A Holograph Letter of Faraday

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A Holograph Letter of Faraday.

Communicated by Professor L. Darmstaedter.

This letter is preserved in the Staatsbibliothek at Berlin in the Darmstaedter Collection. The letter is dated February 2nd, 1821, from the Royal Institution; this was the year of Faraday's marriage and the year that brought him international fame owing to his discovery of the electro-magnetic rotations.

Professor J. A. Fleming, F.R.S., to whom the letter was submitted is good enough to write: "The facts as stated by Faraday are quite correct. He and Ampère had evidently corresponded on the discovery of the rotation of the pole of a magnet round a current. Ampère discovered that a magnet could be made to rotate round its own axis by passing a current along it and Faraday that a part of a circuit could be made to rotate in a magnetic field, as described. Ampère seems to have thought that it afforded a means of deciding whether the Ampèrian currents were molecular or circulated round the magnet as a whole, but Faraday evidently differed from him."

The letter is not mentioned in the important biographies of Faraday¹ nor does it appear in the life of Ampère,² but there is an interesting reference to the effect upon him of Faraday's researches in a letter to J. Bredin, 30 November, 1821.³

"En arrivant ici (i.e., L'Institut de France) la métaphysique remplissait ma tête; mais depuis que le mémoire⁴ de M. Faraday a paru, je ne rêve plus que courants électriques. Ce mémoire contient des faits electro-magnétiques très singuliers qui confirment parfaitement ma théorie quoique l'auteur cherche à la combattre pour lui en substituer une de son invention."

TRANSCRIPT.

Royal Institution,
Febr. 2nd, 1821.

Sir,—

I am very much flattered by the letter you did me the honor to send me and by the present of the Exposé for which I beg leave to return you my best thanks.

Having occasion to write to M. Hachette I have presumed to accompany my

¹ Bence Jones, "Life and Letters of Faraday," 1870. J. H. Gladstone, "Michael Faraday," 1873. S. P. Thompson, "Michael Faraday, his Life and Work," 1898.

² Andre Marie Ampère et Jean Jacques Ampère. Correspondance et Souvenirs (de 1805 à 1864) recueillis par Madame H. C(neuvreux), 1875.

³ "Loc. cit.," i. 206.

⁴ "Quarterly Journal of Science," October, 1821.

letter to him by this to you and venture a few observations on your beautiful experiment of the rotation of the magnet, etc., etc. I repeated the experiment the day after I received your letter and using Hare's calorimeter an instrument equivalent to a very large pair of plates instantly obtained the revolution. I found it convenient to cement a small piece of glass tube on the upper pole of the magnet which forming a cup to receive the mercury made contact very easy without the chance of touching the solid parts of the arrangement.

You mention your opinion that this experiment will be competent to decide the question whether the currents of electricity assumed by your theory exist round the axis of the magnet or round each particle from which I gather that the view you take of it differs from the one I at present have, since to me it seems a modification of the revolution of a wire round a pole. I presume much in differing from yourself on this subject and more in stating the difference to *you* but I do not hesitate a moment in concluding that in the true spirit of philosophy you are anxious to hear (or at last willing) even the doubt of one young in the subject if there be the smallest possibility that they will either correct or confirm previous views.

The rotation of the magnet seems to me to take place in consequence of the different particles of which it is composed being put into the same state by the passing current of electricity as the wire of communication between the voltaic poles, and the relative position of the magnetic pole to them. Thus the little arrows may represent the progress of the electricity; then any line of particles parallel to them except that line which passes as an axis through the pole (represented by a dot) will be in the situation of the revolving wire and will endeavour to revolve round the pole and as all the lines act in the same direction or tend to go one way round the pole the whole magnet revolves. That this is the way in which the magnet revolves is I think evident from the considerations above; from the revolution being in the same direction as with the wire and from the following analysis of the experiment I took a piece of copper wire similar in form to the magnet and having floated it upright in mercury placed a little cup on the top to contain a globule of mercury and then connected the voltaic poles just as they were with the magnet then placing the pole of a strong magnet beneath the cup containing the mercury. It when exactly in line with the axis of the wire made it rotate slowly on its own axis. In this experiment it appears to me that every thing was in the same state as in the former experiment except that the pole was removed out of the revolving mass but present in the line of the axis and the rotation of the wire on its own axis seems to me an effect produced exactly in the same manner as the rotation of the magnet on its own axis.

⁵ The sketch will be found on the page of the letter reproduced on Plate XXI.

I have been thus diffuse in giving my view of the rotation because if it be the true one I do not see how the experiment determines the position of the currents more than the one in which a wire rotates round a pole: Perhaps however you have the same view of it but see explanation I do not. I regret that my deficiency in mathematical knowledge makes me dull in comprehending these subjects. I am naturally sceptical in the matter of theories and therefore you must not be angry with me for not admitting the one you have advanced immediately. The ingenuity and applications are astonishing and exact. But I cannot comprehend how the currents are produced and particularly if they be supposed to exist round each atom or particle and I wait for further proofs of their existence before I finally admit them. Permit me to express my respect for your high philosophical character and to apologise for thus intruding on your time.

I am, Sir,

Your obliged and Humble Servant,

M. FARADAY.

M. Ampère.

in concluding that in the true spirit of philosophy you are
 anxious to hear (or at least willing) even the doubts of one
 young in the subject of there be the smallest possibility, that
 they will either correct or confirm previous views.

The action of the magnet seems to me to take place
 in consequence of the different particles of which it is compo-
 sed being put into the same state by the passing current of
 electricity as the wire of communication between the ^{poles} and
 the relative position of the pole to them. Thus the little arrow
 may represent the progress of the electricity; then any line of
 particles parallel to them exactly that line which passes
 as an axis through the pole (represented by a dot) will
 be in the situation of the revolving wire and will in due case
 to ~~revolve around~~ ^{revolve} round the pole and as all the lines
 act in the same direction or tend to go one way round the
 pole the magnet revolves. That this is the way in which
 the magnet revolves is I think evident from the considerations
 above; from the revolution being in the same direction as
 with the wire and from the following analysis of the
 experiment. Take a piece of copper wire similar in form
 to the magnet and having flattened its upper half in mercury
 place a little cup on the top to contain a globule of
 mercury and then connect the ^{poles} just as they
 were with the magnet then placing the pole of a strong
 magnet beneath the cup containing the mercury its
 action exactly in a line with the axis of the wire made