poles of the machine are tolerably close together (A Fig. 9) a straight spark is the result.

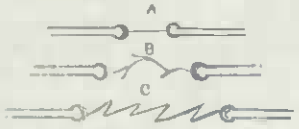

Fig. 9. Electric Sparks.

When the poles are farther apart (B) a sinuous spark is seen; and, when still farther (C), a zigzag course is followed by the electric force. These same varieties of discharge may be seen in the lightning flashes. Here is a plate of glass on which a strip of tin foil has been pasted, and then cut through in the shape of a flower vase. When connection is made with the machine, a spark appears at every cut, and the figure of the vase is clearly seen.

Here too is a long glass tube (Fig. 10), on a convenient stand, with bits of tin foil pasted on the inside in a spiral form. Sparks appear between the tin foil discs when the connection is made, and the spiral figure flashes out in startling brilliancy.

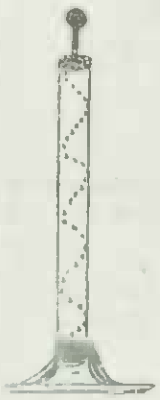

Fig. 10. Spiral Tube.

But perhaps the most beautiful of luminous effects may be realized by passing the current through a tube containing a rarified gas. These tubes are made in great variety of form, and are named from the inventor, Geissler tubes. Several are here connected, and, as the current passes, you see them become luminous, through the incandescence of the enclosed gas; and the result is one of indescribable beauty. (Fig. 11.)

Fig. 11. Geissler Tubes

Every imaginable tint of the rainbow seems to be represented here, in tremulous waves of light.

The room being now re-lighted, we can examine some other effects of this mysterious power. Here are three bells (Fig. 12), two of them suspended by chains from a metallic cross-bar, which I connect with the machine; the middle bell, however, is insulated by a silk thread, a chain connecting with the earth or the other pole of the machine.

As the machine is operated, the little hammers which are hung by silken threads, pass back and forth, being alternately attracted and repelled by the outside and middle bells, and produce a merry jingle, not entirely unsuggestive of sleigh bells.

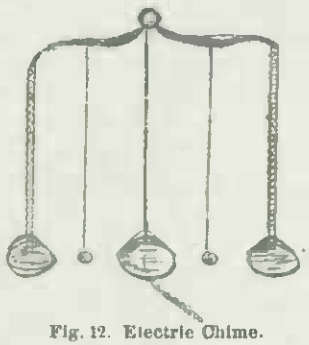

Fig. 12. Electric Chime.

Here too is a vessel, something like a bottle, though instead of a glass bottom it is provided with a metallic base, (Fig. 13). A brass plate is hung within, from a rod of metal passing through the cork and connecting with the machine. The base is in communication with the earth, or it may be joined to the opposite pole of the machine.

Fig. 13. Volta's Hail Storm.

On the base are a number of pith balls; as soon as the machine is worked, you see them dance up and down in merry glee, passing from the upper plate to the lower, and back again with great rapidity. The experiment has been named, Volta's Hail Storm.

One of the most mystical of the many strange effects brought about by the electric discharge, is its power of effecting chemical combination between elements. Here (Fig. 14) is a tin tube—an ordinary canister in fact. A hole has been made in the side near the bottom, a cork inserted, and a metallic rod thrust through the cork, so as to project inside. This has been filled with a detonating mixture of oxygen and hydrogen, and then closed with a cork.

Fig. 14. Oxy-hydrogen Pistol.

As soon as the spark is discharged through the rod, the two gases combine, as you notice, with a deafening report.

But far more powerful than the effects of the best machines, are those of the *condensers* or Leyden Jars. As made now, a Leyden Jar (Fig. 15), consists of a glass bottle, coated with tin foil, within and without for about two-thirds of its height.

Fig. 15. Leyden Jar.

A brass rod communicates with the inner coating and projects above the top. The jar may be charged by holding it in the hand with the knob near an electric machine in action, as you see. To discharge the jar, the separated electricities in the outer and the inner coatings must be brought together. This is best done by means of the discharger (Fig. 16), which consists of a metallic bow, the ends terminating in knobs, and a glass handle affixed to the middle.

Fig. 16. The Discharger.

By grasping the glass handle, and bringing one end in contact with the outer coat of the jar, and the other with the jar knob, a brilliant discharge is the result. If the knob of a charged jar were touched with the hand, the discharge would be effected through the body, and a severe shock would be felt. If the jar were heavily charged, the result would be painful and even dangerous; and if a battery of jars were employed, fatal effects might follow. If a score or more of the audience will join hands we will discharge a feebly charged jar through the company. Judging from the eccentric motions of those operated upon, the demonstration of the physiological effects of the electric discharge is satisfactory.

There is an intimate relationship existing between electricity as developed by the machine, and the lightning of the clouds. Franklin suspected the identity of the two, and proved it in his famous kite experiment; and the practical and useful result is seen in the modern lightning rod.

The effect of points on the electric discharge has long been known. Electricity is discharged from a pointed conductor in a continuous current, without spark or shock. Having removed the terminating knobs from the machine poles, though I operate the instrument rapidly, no spark can be formed; but in the dark, a beautiful brush would be seen terminating the pointed conductors. In such a way does a lightning rod "steal away,"