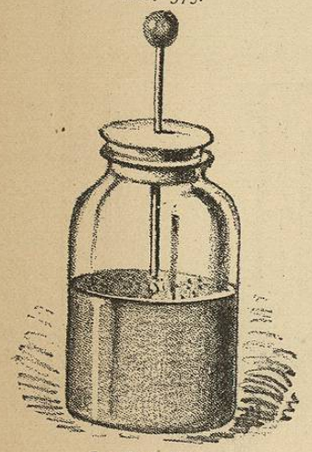
wooden feet, as shown in the engraving. This plate is charged by connecting the tin foil on one side with the ground, and that upon the other side with one of the conductors of the machine. It is discharged by touching opposite sides with a discharger. By connecting opposite sides of the plate with the opposite conductors of the machine, the plate may be charged so that it will discharge over its edges with a loud report.

The Leyden jar, shown in Fig. 375, is nothing more than a fulminating pane rolled up. It may be made by covering a jar over the bottom and about half way up its sides with tin foil, and stopping the mouth of the bottle with a well varnished cork or wooden stopper, through which runs a one-eighth inch wire, having a knob on its upper end, and a piece of chain on its lower end resting on the tin foil lining. The uncovered portions of the glass jar should be coated with shellac varnish. The jar may be made in various sizes, and when the size is so small that it is inconvenient to apply tin foil to the inside, a little shellac varnish may be poured into the bottle, and the bottle coated half way up its sides with the varnish by turning it down upon the side and revolving it. Before the varnish begins to dry, a quantity of metal filings are poured into the bottle and shaken about. They attach themselves to the varnish and form a metallic coating that answers a very good purpose. When the varnish dries, the surplus filings may be poured out and the bottle may be coated with foil on the outside.

FIG. 375.

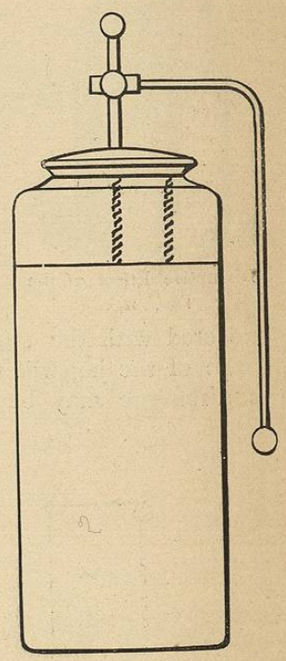


Leyden Jar.

The jar is charged by connecting the outer coating with the ground or with one of the conductors of the machine, and connecting the ball with the other conductor; and it is discharged by touching the ball and the outer coating of the

jar with opposite ends of a jointed discharger. The measuring jar, shown in Fig. 376, is similar to the jar just described, the only difference being the addition of a curved wire having a ball on its lower end, and a support for the wire attached to the vertical discharge wire of the jar. The ball of the additional wire may be placed a greater or less distance from the outer coating of the jar. It is obvious that the jar can never be charged to give a spark longer than the distance between its outer coating and the ball.

FIG. 376.



Measuring Jar.

The disruptive effect of the spark can be readily exhibited by partly filling a glass bottle (Fig. 377) with kerosene, olive, or lard oil, and inserting through the cork a curved wire pointed at its lower end and provided with a ball at its upper end. The pointed end of the wire should be very near the inner surface of the glass, and the ball at the top should be connected with one of the conductors of the machine. The other conductor should be placed opposite the point of the wire and near the side of the bottle.

When the machine is turned, the sparks will perforate the glass, and will continue to pass through until the pointed wire is turned to a new place in the bottle, when another hole will be made. The holes made by the spark are so small that the oil will pass through very slowly, if at all.

Fig. 378 shows a chime of bells operated by the electric discharge. The three bells are suspended from a wire cross arm, which is attached to one of the conductors of the machine or to an insulated support connected with the machine. The two outer bells are suspended with chains,

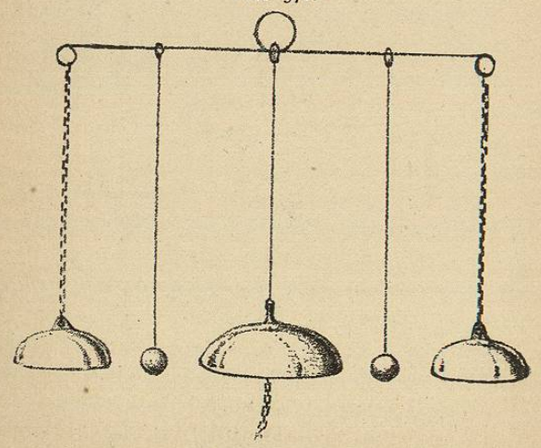
FIG. 377.

