AUTOGRAPHS OF THE ELECTRIC SPARK.

BY GEO. M. HOPKINS.

Electricity of very high tension, when discharged on the surface of a body having very low conductivity, forms a luminous arborescent image, showing the path of one or more of the sparks resulting from the discharge. The erratic course taken by the spark may be due to the compression of air in the path of the discharge, or to the superior conducting power of some portions of the conductor, or to both.

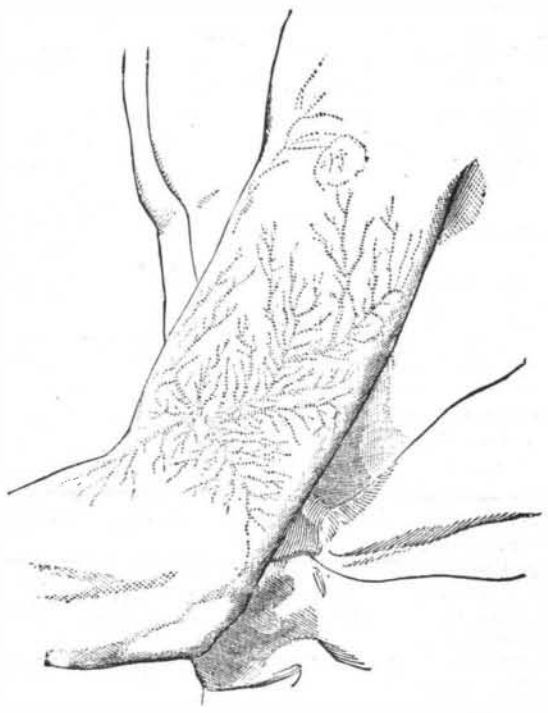

Fig. 1.—MARKS PRODUCED BY LIGHTNING.

The autographic record of such a discharge is sometimes found on the bodies of persons struck by lightning, the tree-like appearance of the marks giving rise to the erroneous notion that the lightning in some way photographs upon the body the image of trees in the vicinity of the catastrophe.

Doubtless the same marks might be produced upon the body by the discharge of a Holtz machine or a large induction coil; but this is an experiment for which it would be difficult to find a subject.

Fig. 1 is an accurate copy of a photograph taken from the arm of a boy who had been struck by lightning. Here the marks bear a striking resemblance to some forms of vegetation.

The writer in striving to secure an autographic record of high tension electrical discharges tried a large number of films before finding one sufficiently delicate to be impressed by the discharge and at the same time having enough firmness to prevent it from being blown away by the spark. A thin film of smoke on glass, fixed by means of alcohol, yielded the first results; but the difficulty of saturating the film with alcohol without destroying it was considerable. Finally, a smoke film formed on glass previously coated very slightly with kerosene oil was adopted as the most practicable. The glass was prepared for smoking by smearing it over with the oil, then removing all but a trace, then smoking it lightly over a very small gas jet or over a candle.

The glass plate thus prepared was arranged between the terminals of the induction coil, at right angles to the terminals, so that the discharge might be directly against the smoked surface of the glass, as shown in Fig. 2.

The coil employed was capable of yielding a 1½ inch spark, and the pointed terminals were separated ½ inch. A single spark, or what appeared to be such, from the negative terminal of the coil produced upon the film a spot like one of those shown in Fig. 3. These spots, to the unaided eye, appear like small holes through the film; but microscopic examination shows them as composed of a large number of very crooked lines cut out of the smoke film, and strongly resembling a tuft of wool. Fig. 4 shows a figure produced by a succession of discharges. These figures indicate the splitting up of the discharge into several branches. It might at first appear that the structure of the film would have some influence on the direction of the discharge and, consequently, on the character of the lines; but the other markings shown are so characteristic, and so evidently independent of the structure of the film, that it seems almost certain that the nature of the film had very little to do with the direction taken by the spark.

Figs. 3 to 7, inclusive, are photo-micrographs of various marks produced in the manner described, taken under a magnification of 20 diameters, and the engravings of their electro-autographs are produced by photo-engraving, without any additions or modifications whatever, so that faithful reproductions of the original work done by the electrical discharge are presented herewith. The figures numbered 3 to 6 were produced by the discharge from the negative terminal of the coil, while the marks shown in Fig. 7 were made by the discharge from the positive terminal.

