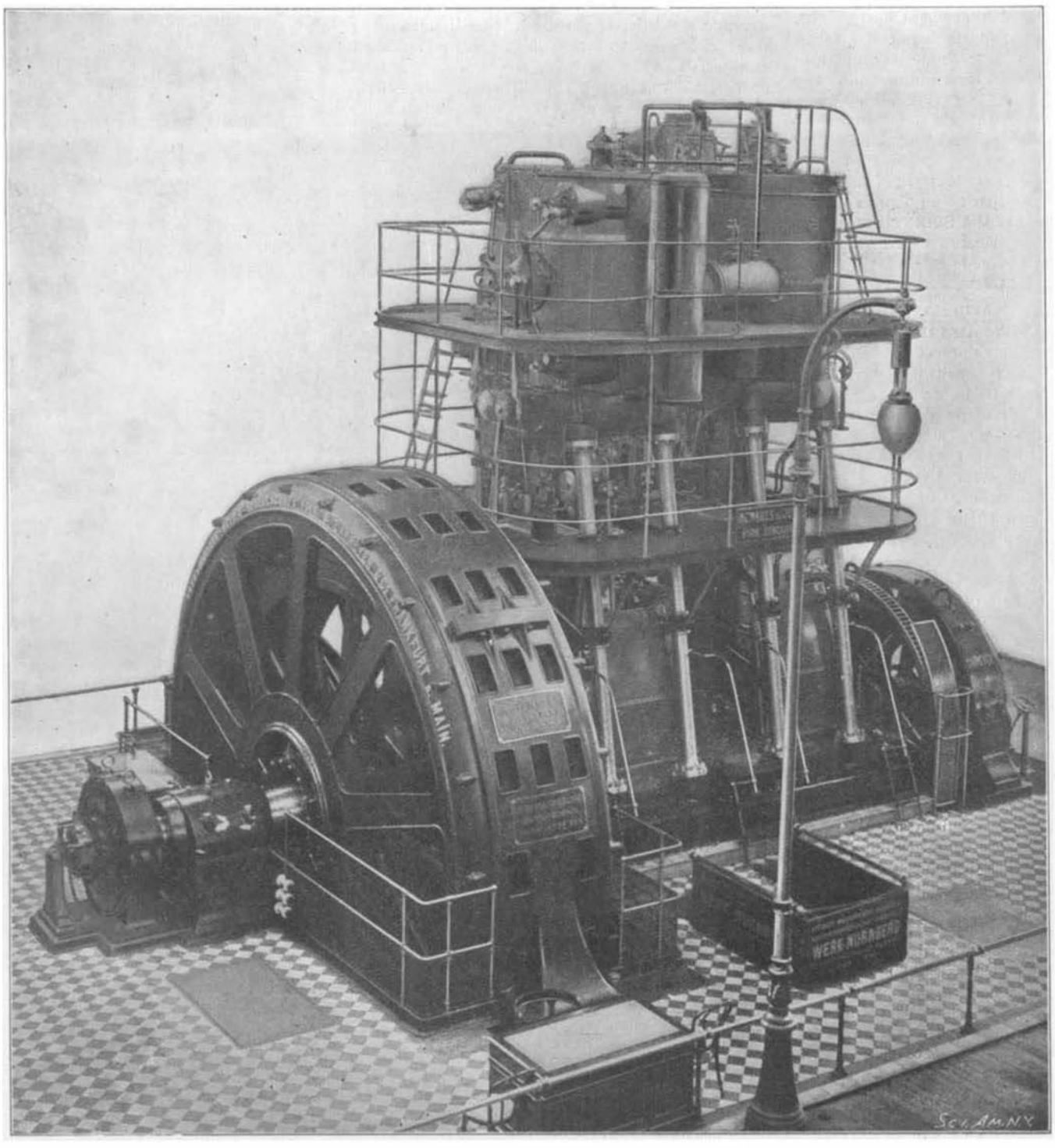
An excellent illustration of the splendor of the light of some of these insects is given by Prof. Jaeger, the German naturalist, who says, "I feel particularly indebted to these little insects because during my excursions in St. Domingo they were frequently the means of saving my life. Often has dark night surrounded me in the midst of a dense forest on the mountain, where the little animals were my only guide." The light giver referred to is Pyrophorus noctilucus, which is provided with three different lights; on each side of the thorax is an oval yellowish spot which emits a brilliant yellowish-white light, throwing the rays upward and outward, while between the metathorax and the first abdominal segment there is a lower light more brilliant than either; and owing to their disposition, the light flashes almost continuously as the insect whirls along. The light appears to be controlled by the will of the animal, as when the insect is feeding or eating it is not seen, but becoming especially brilliant when the animal flies.

I have frequently experimented with these attractive little creatures in the South. The light when held very close to the large print of a book displayed the letters so that they could be read; the time of night was also told by holding the insect close to the face of a watch. The color of the light was green. Dubois states that the eggs of a specimen kept by him gave out a bluish light. This naturalist found that the eggs retained their luminosity for a week, the light reviving when the eggs were placed in water. He produced luminous water by grinding the luminous organs to a powder and dissolving it in water which at once assumed the appearance of molten metal.

