NEW AND CURIOUS ELECTRICAL EXPERIMENTS.

A new treatise on statical electricity has recently been published in France by M. Mascart, in which the author has collected a large number of the most curious, striking, and novel electrical experiments. Many of these have but recently been devised, and hence among the engravings, given herewith and taken from the above named work, our readers will doubtless find much that is new and interesting. The name of

ROUSSEAU'S DIAGOMETER

has been given to the apparatus represented in Fig. 1. The difference in the conductibility of two different liquids, or, in other terms, the time necessary for electric propagation across two identical masses of two such liquids, may serve

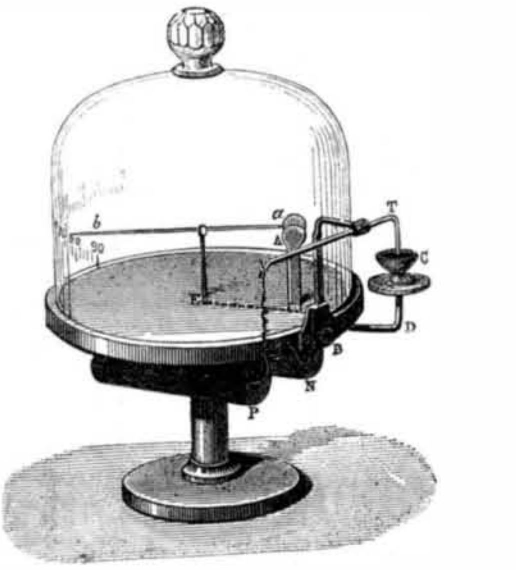

Fig. 1 —Rousseau's diagometer.

as a distinguishing characteristic. Supposing, for example, it were required to determine the degree of purity of olive oil, which, for commercial purposes, is frequently adulterated with peanut and other cheap oils The electric conductibility of the suspected material would be compared with that of oil known to be pure. The least portion of foreign oil alters this conductibility in marked degree, so that here is a novel application of physics to the detection of adulterations, a work ordinarily within the domain of analytical chemistry.

The liquid to be tested is placed in a metallic capsule, C, which rests on a disk connected with the needle, *a b*, movable on a central pivot. One of the extremities, *b*, of the needle traverses a dial; the other carries a small disk which, when in neutral state, rests very near the rod, A, connected to the wire, E D. A battery, P N, transmits, by the pole, P, through the isolated rod, T, and the capsule, an electric discharge into the two balls, A *a*. The time is then noted, necessary to obtain a maximum deviation under, for example, the following conditions: 1. The capsule being filled with pure olive oil, a deviation of 40′ is observed. 2. Filled with peanut oil, 25′′ is noted. 3. Filled with a mixture of the two oils, the deviation is 20′. Now a simple calculation, based on the fact, previously determined, that the conductibility of the mixture is the mean of that of its constituents, shows the measure of the fraud to be in the sample $\frac{1}{100}$. The battery used is a dry pile, that is to say, a voltaic pile formed by bodies containing little humidity, and between which the chemical action is quite weak, in order that the apparatus may retain an invariable electrical status for as long as possible. M. Rousseau suggests a battery formed of double disks of zinc and Dutch metal, between which is a mixture of peanut oil and turpentine in equal parts.

GAUGAIN'S ELECTRIC VALVE.

In Fig. 2 is represented a singular phenomenon yet unexplained. If within an egg shaped glass globe, of form as shown, the air be rarefied by an air pump, and if between the two balls placed within a spark be caused by means of an induction coil, the following will be observed: When the positive pole is attached to the lower ball, and the negative pole to the upper one, or inversely, a galvanometer interposed in the circuit shows a constantly increasing deviation in proportion as the air in the globe is rarefied. This fact is explained by admitting that, of the two inverse currents simultaneously produced by the coil, one has always a greater tension than the other, and naturally it is the stronger which constantly produces an effect. Thus far there is nothing remarkable; but if now the lower ball be varnished, so that of its surface only a small conducting space be left, it will be observed that, for a determinate pressure of the surrounding air, the current transmitted between the two balls has always the same direction, wherever may be the points of attachment of the poles of the coil. The varnished ball seems to fulfil a part similar to that of a valve in a water or air pipe, when so arranged as to allow the flow to pass but in a single direction.

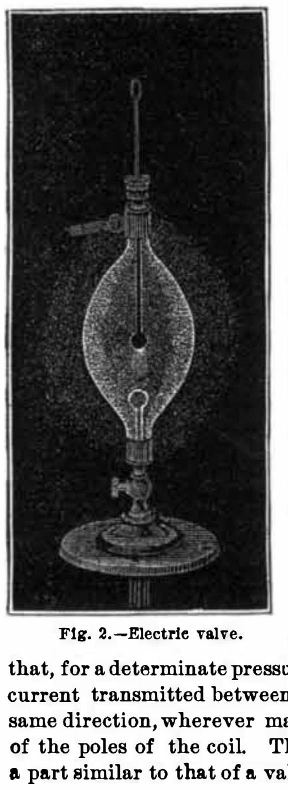

Fig. 2.—Electric valve.

