

determining to a certain extent the general direction of the isoclinal lines by graphic projection.

The observations are arranged in two tables—Table I. recording those taken during the outward and homeward voyages to and from Singapore, and Table II. containing those made in the eastern seas from Singapore up to Nicolaevsk on the River Amur. They are arranged in order of the latitudes of the places visited; but in all cases where the observations have been subsequently repeated at the same station, all those taken at the same place are noted in the Table in succession.

Finally, the author has added a few remarks suggested by a comparison of these observations with those formerly taken by him during his previous visits to China and Japan, 1857–59.

XX. “Experiments on Contact Electricity between Non-Conductors.” By JOSEPH THOMSON, Student at the Physical Laboratory of Owens College. Communicated by B. STEWART, F.R.S. Received May 23, 1876.

It was observed that when a plate of copper was lifted from a plate of glass the copper was electrified, and also that when a plate of glass was lifted from a plate of wax the glass was electrified, care being taken to have as little friction as possible; it was afterwards found that the former experiment had already been made by Fechner (see Wiedemann’s ‘Galvanismus,’ page 21), who also tried lifting copper from sulphur and got the same effect; although the plates were lifted as carefully as possible, yet it was not certain that friction had been entirely got rid of, so the following experiments were made to show that there is an electrical displacement when two non-conductors or a conductor and a non-conductor are put in contact without friction.

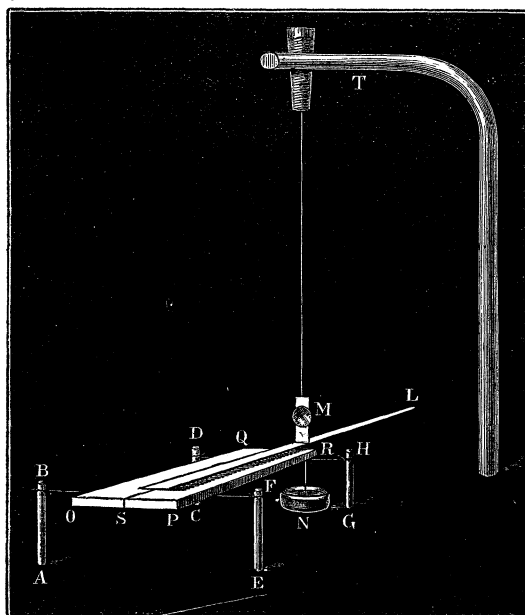
The arrangement used was as follows :—

Glass rods, AB, CD, EF, GH, were fixed in a wooden frame ACGE; round these rods silk threads, BF, DH, were wound; an aluminium needle carrying a mirror, M, was hung by a silk thread from a brass rod, T, fastened in the wooden frame; a wire from the needle dipped into a glass vessel, N, containing sulphuric acid; a small magnet was fastened to the back of the mirror, and a glass case was placed over the whole; outside the glass case were magnets, by means of which the position of the needle was regulated; a wire also from the outside dipped into the vessel N, and was used to charge the needle with electricity; positive electricity was got from an ordinary electrophorus, negative from an electrophorus in which the resin was replaced by a plate of glass which was excited by silk. If wax and glass were the substances experimented on, a cake, OQRP, was made, one half of which, OSQ, was glass, the other half, RPS, being wax; the junction of the wax and glass was parallel

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to OQ, the wax sticking fast to the glass : this cake was then placed on the silk threads under the needle, and it was found possible to bring the



needle into such a position that when it was charged with positive electricity it was deflected from the glass part of the cake, when charged with negative it was attracted towards it. In order to get rid of any electricity which might have got on the cake in the making, the cake was made the day before it was placed on the threads, and the experiment was made at least a day, sometimes a week, after putting the cake on the threads ; pieces of glass and sulphur which had been treated in as nearly as possible the same way as those of which the cakes were made were taken and placed separately on the threads, but no electricity could be detected on them.

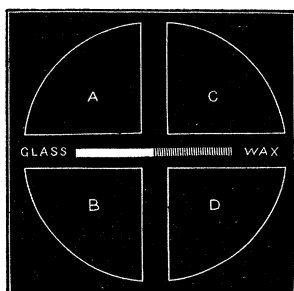
The following cakes were tried :—

Glass and wax	glass +, wax — ;
Glass and resin	glass +, resin — ;
Glass and sulphur	glass +, sulphur — ;
Glass and solid paraffin . .	glass +, paraffin — ;
Zinc and sulphur	zinc +, sulphur — ;
Sulphur and vulcanite . . .	vulcanite +, sulphur — ;

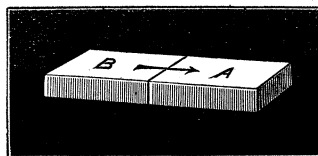
the series so far being in the same order as the frictional series : this seems to suggest that the electrical displacement which takes place when two non-conductors are put in contact acts as a predisposing cause, in

virtue of which the work done by rubbing them together is converted into electrical separation.

