TWO PROJECTION DEMONSTRATIONS IN ELECTROSTATICS.

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1. The apparatus shown in Fig. 1 has been devised and successfully used by the writer in demonstrating that static electricity resides only on the outer surfaces of conductors, when they enclose no charge. A sheet of thin galvanized iron or tin plate, say 6 in. by 1½ in., is cut to the form shown at A in the figure. To this is hinged, as shown, the piece B, and to this again the piece C. On each side of A are two leaves of gilt paper (L, L) hinged to small eyes with fine wire. These are shown in deflected position in Fig. 1 and the detail of the hinge is given in Fig. 2. Gilt paper leaves are used as either gold or aluminum leaf is too much affected by the air currents due to the heat of the beam from the lantern. Gilt paper is sufficiently light to make a

Fig. 1.

Fig. 2.

good indicator yet it is heavy enough to be unaffected by the air currents. If the hinges are carefully made there is no trouble with the leaves. The whole system is insulated from the stand by mounting on a block either of ebonite or of sealing wax. A silk thread (T) to the bottom of C completes the apparatus.

The demonstration is as follows: Placing the apparatus in the lantern with its plane at right angles to that of the condenser, one charges it from a rubbed ebonite or glass rod. The leaves are seen

to rise equally on the opposite sides of A. Now by pulling on the silk thread the hinged pieces are raised into the position

Fig. 3.

shown in Fig. 3, enclosing one of the leaves, which immediately falls to its zero position, while the other leaf increases its deflection. On slackening the silk thread the hinged pieces fall into a vertical plane and the leaves return to their former positions. The hinged pieces may now be raised so as to enclose the other leaf with like results.

The behavior of the leaves thus makes it quite plain that the electricity always passes to the outer surface. The experiment is used

to supplement the classic "butterfly net experiment" of Faraday and not as a substitute for it. Approximate dimensions may be obtained from Fig. 3 where the dotted circle indicates the area and position of the lantern condenser.

2. Modification of Mach's apparatus for showing the variation of surface density with change of curvature. Four pieces of thin metal are hinged together as shown in Fig. 4, the lower pieces hinging on part of the rectangular wire frame F. The hinge of the upper pair is extended so as to embrace the vertical sides of the frame, thus acting as a guide. The lower plates are cut away at the center, and two small gilt paper leaves (L, L) are hinged to the horizontal part

Fig. 4.

of the wire frame F, as shown in Figs. 4 and 5. This makes them perfectly free of the motions of the plates. F is insulated by a bit of sealing wax and a silk thread T to the guide rings of the upper hinge enables one to alter the angle of the lower plates at will.

If the apparatus be set in the lantern the hinged plates may be raised, by means of the thread so as to show first, that the movement of the plates causes no separation of the indicating leaves. After charging the system, however, the action of the leaves shows that there is a greater density of electricity at the lowest edge when the angle is acute than when it is obtuse. The axis of the leaves, it will be noted, is the point to which the attention of the class is especially directed, and with this design this is the point that remains stationary during the whole demonstration. This

Fig. 5.

is of importance in the pedagogics of the design of demonstration apparatus. The idea and the essential features of the apparatus are of course Mach's, but the ease of operation and the effectiveness of the experiment are, it is thought, better in the form just described than in the older one.

Note—In both of the above the silk thread must be quite clean and dry. It is often best to put on a new thread just before the class is to be met. In any case a bent pin stuck into the end of a bar of sealing wax will give a satisfactory insulating handle that will work in all weathers. The silk though is better, when possible, as it is finer and so does not look so clumsy on the projection screen.

A very strange and interesting fact in connection with the gold-bearing gravels in the Dawson district is that some are frozen even as far down as 250 ft., and some only to the depth reached by a single season of frost; and another strange fact is that in the frozen gravels the ice is free from detritus. The presence of ice to such great depths suggests a long period of very severe frost. The exact time of this severe frost it would be impossible to say, but it must have been previous to the formation of the creek deposits, which are not frozen. The absence of detritus in the ice, it is said, would suggest that the water was not in motion.