Magnetic field and relative motion

Source: http://sci.tech−archive.net/Archive/sci.physics.relativity/2004−06/2966.html

---

From: V.K.Tamhane (*vktamhane12_at_rediffmail.com*)
Date: 06/15/04

Date: 15 Jun 2004 04:13:01 −0700

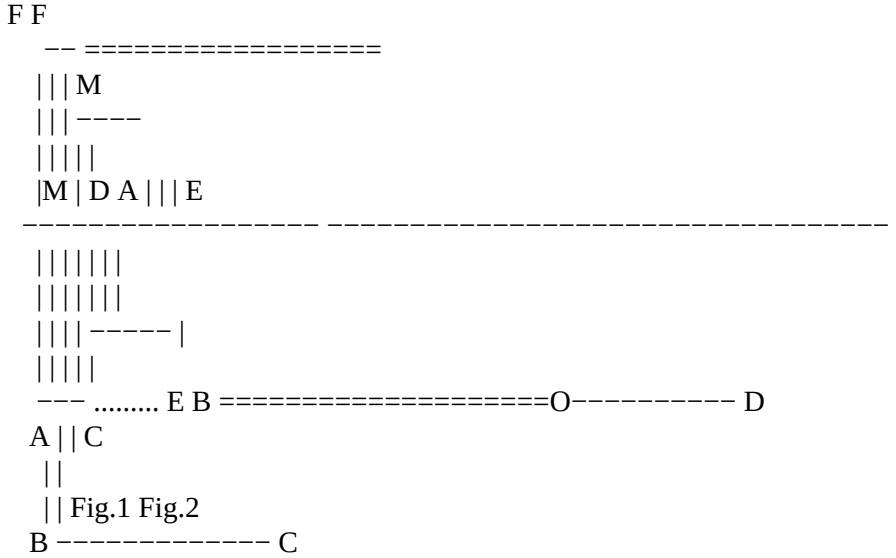

Fig.1 Fig.2

Consider a conducting disc F, rotating in the uniform , steady magnetic field normal to its plane (fig.1). emf produced is measured at the rim A and at axle D.

For an observer on the disc, the circuit ABCED is rotating in the opposite direction and so he concludes that emf is produced in this circuit. (Note that emf in AB and CE are equal and opposite. Leftover emf is that which would be produced in ED, if we 'actually' rotate it). Such a notion of relative motion is wrong, because,

1. Observer on the disc will notice magnetic field rotating along with the circuit and so seen from this frame, there is no emf generated in the circuit of stationary frame.
2. Emf is generated either in the disc or in the stationary circuit, but not in both. To ascertain this, we once more fall back on Barnett's expt.

Replace the disc by a spoke MA. Point M is attached to the axle and A to a conducting ring of radius MA (so that end of the spoke A continuously make contact with the brush at A). Introduce two proper diodes, one in the spoke MA and the other in the circuit ABCED, with forward bias. Make arrangenment to connect or

disconnect brushes at A and D, simultaneously.

Connect the brushes, rotate the spoke and while it is still rotating disconnect the brushes and stop rotation. Charges will be either at the two ends of the spoke or on the brushes at A and D. Needless to say that former will be true. By making such simple modifications, fallacy of the relative motion can be pointed out.

There is another important aspect regarding the nature of the field of a magnet. Faraday proved that it is fixed in space and not attached to the mass of the magnet. Of course confuguration of fig.1 cannot prove or disprove it, for folowing reason,

1. When the magnet producing the field is rotated and if the field is fixed then there will not be an emf.
2. If the field is rotating along with the magnet then too, emf will be zero. Because equal and opposite emf will be produced in the lengths MB and CD.

(Of course Barnett method can come to our rescue. Just take a single conductor MA with a diode in series. There will be no charges collected, when we rotate the magnet and not the conductor.)

Let me refer to the actual experiment conducted. (J.W.Then,"Experimental study of the motional electromotive force", American journal of physics,30,411,1962).

Refer fig.2. Disc shaped ceramic magnet M was placed in the brass cup F, co−axially. Magnetic flux was normal to the cylindrical side of the cup and parallel to the lead wire DE. It was observed that,

1. When cup alone was rotated, emf was produced.
2. When magnet alone was rotated there was no emf.
3. When the cup and the magnet were rotated together, emf was produced.

Note that in 2 there is a relative motion and in 3 relative motion is zero. Placing contact E at various positions of the disc AB, emf remained unaltered, proving no emf was generated in the lead wires. (If you are still in doubt then you can simply extend the length of the cup, so that the stationary circuit is in the extremely weak field.)

This expt. proves that relative motion plays no part. Further it proves 'reality' of the magnetic field. If it is just a force, then there cannot be any emf, because there is no change in flux. Force on the moving charge can be explained only by the proerty 5 of the article 17.

==========

This is one article out of a serial. New visitors should go through all the previous. Dates are posting dates. Articles are posted to 1. Alt.sci.physics.new−theories 2.Sci.physics 3.sci.physics.electromag 4. sci.physics.relativity