The intensity of light is by no means in proportion to the size of the animal.

One of the most remarkable and brilliant light givers I have ever observed was a marine worm almost invisible to the naked eye; so small, in fact, that it would not be noticed by the casual observer. I have seen the surface of dark corners of a southern Californian bay dotted with seeming candlelights, the effulgence of this minute creature. At first it was noticed on the bottom, forming a luminous spot as large as a fifty-cent piece; this rapidly increased until a light as large and as circular as a dinner plate appeared. So large and brilliant a light could seemingly be produced only by a large animal, but suddenly the light began to diminish, then rise from the bottom, coming up in a zigzag course, trailing blue, green, yellow, and white flashes behind it until it reached the surface, where it rested, forming a phosphorescent light the size of a pea, but so bright that it could be distinguished thirty or more feet away. On certain warm nights I have seen the surface dotted with them. When disturbed the spot swam off with a wriggling motion, emitting as it went the various hued lights which seemed to be thrown off as a luminous fluid. Yet this brilliant light giver was a minute, almost invisible, worm.

The combined light of noctilucæ is often so brilliant that by constant irritation a light is produced by which large print can be read. A French naturalist on the African coast improvised a lamp of these living lights by taking a tube fifteen millimeters in diameter and placing in it noctilucæ, so that they formed a band at the surface twenty millimeters in thickness, when it was found that the light was sufficient to read large type by at a distance of two feet. To effect this the animals were agitated with a stick: but if a



ENGINE IN THE ELECTRICAL PALACE, PARIS EXPOSITION.

large number are placed in a glass of milk they convert the glass into a white light the intensity of which lasts several moments.

Another interesting example of a brilliant light I observed in a very small animal, in the San Gabriel Valley. In walking just after nightfall, I noticed, by the path, an intense white light, which was found to be a minute myriapod about a tenth of an inch in length; so small that I had difficulty in picking it up, though the light gleamed brightly. When it was finally secured it was seen that the light was upon the head, while another, half as bright, was seen upon the tail. The head light was extremely beautiful, reminding one of a blazing match, and was continuous.

A number of myriapods are phosphorescent. Geophilus electricus of Europe is a light giver, and often makes a magnificent display, when suddenly uncovered; M. Audoin describing the soil as sprinkled with gold where he disturbed them. One of the most remarkable displays from these insects was observed by Mr. B. E. Brodhurst, who says that the light was so brilliant that he first observed it twenty paces away. It resembled an electric light in its brilliancy, and was produced by two centipedes, and the luminous train they left behind. "The light illumined the entire body of the animal, and seemed to increase its diameter three times. It flashed along both sides of the creature in sections, there being about six from head to tail between which the light played. The light behaved precisely like the electric light, moving, as it were, perpetually in two streams, one each side, and yet lighting up the whole body. The trail extended from one and one-half feet from each centipede over the grass and gravel walk and it had the appearance of illuminating mucous."

It is possible to read by the light of the humble earthworm. One of the most brilliant displays of animal phosphorescence I have observed came from such a source. Its discovery was accidental. In passing through an orange grove one rainy night in Southern California, I kicked aside a large clump of earth, when to all intents and purposes a mass of white molten metal went flying in every direction, affording an unusual display. The cause of the light was a single, possibly two, earthworms, not over two inches in length. The luminous matter was exuding from them and had permeated the surrounding soil, rendering it phosphorescent. The light-emitting mucous came off upon my hands, and the light lasted several seconds, gradually fading away.

