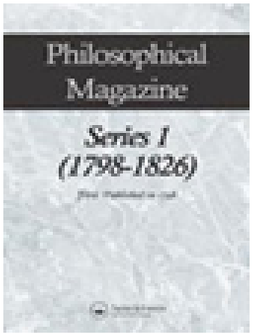

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Philosophical Magazine Series 1

ISSN: 1941-5796 (Print) 1941-580X (Online) Journal homepage: http://www.tandfonline.com/loi/tphm12

XLIV. On electricity

Mr. George John Singer

To cite this article: Mr. George John Singer (1813) XLIV. On electricity , Philosophical Magazine Series 1, 42:186, 261-264, DOI: 10.1080/14786441308638328

To link to this article: http://dx.doi.org/10.1080/14786441308638328

P. 68, l. 17, in clay-pits *.—* These alluvial Marl-pits with Granite and other foreign Bolders, extend into the NW corner of Derbyshire, Rep. i. 456.

69, l. 22, denominated *rents* *.—* Mr. B. seems here alluding, to the nearly vertical *joints*, slines cutters, &c. between blocks of stone, or masses of Coal, &c. which are generally peculiar or confined to each bed; and should not therefore have been confounded by a common term, with the vastly different phænomenon of *Faults*, as is done in page 47, see my Note on page 162.

72, l. 3, to mica slate *.—* Did not Mr. B. note, in his Woburn observations, that the micaceous stones alluded to, were worn and decomposing pebbles among the Gravel?. I have found such, very plentifully, on the lower chalk hills NE of Dunstable, and they have also reached Derbyshire, with many of their travelled companions, see Rep. i. 466.

73, l. 10, of statuary marble *.—* Mr. John Lingard, the occupier of Lodge Farm in Great-rocks Dale in Derbyshire, showed me small specimens of white granular Marble, scarcely if at all distinguishable from foreign statuary, which came I believe from a Dyke or vein of this stone, which there intersects the 4th Limestone Rock, Rep. i. 414.

83, l. 9, secondary rocks (6)*.—* In a note on page 45, I have already expressed a doubt, on the reality of such *strata* as are represented, No. 6, in fig. 1, plate I. and shall feel obliged to Mr. B. if he will particularly point out as many undoubted cases of the kind, as he can.

My next communication commences Mr. B's 4th Chapter, and shall be sent in due time.

I am, sir,

Your obedient servant,

Upper Crown-street, Westminster, 26th July, 1813. JOHN FAREY Sen.

XLIV. *On Electricity. By Mr.* GEORGE JOHN SINGER, *Lecturer on Chemical and Experimental Philosophy.*

THE phænomena observed in an experiment detailed in the last number of this Magazine*, as indicative of a double

* Page 161.

current in the discharge of the Leyden jar, have been the subject of consideration with all practical electricians since the year 1760, when an account of them was first published.

In the fifty-first volume of the Philosophical Transactions (page 171 and following) Mr. Symmer has given an account of some experiments that led him to suspect the existence of a double current in the discharge of the Leyden jar: that which appeared to him to afford the most satisfactory evidence was the following.

He placed a slip of tinfoil in the middle of a paper book (the thickness of a quire), and, passing an electric charge through it, observed that the leaves on each side the tinfoil were pierced; the tinfoil itself was not perforated, but an indentation was made on each of its surfaces at a little distance one from the other: these indentations were *opposite the holes in the paper*, and evidently pointed in opposite directions.

In another book of the same thickness, he placed two slips of tinfoil with the two middle leaves of the book between them; and he states that all the leaves of the book were pierced, excepting the two that were between the slips of tinfoil: and in these two instead of holes the two impressions in contrary directions were very visible.

I have frequently repeated Mr. Symmer's experiments. The result of the first is usually as he has stated, but the phænomena of the second are somewhat different. When the two middle leaves of a paper book are inclosed between two slips of tinfoil, and a sufficiently powerful charge is passed through the book; *all the paper leaves are pierced*, and *each slip of tinfoil* has *two indentations* in *opposite* directions and in *different parts* of their opposite surfaces. Consequently, if these impressions are caused by distinct currents of electricity, there must be *four* currents to produce this effect.

