V. "Experimental Researches on the Electric Discharge with the Chloride of Silver Battery." By Warren De La Rue, M.A., D.C.L., Ph.D., F.R.S., and Hugo Müller, Ph.D., F.R.S. Received December 21, 1883.

Plasticity and Viscosity of Strata.

During our experiments we have often been struck by the evident plasticity of strata whose form at times becomes modified when they meet with an obstacle or are influenced by other causes, as, for example, the crossing of other strata produced by a separate discharge;* and we have stated in Part IV of our researches that "one cannot but be impressed from this (an experiment therein spoken of) and others before,† and herein described, by the apparent plasticity of the aggregate assemblage of molecules which constitute a stratum." In all probability the molecules are being continuously thrown off and are replaced by others which become controlled and held in position by the same balance of forces as those they replace.

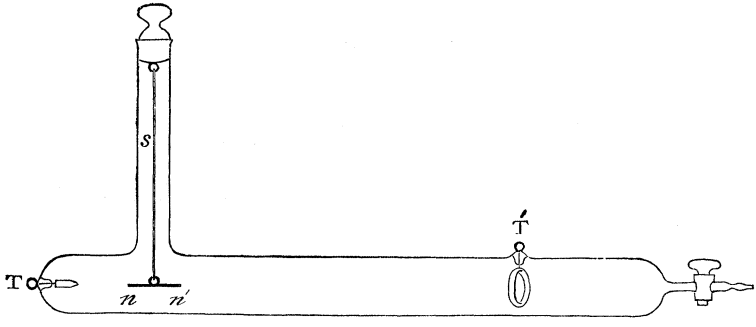
One of our tubes, No. 9, with a residual hydrogen vacuum, has a diaphragm in the centre $\frac{1}{4}$ of an inch, 0·63 centim., thick, through the centre of which there is a hole $\frac{1}{4}$ of an inch, 0·63 centim., in diameter. To the end of the tube is attached a potash absorption chamber, the heating and cooling of which causes a change in the number of strata; when the number of strata increases they approach closer and closer to the diaphragm, and occasionally one threads itself through it, as if squeezed through, and its form is gradually changed thereby; when by a change in the temperature of the absorption chamber, the number of strata becomes less, the stratum which had been forced through the hole in the diaphragm returns through it, its form becoming modified to enable it to do so.

A tube, No. 368, fig. 1, with a hydrogen residue gives evidence of the viscosity of a stratum.

The tube is 14·5 inches, 36·8 centims., long, and 1·5 inches, 3·8 centims., in diameter, 9·75 inches, 24·8 centims., distant between the terminals, a point T and a ring T′. At right angles a tube of smaller diameter is attached 5 inches, 12·7 centims., long; in this tube is a stopper having a loop underneath from which is suspended by two silk fibres, s, a piece of decarbonised iron, n n', $\frac{5}{8}$ inch, 1·6 centims., long, and 0·026 inch, 0·66 millim., in diameter. The stopper when greased turns quite smoothly, and by turning it the needle can be easily placed in any direction with regard to the tube.

* "Phil. Trans.," Part II, vol. 174, p. 393. Separate copy, p. 220.
† "Phil. Trans.," Part I, vol. 171, p. 257. Separate copy, p. 192.

FIG. 1.



In the first place the tube was placed in the magnetic meridian, and the needle of iron wire, *n n'*, in the same direction; tested by means of a very small magnet, both ends were equally attracted, showing that the needle had been thoroughly decarbonised; this was done by heating it to redness for many hours in peroxide of iron, prepared by burning its oxalate.

The discharge was in the first instance passed from the ring to the point, so that the needle was in the dark space; no magnetism was developed in the needle, which would have been the case if the discharge had had a spiral motion as we have often observed and described to be sometimes the case.* It was with the object of ascertaining this fact that the apparatus had been made.

FIG. 2.

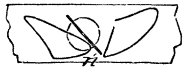
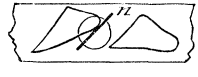


FIG. 3.



The needle was now placed at right angles to the tube, and the point made positive; after a few trials at different exhausts a beautiful tongue-shaped stratification was obtained, and it was then possible to make the apex of a stratum impinge on one or the other end of the needle, figs. 2 and 3, on whichever end the stratum touched, the needle was pushed away from it, showing clearly that the balance of forces which hold together the molecules composing a stratum are sufficient to render it viscous, and unyielding to a small resistance. With disk or saucer-shaped strata the whole length of the needle being touched at the same time, it had no tendency to turn it on its axis, but became agitated when touched by strata.

* "Phil. Trans.," Part I, vol. 169, pp. 250–253, 255–263, 265.