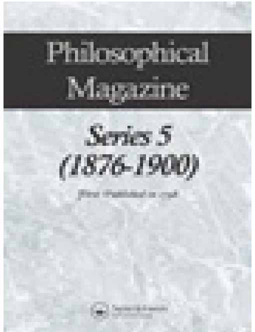


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# LVI. On the influence of proximity of mass upon electric conduction-resistance

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# LVI. *On the Influence of Proximity of Mass upon Electric Conduction-resistance.* *By* Dr. G. Gore, *F.R.S.**



IN a previous research on the Influence of Proximity of Substances upon Voltaic action (Phil. Mag. June 1897), I have shown that the presence of a mass of a heavy substance near one of the electrodes of a voltaic cell alters its electromotive force; and as I have since then made a very tedious research to determine whether the same influence affects the electric conduction-resistance of metal wires, I beg leave to describe, in the briefest possible form, the general arrangement adopted for testing the question.

The apparatus employed consisted of an Elliott's differential galvanometer ("No. 96" in their catalogue), having a resistance of "3140 ohms" in each coil, and a six-inch cube of lead weighing nearly eighty pounds divided in two halves vertically, and having spaces cut out of its opposing surfaces to receive a coil and thermometer. Two coils were employed, each being about $\frac{3}{4}$ inch diameter and $2\frac{1}{8}$ inches long, the insulated copper wire upon each being ·002 inch diameter, and having a resistance of "7432 ohms at 15°·5 C." Two similar and very sensitive thermometers were also used, readable to a one-hundredth of a C. degree, and verified at Kew.

Sufficient uniformity of temperature of the coils and thermometers was secured by enclosing them in a nest of five wooden boxes with intervening layers of cotton-wool and sheets of brightly tinned iron, with layers of flannel outside; the inner box contained two smaller ones, 6 inches square and 3 inches apart, to contain the cube of lead, the comparison coils, and thermometers. The nest of boxes was placed in a carefully selected situation, so that the average temperatures of the thermometers when in the two small boxes were as nearly as possible alike.

Equal rates of transmission of temperature from the external atmosphere to the centres of the small boxes when the leaden cube was in place, so that each thermometer arrived at a maximum or a minimum at the same time, were ultimately secured by lining the entire surface of the empty box with plates of paraffin one inch thick.

The coils employed consisted of the pair of copper ones already mentioned; a second ditto about $3\frac{1}{2}$ inches long, wire ·003 inch diameter, and resistance about 350 ohms; a third pair about $5\frac{1}{2}$ inches long, wire ·003 inch diameter, and resistance about 350 ohms; and a fourth of aluminium wire, $5\frac{1}{2}$ inches long and $\frac{3}{4}$ inch diameter, wire ·003 inch diameter, and resistance of about 1800 ohms. The covered wire upon all the coils was carefully insulated with paraffin.

* Communicated by the Author.

The sources of voltaic current employed varied from a single couple to four hundred in series of small copper and zinc plates in a slightly acidified solution of sodic sulphate, the galvanometer being used differentially and the current divided in parallel between the coil in the lead and that in the paraffin-box. With the four hundred cells a considerable current passed.

The greatest care was taken to adjust the galvanometer to perfect neutrality with the full current passing, and to make each pair of coils perfectly equal in resistance when placed together in the centre of the space between the two small boxes and at exactly the same temperature.

After very numerous experiments extending over many months; frequently exchanging the situations of the coils in the cube of lead and the paraffin-box; making corrections for minute differences in the two thermometers and small changes in the galvanometer; and in all cases taking the observations of conduction-resistance when the two coils were at exactly the same temperature in the two boxes, no perceptible difference could be detected in the resistance of either of the pair of coils by the influence of the lead: the influence of the lead, therefore, if any, must have been excessively minute. A single millimetre of movement of the reflected image upon the scale at a distance of one metre from the needles could easily be detected; and the current from a single cell of the battery was quite sufficient to send the image rapidly off the scale when the galvanometer was used nondifferentially.

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## LVII. *On the Damping of Galvanometer Needles.* By Maurice Solomon*.

IT is well known that shortening the period of oscillation of a galvanometer-needle by increasing the strength of the magnetic controlling field decreases the *decrement*, or ratio of one complete swing to the next. It follows therefore that for a given initial amplitude of vibration a needle swinging in a strong controlling field will make a greater number of oscillations before coming to rest than when swinging in a weak field; but since the time of each oscillation is less in the former case it does not follow that the time required for the amplitude to be reduced to a given fraction $\left(\text{say } \frac{1}{m}\right)$ of its initial value is greater with a strong than with a weak controlling field.

* Communicated by the Physical Society: read March 9, 1900.