The following experiment, suggested by Dr. Schuster, was also tried : the needle was taken out of a Thomson's quadrant electrometer and replaced by a needle, half of which was sealing-wax and the other half

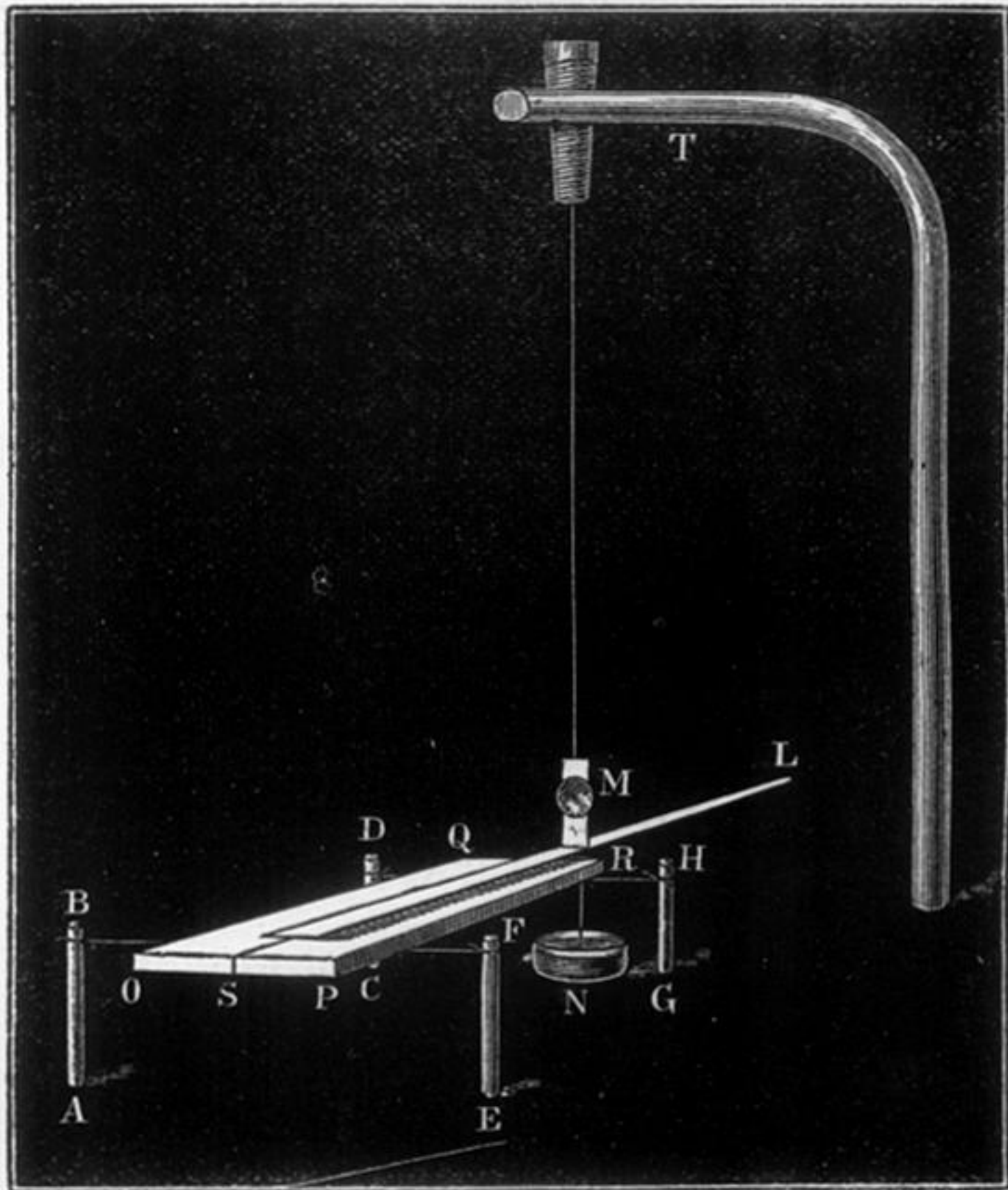


glass ; the quadrants C and D were connected with the earth ; and it was found possible, after the needle had stood undisturbed for ten days, to set the needle in such a position that when the quadrants A, B were charged with negative and positive electricity respectively, the needle rotated in the direction of the hands of a watch, and when A and B were charged with positive and negative electricity respectively, the needle rotated in the opposite direction.



When two non-conductors, A, B, are placed in contact, the electricity will not be distributed through the whole of A and B ; and if the displacement is from B to A and parallel to the sides of the cake, the only parts electrified will be the middle and ends of the cake ; the A end of the cake will be positively and the B end negatively electrified ; and if A has a greater specific inductive capacity than B the middle will be negatively electrified ; if it has a less specific inductive capacity than B it will be positively electrified.

I intend to examine more substances, and to endeavour to make some quantitative measurements. The above experiments were made in the Physical Laboratory of Owens College, Manchester ; and I have much pleasure in thanking Dr. Stewart, Dr. Schuster, and Mr. Kingdon for the assistance they have given me.





GLASS



WAX