The sagittate form of the larger marks in Fig. 5 are produced by a heavier discharge, and are suggestive of infernal origin. The sagittate and bird-like forms shown in Fig. 6 are of rare occurrence, but they are of substantially the same nature as those shown in Fig. 5. Figures resembling these have been seen in vacuum tubes, and sketched by De La Rue. Reproductions of some of his drawings are given in Fig. 8. 1 in this cut shows striæ in which each section resembles an arrow head, the points always extending toward the negative conductor. 2 shows the tendency of striæ to become conical. 3, 4, and 5 show sagittate forms similar to those shown in the autographs, Figs. 5 and 6, but the images of them vanished when the current ceased. 6 in Fig. 8 shows forms taken by the discharge from the positive terminal in a vacuum tube, which have substantially the same appearance as the marks shown in Fig. 7.

Two peculiarities are noticed in the marks in Fig. 7,

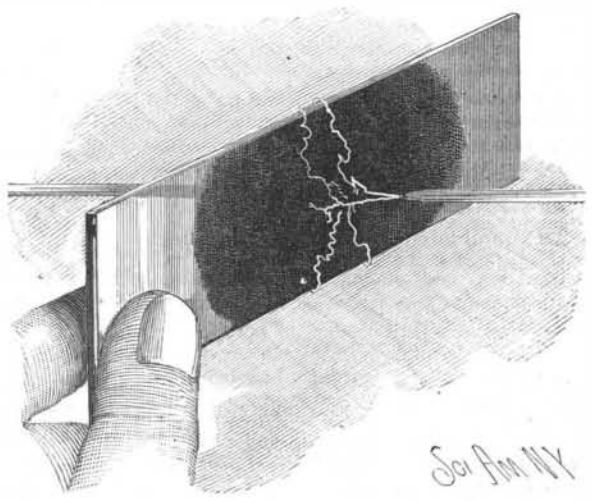

Fig. 2.—POSITION OF THE PLATE BETWEEN THE TERMINALS.

one being the longitudinal grooves in each mark, the other the evidences of the ricocheting of the spark.

De La Rue says: "The gases, in all probability, receive impulses in two directions, at right angles to each other, that from the negative being the more continuous of the two." The autographic records here shown seem to bear out this theory, since all of the arrows have lateral enlargements and point toward the negative.

The longitudinal groovings of the marks made by the sparks from the positive terminal are suggestive of a multiple discharge.

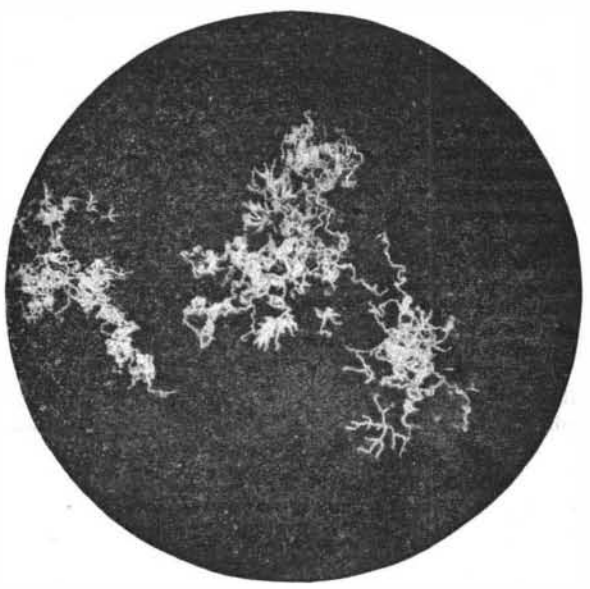

Fig. 3.

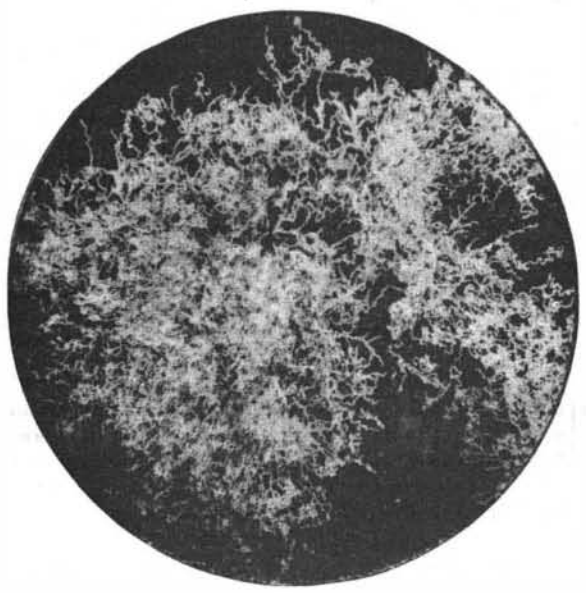

Fig. 4.

