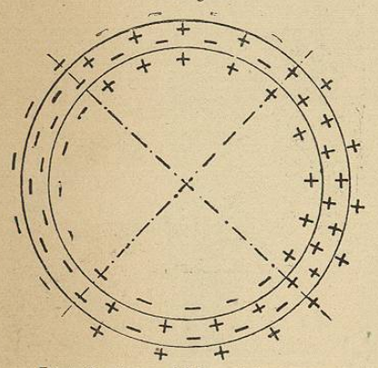
To secure good results small Leyden jars or condensers must be connected with the conductors, as shown in Fig. 359. To the bottom of each jar is attached a small chain. These chains are brought into contact when a detonating discharge is desired, and separated for a silent discharge.

The machine is self-exciting and yields sparks varying in length from one-fourth to nearly one-half of the radius of the rotary disks, according to the state of the atmosphere and the condition of the machine.

The machine illustrated has 12-inch rotary disks and 14-inch stationary disks.

Mr. Wimshurst has constructed the diagram (Fig. 360) which shows the distribution of the electricity upon the plate surfaces when the machine is fully excited. The inner circle of signs corresponds with the electricity upon the front surface of the disk. The two circles of signs between the two black rings refer to the electricity between the disks, while the outer circle of signs corresponds with the electricity upon the outer surface of the back disk. The inventor found by experiment that when two disks made of a flexible material were driven in one direction, they close together at the top and the bottom, while in the horizontal diameter they are repelled. When driven in the reverse direction, the opposite action takes place.

FIG. 360.



Distribution of Electricity upon the Plates.

EXPERIMENTS WITH THE INDUCTION MACHINE.

The appearance of the spark when the two conductors are separated only a short distance is shown in Fig. 361. It leaps in a straight line from one electrode to another. When the distance between the electrodes is greater, the spark takes a

FIG. 364.

FIG. 363.

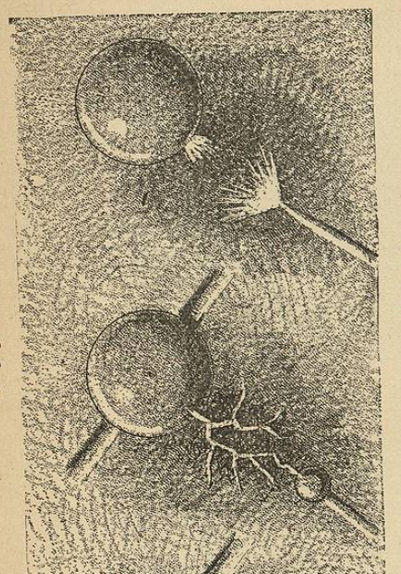


FIG. 365a.

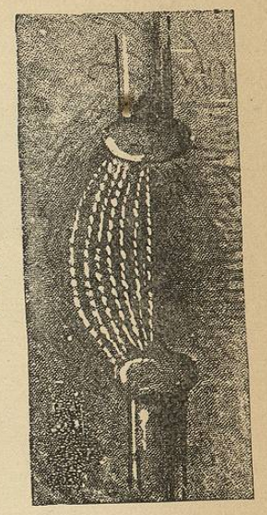


FIG. 362.

FIG. 361.

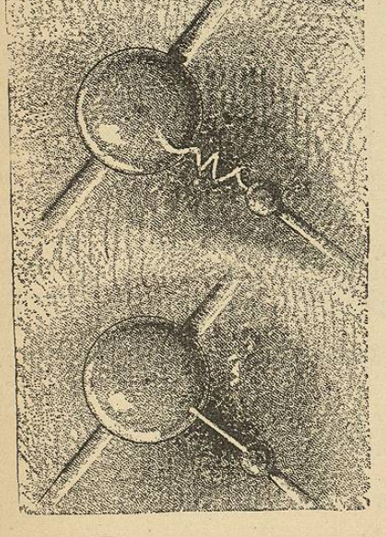
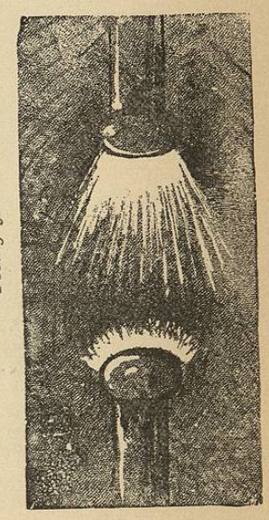


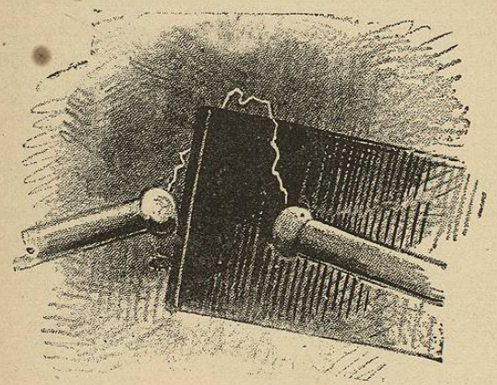
FIG. 365.