Disruptive Effect of the Discharge.

the middle one with a silk cord. Two small metal buttons are suspended by silk threads half way between the outer bells and the middle one, and the middle bell is provided with a chain which rests on the table.

When the machine is turned, the suspended buttons are attracted to the outer bells, and after becoming charged with electricity are repelled by the outer bells and attracted toward the middle one. After parting with their charge they are again attracted by the outer bells, again repelled, and so on. If the bells are connected with the ball of a Leyden jar, and the chain from the middle bell is connected with the outer coating of the jar, a slow discharge of the jar will take place. The time occupied in the discharge may be prolonged by fastening up one of

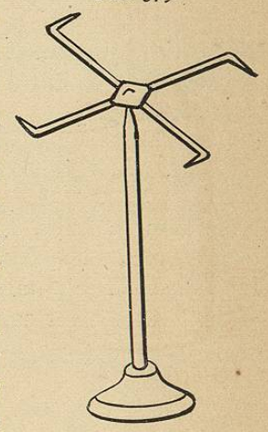
FIG. 378.



Electric Chime.

the buttons so that it will not swing. The electric fly, shown in Fig. 379, illustrates the effect of the electric discharge from points. The fly consists of a piece of metal having a slight depression in the center to receive the pivotal point on which it turns, and having a number of wire arms, pointed at their outer ends and all bent in the same direction. When the pivot of the fly is connected with the machine, the fly revolves in a direction opposite to that of the points. The motion is owing to a repulsion between the electricity of the points and the electricity imparted to the adjacent air by conduction.

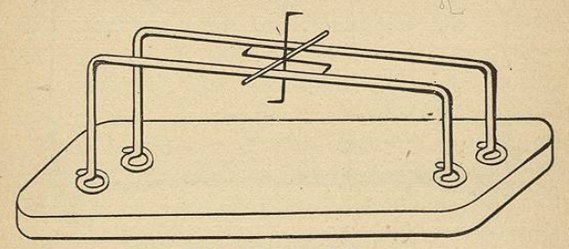
FIG. 379.



The Electric Fly.

Fig. 380 shows a fly mounted on a horizontal axis, the latter being placed on two inclined wires having feet resting on a pane of glass. On connecting the incline with the machine, the fly will revolve and ascend the inclined plane in opposition to gravity. When electricity escapes from a point, the electrified air is repelled so strongly as to blow out a candle.

FIG. 380.



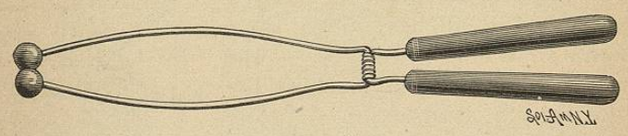
Fly and Inclined Plane.

For various experiments with the electrical machine and with Leyden jars a jointed discharger is required. A simple and inexpensive one is shown in Fig. 381. It consists of two wires bent one around the other to form a joint, and

bent out nearly parallel in one direction to receive vulcanite handles, while the opposite extremities are curved and provided with balls at the ends.

In many experiments in static electricity the wires must

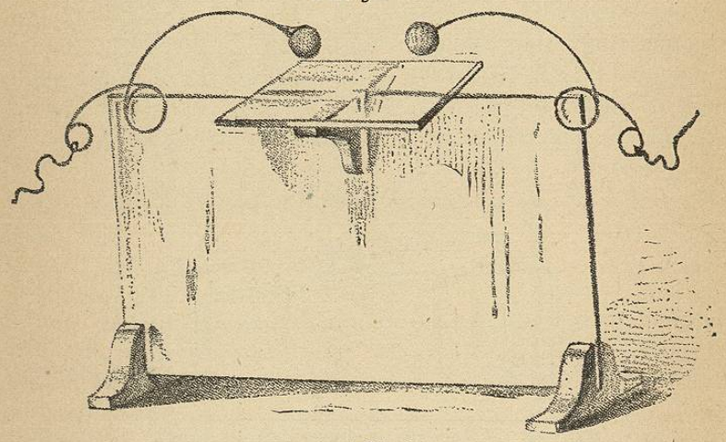
FIG. 381.