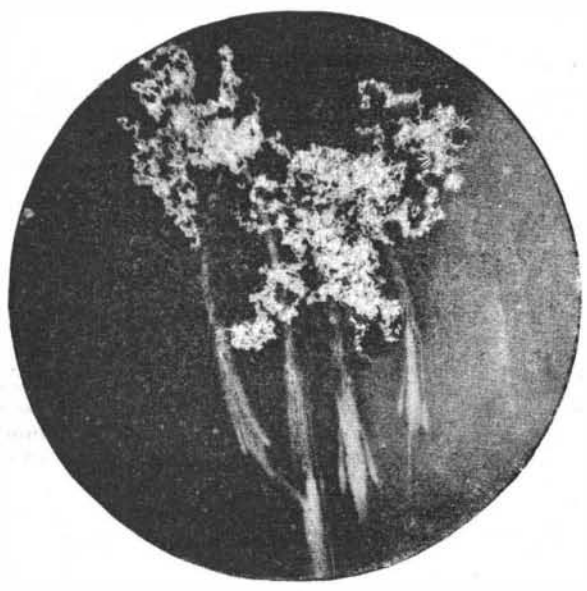

Fig. 5.

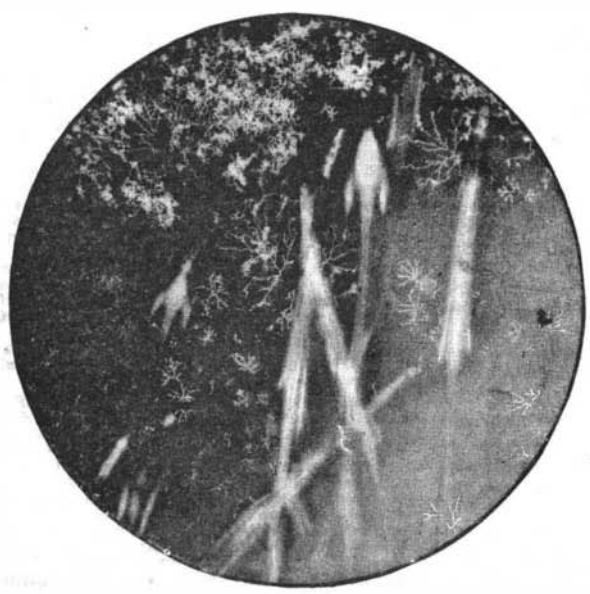

Fig. 6.

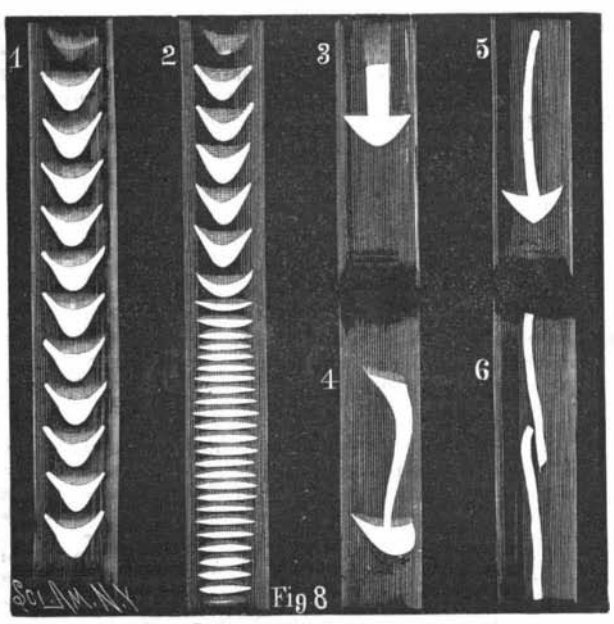

Fig. 8.

Fig. 7.

Figs. 3, 4, 5, 6, and 7.—AUTOGRAPHS OF THE ELECTRIC SPARK. Fig. 8.—FIGURES FORMED BY THE ELECTRIC DISCHARGE IN VACUUM TUBES.