Various Phases of the Electric Discharge.

zigzag course, as shown in Fig. 362; and when a very long space separates the electrodes, the appearance of the dis-

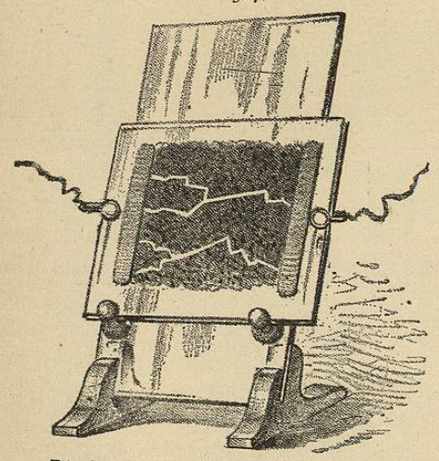
FIG. 366.



Lengthening the Spark.

charge is as illustrated in Fig. 363. In Fig. 364 the discharge of positive electricity to a point is exhibited, and

FIG. 367.



Discharge over Finely Divided Metal.

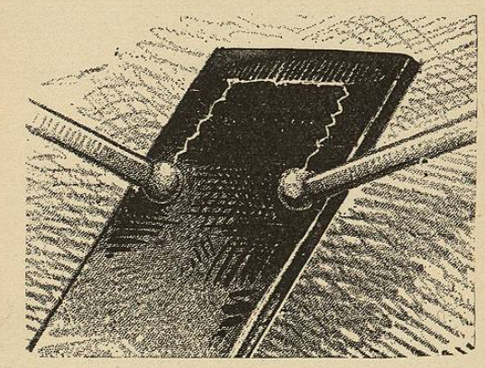
in Fig. 365 the ends of the discharge rods are shown as they appear when a considerable distance apart, the machine being

arranged for the silent discharge. The multiple appearance of the small spark of the silent discharge, when the discharge rods are near together, is shown in Fig. 365*a*.

The report of the discharge is increased when a rubber plate is held between the rods, as in Fig. 366, the spark jumping over the edge of the rubber through an increased distance. Thick cardboard placed in this position is readily perforated, and the spark will pass through a pamphlet one-fourth inch thick.

Fig. 367 shows a glass plate eight inches square, furnished with a coating of finely divided metal. It is covered with a

FIG. 368.



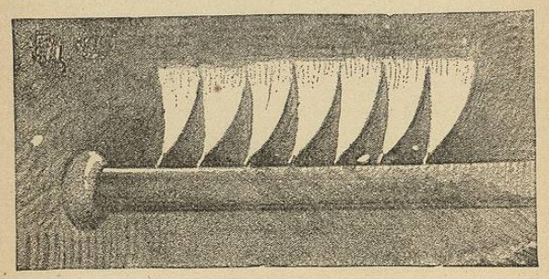
Diversion of the Discharge by Moisture.

coat of thick shellac varnish or other suitable cement, and is thickly sprinkled with brass or iron filings before the varnish begins to dry. When the varnish is thoroughly dry, a band of tin foil is pasted across opposite ends of the glass. When opposite ends of this plate are connected with the conductors of the machine by a wire or otherwise, the discharge takes various courses over the filings, and when the machine is arranged for the silent discharge, the brilliancy of the spark is diminished, while the rapidity of the discharge is greatly increased.

The support shown in Fig. 367 is convenient for exhibit-

ing this class of experiments. It consists of a thick plate of glass supported in a slightly inclined position by two wooden feet. Two knobs furnished with large flanges are cemented to the glass near its lower edge. The

FIG. 369.

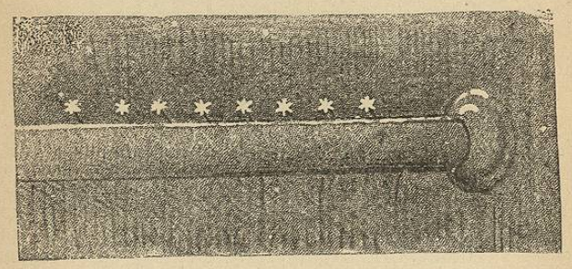


Glow at the Positive Collector.

knobs are sufficiently long to receive a tube or anything of that nature which it is desired to exhibit.

To conveniently connect the luminous panes with the machine, two U-shaped springs may be clasped on the edges

FIG. 370.