Jointed Discharger.

terminate in balls, to prevent escape and to secure the desired form of spark. It is a matter of considerable labor to make a large number of metal balls on the lathe. Balls which will answer every purpose may be cast directly upon the wires by using an old-fashioned bullet mould with a hole

FIG. 382.



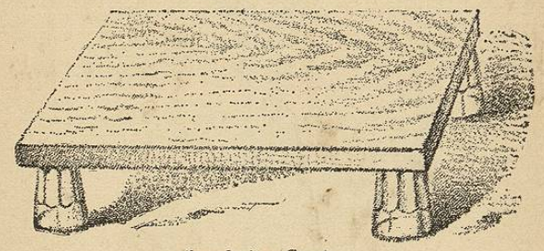
Universal Discharger.

drilled in the bottom to receive the wire upon which the ball is cast. Type metal is excellent for this purpose, but lead will answer very well. An alloy of tin and antimony makes a very fine ball, having the appearance of silver.

In a certain class of experiments the universal discharger

is convenient if not absolutely necessary. A cheap and simple form of this instrument is shown in Fig. 382. It consists of a pane of glass a foot long and six inches high, supported on wooden feet. Upon the upper edge in the center there is a glass table supported by two wooden brackets cemented to both glasses. Upon opposite corners of the upright glass there are two curved wires bent into the form of a spring in the middle to clasp the glass, and having at their upper ends balls and at their lower ends rings to receive the conductors which connect the discharger with the machine. By means of this instrmuent the electric discharge mav be made to pass through or over any substance placed on the glass table.

FIG. 383.

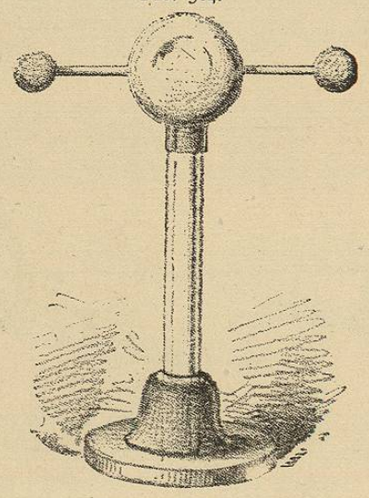


Insulating Stool.

The simplest method of making an insulating stool for supporting a person while being charged with electricity is shown in Fig. 383. It consists of a board resting on four common tumblers. An insulated spherical conductor is shown in Fig. 384. It may be made of any thin metal or it may consist of a pasteboard or wooden ball covered smoothly with tin foil. This sphere is provided with lateral arms terminating in knobs, and is supported upon a glass standard inserted in a wooden base. Fig. 385 shows a cylindrical conductor about four inches in diameter and twenty inches long. It has rounded ends, and is supported on a glass standard at the same height as the spherical conductor. With these two conductors the phenomena of static induction may be exhibited. In each end of the cylindrical conductor is inserted a standard from which two pith balls are suspended by silk

threads. A pair of pith balls may also be suspended at the center of the conductor. Now, by charging the spherical conductor with positive electricity, and bringing it within a few inches of one end of the cylindrical conductor, the pith balls at the ends of the latter will diverge, while those at the center will remain quiet. By testing the charges of the conductor, it will be found that the electricity of the end of the conductor nearest the sphere is negative, while that of the remote end is positive.

FIG. 384.



Insulated Sphere.

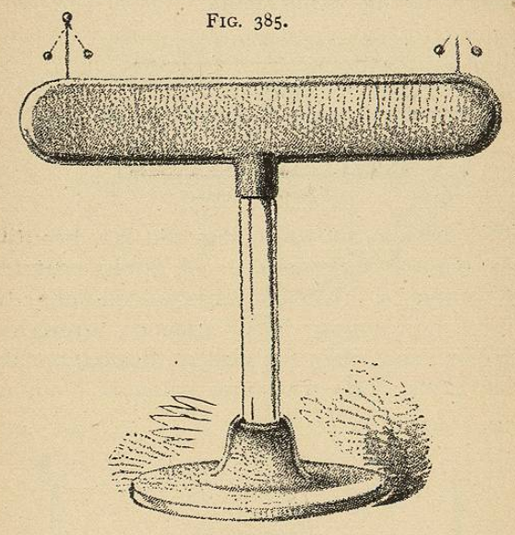
The positive charge of the sphere attracts the negative electricity of the cylinder and repels the positive, thus disturbing the equilibrium which existed before the approach of the positively charged sphere. On testing the middle portion of the cylinder by means of an electroscope, it is found to be neutral.