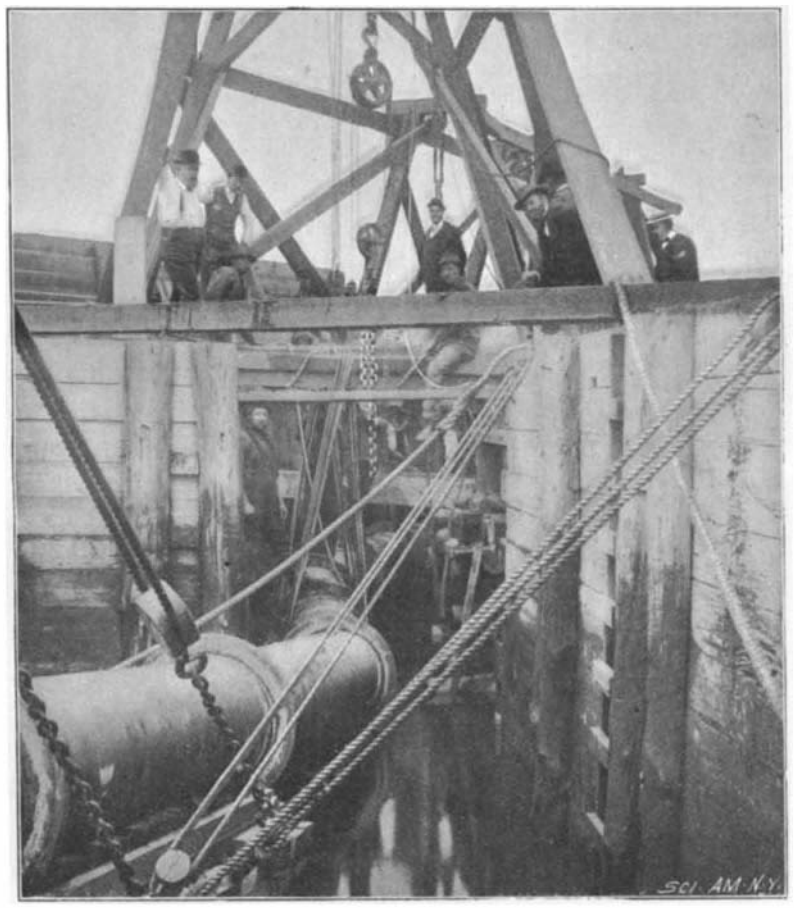
Possibly the most remarkable light ever used for purposes of reading is the beautiful Pyrosoma, a columnar, jelly-like creature, one of the free-swimming Tunicates. They are usually from one to two feet in length and three or four inches across, open at one end. The column is an aggregation of animals, each of which takes in water and expels it by an orifice in the interior; and this volume of water rushing from the open end propels the animal along. Its luminosity is wonderful, its name, fire body, well chosen. To illustrate its intensity, a Portugese sea captain secured 6 of the animals, which he placed in glass jars which were suspended from the ceiling of his cabin. By their own light he wrote a description of their beauties. Bennett, the English naturalist, placed a deep-sea shark, of the genus Isistius, in a jar in his cabin and could easily have read by its light, describing the appearance of the fish as truly ghastly.

THERE are said to be at least 5,207 motor cycles in France, on which the annual tax has been paid.

LAYING A 24-INCH GAS MAIN ACROSS THE HARLEM RIVER.

BY G. H. P. M'VEY.

The work of laying a 24-inch gas main from the Borough of Manhattan to the Borough of the Bronx, across the Harlem River, is about completed. The purpose of this pipe is to supply additional illuminating gas to the Borough of the Bronx from the mains in Manhattan Borough.



METHODS OF JOINING PIPE IN THE MANHATTAN BULKHEAD.

THE LAST LENGTH OF PIPE BEING LOWERED TO POSITION.

METHOD OF JOINING AND Llaunching THE FINISHED PIPE.

To complete this undertaking the Consolidated Gas Company arranged with the Seaboard Contracting Company, the latter employing a number of hands and an enormous plant to operate the work.

The plans of the work were designed by Mr. W. H. Bradley, Chief Engineer, and Mr. Colin C. Simpson, the General Superintendent of mains for the gas company. The pipe crosses the river from a point in Manhattan at One Hundred and Thirty-ninth Street to a point at One Hundred and Thirty-eighth Street in the Bronx, north of and adjoining the Madison Avenue bridge.

Preliminary work was commenced in the river last April by cutting away the bulkhead on the westerly or Manhattan shore and by removing about 100 feet of the ice fender pier of the bridge. This was done to enable the dredge and its accompanying dumping scow to operate at this point.

About 50 tons of rock and earth, as well as a mass of timber, had to be removed from the Manhattan bulkhead, which work was done mainly by the divers. This opening in the bulkhead was 60 feet long, 6 feet wide, and from 5 to 25 feet deep. Four-inch yellow pine tongued and grooved sheathing, 25 feet long, was driven, in order to hold up the sides and thus protect the divers while they were at work, and also to prevent the trench from again filling up with silt.

The divers who performed this dangerous duty, besides cutting away the bulkheads and fender pier, had to make the soundings, guide the suction pipe which removed the mud from the submarine trench, and also place the wooden blocking under the pipe where necessary.

To locate the direction of the trench, transit lines were taken from each shore. The trench has a fall of four feet in a hundred from both shores to the center of the river. It is 20 feet wide and from 10 to 20 feet deep, according to the depth of the mud and silt in the bottom of the river. The extreme length of the trench is 750 feet, from which 14,000 cubic yards of mud was dredged.

In course of time this trench will again fill up with the mud and silt deposit, thus affording ample protection to the pipe, which will lie on the hard clayey bed at a depth in the center of the river of 32 feet below mean low water.

Where the surface of the bed is depressed or uneven, heavy 6 by 12 pine timbers from 3 to 10 feet long were laid at right angles to the pipe in order to block and grade it. This latter precaution was taken in order to prevent straining, and also to avoid the formation of a trap or drip into which condensation would flow and settle, thereby choking the easy flow of the gas.

A depression of the pipe has been provided for, however, in the middle of the river, about 35 feet below mean low water mark. At this point a drip-pot has been provided, which takes the place of an ordinary length of pipe. It will hold 180 gallons. From the top of the drip-pot there will extend to the surface a standpipe, by means of which the condensation will be pumped out.

The iron pipe used in this submarine work is known as Ward's flexible joint. Each length is 12 feet long, 24 inches in diameter at the body and 29 inches at the hub or socket. The iron is one inch thick and each length weighs two tons.

Each joint required 250 pounds of lead to