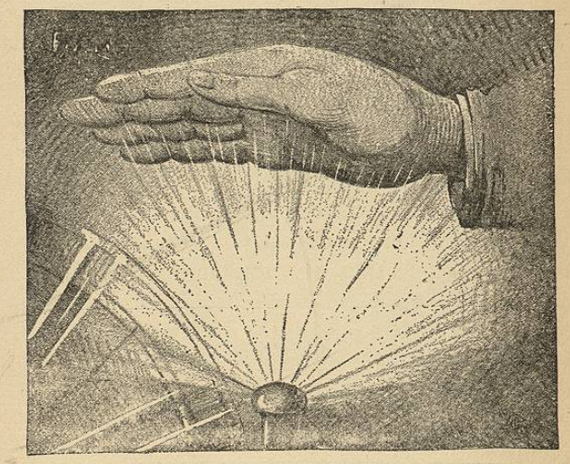
Glow at the Negative Collector.

of the glass, and connected with the machine by large wires. Unless chains with soldered links can be procured, wires or rods with rounded ends are preferable for making electrical connections, as chains afford numerous points for escape of electricity.

A case of the diversion of the electric discharge by exceedingly slight causes is illustrated by Fig. 368. The end of a vulcanite plate is moistened and placed against the ends of the conductors, and moved along so as to make a tracing of the moisture along the surface of the rubber. The discharge will follow these lines of moisture, however slight they may be, in preference to traversing the shorter route between the two conductors.

As to experiments possible with the induction machine, they are endless. The machine itself presents a weird and

FIG. 371.



Effect of the Hand on the Discharge.

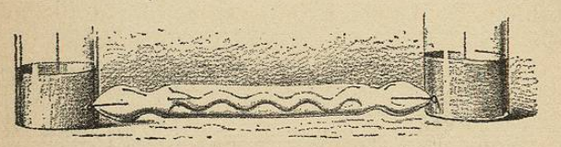
interesting appearance in the dark. From the positive collector a luminous brush extends from each point, as shown in Fig. 369, while on the points of the negative collector only stars or luminous points are seen, as represented in Fig. 370. Besides these effects the inductors glow with a shimmering light, like the aurora. The brushes of the cross-arms are luminous, and all conducting points near the machine are aglow with the lambent light.

When the machine is at rest, if one hand is placed upon the negative conductor and the other hand is held a short

distance above the positive conductor, as shown in Fig. 371, and if an assistant turns the machine, beams of soft purple light will radiate from the knob at the end of the discharge rod toward the hand. In this experiment the jars must be disconnected. No shock will be experienced during this experiment if it is carefully conducted.

Geissler tubes are best exhibited by placing them between the jars, allowing them to nearly touch the outer

FIG. 372.

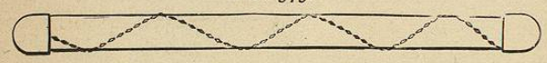


Discharge through a Geissler Tube.

coating of the jars. (Fig. 372.) The conductors should be placed one-fourth inch apart, and the machine adjusted for the silent discharge. Care should be taken in the use of tubes having long, sinuous passages, such as twisted or spiral tubes and the like, as they are very liable to be ruptured by the spark. When such tubes are used, the rods must be as near together as possible without destroying the effect.

Another method of exhibiting Geissler tubes is to hold them in the hand parallel with the face of the revolving

FIG. 373.

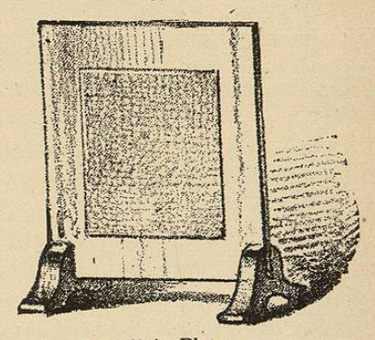


Tube with Interrupted Conductor.

plate, and about three or four inches from the large balls through which the discharge rods pass.

When the electric discharge is over an interrupted conductor, a bright spark appears at every interruption. Fig. 373 shows a tube wound spirally with a narrow strip of tin foil, cemented to it with starch paste, stratena, or shellac varnish. After the cement is thoroughly hard, the tin foil is separated at short intervals, say one-quarter inch, with a knife or file, leaving a narrow space of about one thirty-second inch between the sections. This tube may be from twelve to eighteen inches long, and for the sake of protection may be inclosed in another glass tube. A strip of foil should extend from the extremities of the interrupted strip over the ends of the outer tube. The inner tube may then be stopped with a cork at each end, which is allowed to project a short distance. These corks are rounded at their outer ends, and covered with rather thick tin foil, which is allowed to extend a short distance over the end of the outer tube. This tube, held by one end in the hand and presented by its other end to one of the conductors of the machine, exhibits a brilliant luminous spiral. The brilliancy of the

FIG. 374.



Franklin's Plate.

sparks may be increased by connecting the conductors with the ends of the tube.

By means of a condenser, large quantities of electricity may be condensed upon a small surface.

The various forms of condensers are alike in principle. They consist essentially of two insulated conductors separated by a non-conductor.

The Franklin plate or fulminating pane, shown in Fig. 374, is the simplest form of condenser. It is made by attaching sheets of tin foil to opposite sides of a pane of window glass, leaving a space of two inches all around. It will be found convenient to support the glass upon two