In Fig. 386 is shown a gas pistol, consisting of a metallic tube permanently stopped at one end with insulating material, and having a wire inserted in the stopper so that it nearly touches one side of the tube. The tube is filled

with a mixture of illuminating gas and air, and lightly stopped with a cork.

An electric discharge through the wire and tube explodes the charge of gas. Fig. 387 shows a somewhat

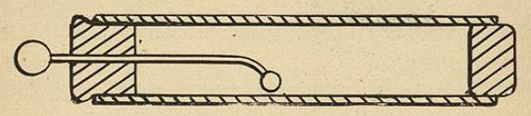
FIG. 385.



Cylindrical Conductor.

similar device for exploding gunpowder. It consists of a block of wood having a central cavity into which are inserted two wires nearly touching. The powder is placed in the cavity, and the spark sent through the wires, and in

FIG. 386.



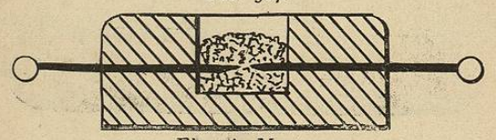
Gas Pistol.

leaping the space between their inner ends, ignites the powder.

Fig. 388 represents a simple apparatus for exhibiting the alternate attraction and repulsion of pith balls when placed

between two metallic plates connected with opposite conductors of the machine. To prevent the pith balls from flying in all directions, they are confined by the glass jar. Four pieces of window glass forming a hollow square may replace the jar in this experiment.

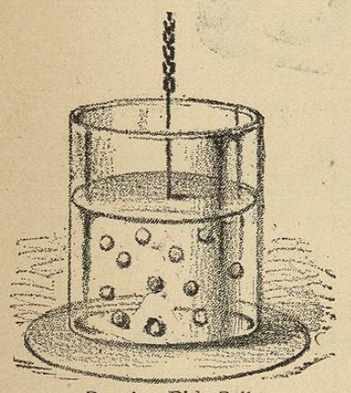
FIG. 387.



Electric Mortar.

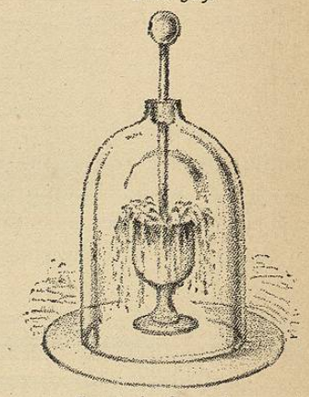
Gassiot's cascade, shown in Fig. 389, is a beautiful experiment, but requires an air pump. A goblet coated with tin foil in the manner of a Leyden jar is placed under the tubulated bell of an air pump; a rod extends through the bell into the goblet, and when the electric discharge takes place (the rod and plate of the air pump being in communication

FIG. 388.



Dancing Pith Balls.

FIG. 389.



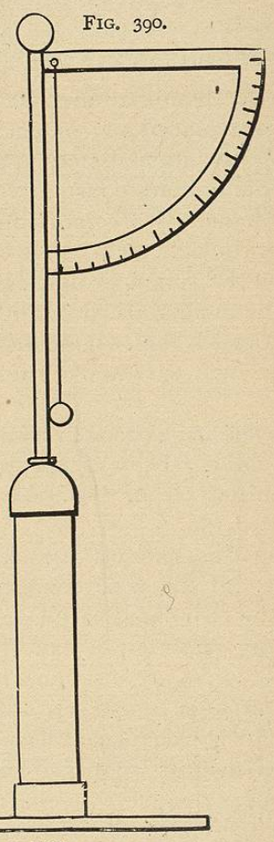
Gassiot's Cascade.

with the machine), a cascade of wavy light overflows the goblet like a fountain.

The pith ball electroscope, shown in Fig. 390, consists of a rod having at its upper end a ball and at its side a scale, from the angle of which is suspended a pith ball on a filament of whalebone. The upper end of the whalebone is formed

into a loop which hangs on a delicate pivot projecting from the scale. This instrument placed on a body receiving an electric charge will indicate roughly the extent of the charge. What has been said covers a very small proportion of the experiments possible in static electricity; but

FIG. 390.



Pith Ball Electroscope.

it is hoped that some of the hints given in regard to the construction of the electrical machine, and some of the apparatus to be used in connection with it, will enable the student of electricity to at least begin a course of experiments which will prove of interest.