But the phænomena were still more remarkable when I introduced between the leaves of a quire of paper, *six* slips of tinfoil, each pair separated by three leaves of paper. The charge perforated all the paper leaves, but in different places, and *each slip of foil had an indentation on each of its surfaces*, and consequently in opposite directions; so that, according to Mr. Symmer's reasoning, there must have been *twelve* distinct electric currents.

The perforations in the paper were never in a right line through the separate strata; and consequently the indentations on the *opposite* surfaces of each slip of tinfoil were at

at some distance from each other, and sometimes considerably so, being at the opposite extremities of the slip: but *each impression was immediately opposite to the perforation in the paper contiguous to it;* so that an *upward impression*, and an impression *downwards* on two opposite tinfoil slips, resulted from the perforation of *each* interposed stratum of paper: which is a sufficient proof that the effect arises from the *expansion caused by a spark at each interruption of the metallic circuit*, and *not* from any effect of opposite currents.

When a card or quire of paper is pierced by a charge passed through wires applied to its opposite surfaces, there is but one interruption of the metallic circuit, and consequently but one spark; this produces an expansive effect, which will operate with the greatest force where it finds the least resistance; which will be at the opposite surfaces of the card or paper: consequently a bur or protrusion will take place at those surfaces, and if any soft substances are contiguous, they will receive an impression, although they are *out of the circuit*, and of course could not be affected by a current either way. But if a series of cards or strata of paper are placed on each other, and separated by as many slips of tinfoil, the interruptions in the metallic circuit will be as numerous as these slips; and as a spark will take place at each interruption when a charge is passed through them, an expansive effect will be produced by the perforation of each stratum of paper, and this expansion must necessarily indent the tinfoil contiguous to its opposite surfaces, and consequently produce two indentations in opposite directions. The slips of tinfoil may be considered as stepping-blocks for the electric fluid, which does not (in consequence of their extension) pass in a right line, but through the *least resisting part* of each interposed stratum of paper.

The truth of this explanation is evident from other phænomena attending the experiment; for, allowing it to be correct, the effect of expansion may be expected to be most considerable when the slips of tinfoil are at the greatest distance from each other, as the spark then passes through a greater interval: and it will be found that the impressions are better defined and deeper, when *several sheets* of paper are interposed between each pair of tinfoil slips, than when they are only separated by a *single sheet*.

An additional confirmation of this fact has also occasionally occurred in my experiments. In varying Mr.

Symmer's arrangement, by including a *single leaf of paper* between two tinfoil slips in the middle of a book; it has sometimes happened that the perforation of the paper took place in a *right line*, and in such cases *both slips of tinfoil have been indented in one direction only*, and invariably in a direction from the positive to the negative surface.

From these facts, (and from various others, which if my leisure permitted I could state,) I feel authorised to conclude that Mr. Symmer mistook the expansive effects of electricity for an evidence of its direction; and that Mr. E. Walker has ingeniously amplified this error by adducing in his second experiment two opposite impressions, which are produced *out of the electrical circuit*, as an evidence of opposite currents supposed to take place *within it*.

With respect to the *permanence* of the effects produced by electrical influence, Mr. W. has fallen into error by confounding them with *communicated* electricity. If, after bringing an electrified body near an insulated conductor, on withdrawing it the insulated conductor remains permanently electrified, it must have *lost* or *received* electricity; and in either case it is electrified by *communication* and *not by position*, whether its loss or gain be the consequence of the contact of some conducting body, or the imperfection of its own insulation during the disturbance of its natural electricity; and *one of these causes must operate* to produce *permanent electricity* in such an experiment: for *neither an insulated rod* nor a *gold-leaf electrometer*, if *properly constructed*, will be permanently electrified by approximation to an electrified body; unless they *communicate* by *imperfect insulation*, or *pointed terminations with surrounding unelectrified substances during such approximation*. These are facts, which the constant repetition of such experiments professionally enables me to state with confidence; and they are indeed such as amongst electricians are generally admitted: but perhaps Mr. Walker has yet to learn, that a conducting body supported by dry glass, and surrounded by dry air, may be still very far from perfectly insulated.

London,
Oct. 12, 1813.

G. J. SINGER.

XLV. *An*