VARIOUS FIGURES OF THE ELECTRIC DISCHARGE.

Faraday distinguished four forms of the figures or conditions assumed by the electric discharge: 1. The spark. 2. The feather. 3. The lambent illumination. 4. The obscure discharge. The spark is the fiery offshoot which leaps between two unequally charged conductors. It becomes thinner as the explosive distance augments, while keeping its brilliancy at the extremities. Fig. 3 represents the spark obtained between the conductor of an electric machine and the edge of a metal plate in communication with the soil. Beyond a certain distance from the point of emission, the spark no longer traverses a right line, but is formed of a succession of zigzags. Fig. 4 represents such a discharge at the distance of from 5·8 to 9·7 inches. If the distance is increased, the form becomes complicated, and lateral ramifying offshoots from the angles of the zigzag are thrown out, as shown in Fig. 5.

Fig. 3.—Spark to the edge of a metal plate.

When an electric machine acts in a dark chamber, luminous feathers or *aigrettes* escape from the salient parts of the conductors with a dull sound analogous to that of a puff of steam or air. These *aigrettes* are generally formed of a quite brilliant stem which suddenly splits into a large number, of less vivid violet hue. The branches in turn ramify and finally melt into darkness. Beautiful *aigrettes* may be produced by holding a metallic plate at a distance from the conductor a little exceeding that required to make the zigzag spark, and by terminating the conductor with a small ball. Fig. 6 represents an *aigrette* obtained at a distance of 13·6 inches. Under these conditions the edge of the disk becomes slightly luminous, although it is separated from the *aigrette* by a comparatively dark interval. *Aigrettes* may be still more clearly shown when the non isolated exterior conductor presents a large surface, as shown in Fig. 7.

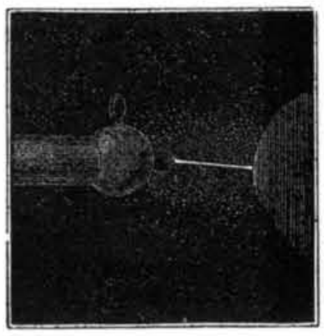

Fig. 4.—A seven inch spark.

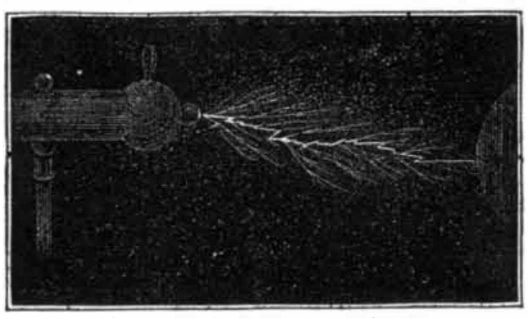

Fig. 5.—The zigzag form of electric spark.

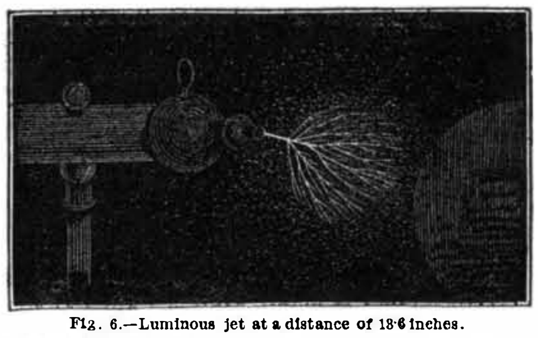

Fig. 6.—Luminous jet at a distance of 13·6 inches.

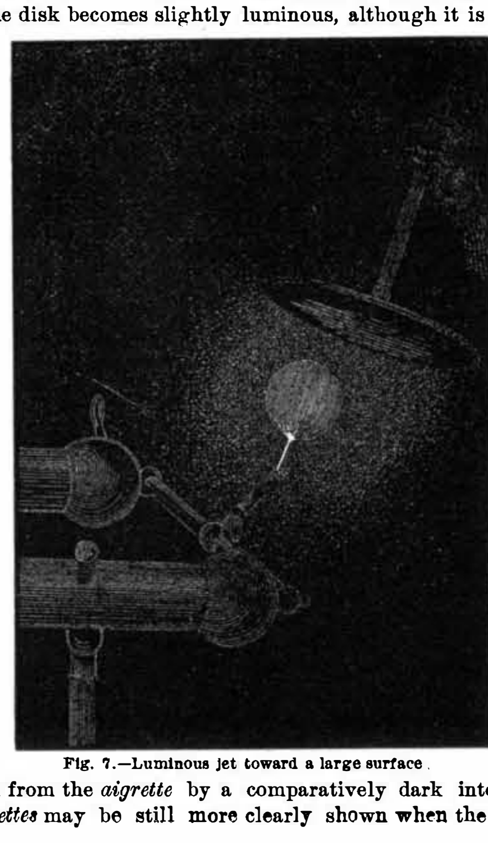

Fig. 7.—Luminous jet toward a large surface.

