

## 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 Nuremberg 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  $34\frac{1}{2}$  and  $53\frac{1}{4}$  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 Frankfurt; 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  $3\frac{1}{2}$  inches, and the diameter of its center of gravity 15 feet  $6\frac{1}{4}$  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 Balearic 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. Becquerel. The experi-



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

ments 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. Becquerel 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.

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.

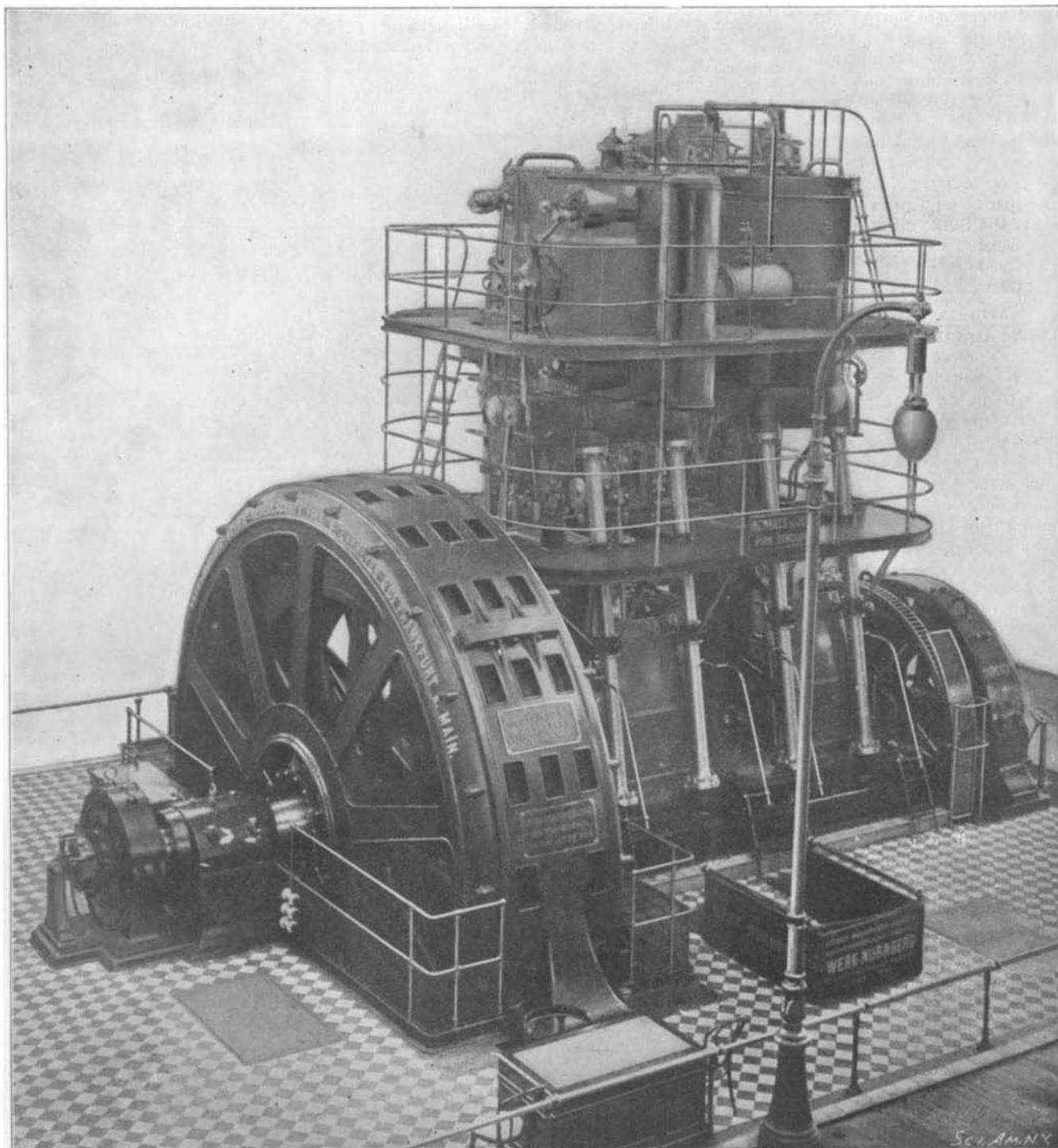
I have frequently experimented with these attractive little creatures in the South. The light when held very close to the large print of a book displayed the letters so that they could be read; the time of night was also told by holding the insect close to the face of a watch. The color of the light 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 seeweed 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 zig-zag 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 spots 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 *noctiluca* 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 *noctiluca*, 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.