XLIV. Electro- and thermo-magnetical experiments

William Sturgeon

To cite this article: William Sturgeon (1824) XLIV. Electro- and thermo-magnetical experiments , Philosophical Magazine Series 1, 63:312, 266-268, DOI: [10.1080/14786442408644504](https://doi.org/10.1080/14786442408644504)

To link to this article: <http://dx.doi.org/10.1080/14786442408644504>

Published online: 27 Jul 2009.

Submit your article to this journal [↗](#)

Article views: 2

View related articles [↗](#)

$$a = 3 - \lambda$$

$$\psi = z$$

$$r = a(1 + \alpha) \sin \theta. \int \frac{2dz(1-z)}{\sqrt{\cos^2 \theta + (6i - 4i\lambda)z + 2i\lambda z^2}} :$$

and in this case we have an exact value of the refraction in finite terms; the formula being integrable. Now the horizontal refraction at p. 148 of the Journal is included in the expression we have just found. Again, my general equation

between the pressure y and the density z , is $y = z^{\frac{m+1}{m}}$; and when $m=2$, $y=z^{\frac{3}{2}}$ which is the particular case in the Journal; and when $m=4$, $y=z^{\frac{5}{4}}$ which is the case I have chosen as best representing the state of the atmosphere. Yet it seems to be insinuated in the Journal that something is found out different from my theory, and about as good. Now this is nothing else than taking away from a person the result of his own labour, and turning it against himself; which is no fair way of dealing.

I have now, by such arguments as hastily occurred, endeavoured to vindicate my table from the burlesque comparison in the Journal of Science. I am far from thinking that the table is the only part of my paper by which science may, in some degree, be benefited. But if it was necessary at this time to discuss the particular results published for illustrating the theory I had to propose, the objections ought, in the discharge of a gratuitous office, to have been well-founded; and they ought to have been urged in a candid, open, and manly manner. My purpose being merely to defend myself, I have abstained as much as possible from all remarks on the table in N. A. The construction of that table may hereafter become a fair subject of discussion. But it is not impossible that it may be withdrawn, and another of a less mysterious construction substituted in its place; as it appears that a new method for the refractions was read before the Royal Society at their meeting on the 5th February last.

I remain, gentlemen, &c.

April 9, 1824.

JAMES IVORY.

XLIV. *Electro- and Thermo-magnetical Experiments.* By Mr. WILLIAM STURGEON.

To the Editors of the Philosophical Magazine and Journal.

Gentlemen,

ALTHOUGH the experiments I have detailed in my former paper have sufficiently satisfied myself with respect to

to

to the directive exertion of the forces of the differently excited wires or machines, yet it is not impossible that some may still doubt of the sufficiency of those experiments to determine the apparently anomalous phenomena: owing, perhaps they may say, to the difference of the construction of the apparatus employed for exhibiting them. I am persuaded, however, that the following mode of making the experiments will, in all probability, be sufficiently decisive to convince the most sceptical on this point.

Suspend the semi-circular copper arc, with its zinc diameter, as described in my former paper (the extremities of the metals need not be soldered but twisted together). Wrap one of those joinings of the metals loosely with a piece of tow or unspun cotton. Dip this part of the machine into dilute nitric acid (observe to counterpoise at the other end); present the north pole of a magnet to the same arm, and it will be projected to the right.

Take off the cotton, wash and dry the machine, and suspend it as before. Apply the lamp now instead of the acid, and the magnet as in the former experiment; that arm of the apparatus will be now propelled to the left.

I have merely pointed out this method of making the experiments, as the most likely to be understood in comparing the phenomena; but that described with the galvanoscope, for making the chemico experiment, is by far the most efficient and eligible.

The results obtained from the mode of comparing chemico and thermo phenomena, could hardly fail to suggest the idea, that chemico-excited wires would have their electrical tension increased by thermo application at the opposite extremity. And in order to try the suggestion by the test of experiment, I had recourse to the above-described simple apparatus. I twisted the copper wire a good length round the extremities of the zinc, so that as great a metallic surface as possible might be exposed to the action of the acid. After dipping the extremity wrapped with tow into the acid, I suspended the machine in the galvanoscope. On presenting the north pole of the magnet to the arm ascending from the chemico extremity, the latter was deflected to the right about 80° . From that it returned to nearly 20° : thence propelled again to nearly the same distance as before; and so vibrating several times from about 15° to 60° , when I changed the pole of the magnet. It was now deflected in a contrary direction (left) to about 70° : from thence it returned as before by the silk endeavouring to untwist itself, and was again propelled by the

magnetic influence; thus vibrating, still describing a smaller arc, and approximating nearer the magnet.

When it had become so feeble that the greatest distance did not exceed 30° , I applied the lamp at the other extremity. It was soon propelled to above 400° : and by keeping the extremity of the wires warm (it is well known that zinc would soon melt in a strong flame) I could keep it vibrating at about right angles to the pole of the magnet; for when it went further than 90° , the thermo arm became acted on by the magnetic influence, and conspiring with the reaction of the convoluted silk, the machine was frequently driven back again 40° or 50° ; but by keeping it moderately warm it was kept at between 80° and 90° from the magnet.

I now again changed the pole of the magnet, and took away the lamp. The chemico action had now become so feeble as to be just discernible. However, by applying the lamp it soon acquired between 60° and 70° , and could be kept up to nearly the lower point.

I have repeated the experiment, with the same success, in about $6\frac{1}{2}$ minutes each time. The copper wire was about 1-60th of an inch in diameter; and the zinc about twice that thickness.

When the lamp is applied before the chemico action gets too weak, this *thermo-chemical magnetic* experiment, in miniature, is most strikingly decisive. Not having it in my power at present to carry on the experiment on a large scale, I am not prepared to say how it might answer.

All the phænomena yet exhibited by the differently excited wires, seeming to be so perfectly analogous in every other respect than in the direction of their forces, I have, by parity of reasoning, found no difficulty in producing a thermo rotation by the influence of a central magnet.

As this experiment seems to have baffled the exertions of some of your scientific correspondents, it may perhaps be considered of some importance in promoting the advancement of the science.

I am yours, &c.

Artillery Place, Woolwich,
Feb. 16, 1824.

WM. STURGEON.