It happens sometimes that an electric machine in activity presents, at the extremities of its conductors, especially when they terminate in small balls, a lambent illumination of variable brilliancy and extent, tranquil, continuous, and noiseless. Faraday has shown that in order to transform an *aigrette* into this species of discharge in ordinary air, it is necessary to diminish the dimensions of the conductor at the point of emission, to force the action of the machine, and to remove all foreign bodies. The lambent discharges then appear to be the location of a continuous communication from the electricity to the surrounding air. In rarefied gases, the phenomenon is most striking. Under a vacuum of 2 to 3 inches in the apparatus known as the electric egg Fig. 8, there escapes from the upper ball, supposed to be positive, a multitude of purple bands, of which some are directed toward the sides of the globe, while others form a bundle of ribbons ending at the negative ball. At the same time the last mentioned ball and the rod which supports it are enveloped in a thick atmosphere of violet light.

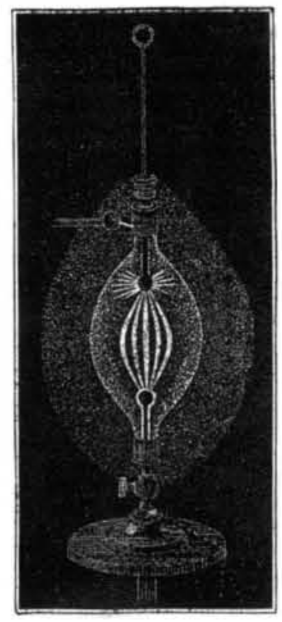

Fig. 8.—Electric egg in rarefied gas.

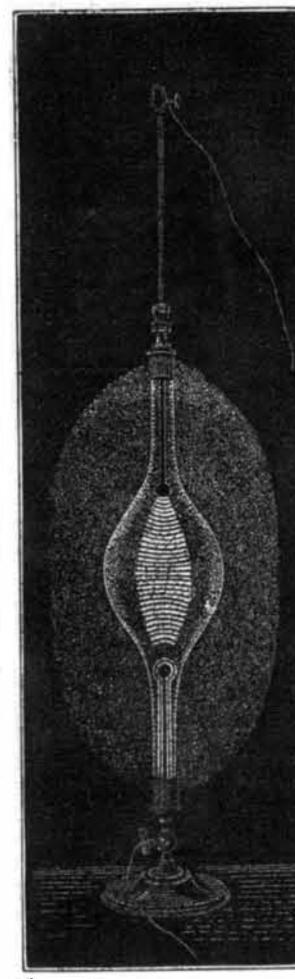

Fig. 9.—Electric egg in vapor of turpentine.

If the upper portion of the egg is connected with the conductor of a machine or terminated by a point which gives a continuous flow, the discharge is not propagated over any great distance. At the positive ball appears a faint purple light, and the negative ball is surrounded by a violet halo; but the illuminations are separated by a completely obscure interval. In this interval, however, a movement of the electric fluids occurs, and hence the phenomenon has been termed an obscure discharge.

STRATIFICATION OF THE ELECTRIC LIGHT.

When vapors of alcohol, turpentine, etc., are introduced into the electric egg, previous to rarefying the air therein, and when through these the discharge is passed, the luminous emission becomes divided into strata separated by obscure bands, as shown in Fig. 9. This is produced in all tubes containing rarefied gas. The distance and brilliancy of the strata depends on the nature and pressure of the gas, the dimensions of the tubes, and the energy of the discharges. They are more marked with a bright light and narrow tubes. The explanation of the phenomenon is not yet definitely known.

COMPOSITION OF THE ELECTRIC LIGHT.

We terminate the present series of illustrations with Fig. 10, representing the spectrum of an electric spark passing between two electrodes of antimony. It is the characteristic spectrum of that metal, showing the rays α, β, γ, δ, in the situations indicated between the red and the green. After a number of experiments upon spectra electric sparks, similar to others, M. Masson has reached the conclusion that the constitution of electric spectra is, for a like substance employed as poles, independent of the electric source and of the medium to which the spark passes.

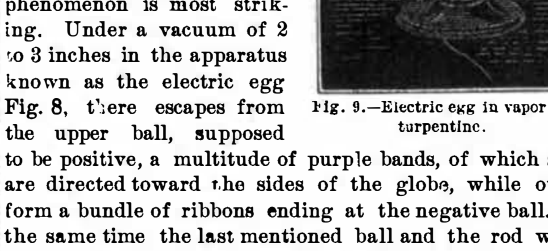

Fig. 10.—Electric spectrum between two antimony electrodes.

TO CLEAN PLATE.—Take an ounce each of cream of tartar, muriate of soda, and alum, and boil in a gallon or more of water. After the plate is taken out and rubbed dry, it puts on a beautiful and silvery whiteness. Powdered magnesia may be used dry for articles slightly tarnished, but if very dirty it must be used wet and then dry.