Discussion of Johnson's "The secret world of magnets"

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Introduction

In 1970 Howard Johnson published the booklet "The secret world of magnets" which is available again now [1]. This contains some of his pioneering work on magnets and unusual applications of them. By measuring the magnetic fields of permanent magnets, he discovered certain vortex structures not seen before in this field. The question is how these structures can be interpreted by Maxwell's theory of electromagnetism and alternatively by ECE theory.

As described in this article, the interpretation of Johnson's findings is not easy, in particular, because not all experimental conditions are described in enough detail. But the discussion of these points is important regarding the effects of other devices like the Cook coil [2]. If this device is reproducible, similar questions will arise as those brought up with Johnson's measurements.

This article aims at bringing the problems to the point and presents some simulation results which could indicate in which direction a solution should be sought.

The findings

The booklet of Johnson contains some special arrangements of magnets and measured maps of magnetic fields. Our discussion will concentrate on the figures on page 3 of the book (see Fig. 1). This page is also available in the internet [3]. Johnson has measured the distribution of the magnetic field of a permanent magnet by using a Hall sensor [4]. By this he was able to determine the three field components at each position. He has built an electro-mechanical positioning system which was controlled by a computer and was able to record some thousand points so that he could create maps of field lines by a computer graphics program.

In the book only two-dimensional maps are given, but it is not descried where these slices are located relative to the magnet. It seems that these were cuts through the magnet, but this is not possible since the sensor cannot be placed inside the magnet. I assume that data were recorded in a plane in parallel to the surface.

At the north pole as well as at the south pole, double-vortex like field structures were measured. Both parts of the double-structure are slightly different in strength. This leads to a flow of field lines different from the conventional view (Fig. 1, left).

The interpretation by Johnson

The field lines go out both from the north pole and the south pole. This is contrary to the conventional view where the field lines have to go *into* the magnet at the South pole. Johnson instead consideres the clock-, anti-clockwise flow to be important in the sense of *net* strength of each pole. There is a pair of poles at each end of the permanent magnet. The net anti-clockwise pole flow results in a conventionally sensed north pole at one end. A net clockwise pole flow results in a conventionally sensed south pole at the other end of the permanent magnet. The most interior isobar circulation line denotes the maximum strength of a pole. This gives a complete different view of magnetism.

A further argument concerns the visualization of field line by iron filings which usually demonstrate that field lines go from north pole to south pole directly in the outer region. Johnson argues that small iron pieces are being magnetized and becoming magnetic dipoles. These dipoles attract each other and do no longer indicate the direction of the external magnetic field.

The interpretation by Maxwell and ECE theory

Both poles have outgoing field directions and according to Maxwell theory are undistinguishable, they cannot behave differently. You can see this by rotating the picture by 180 degrees. When assembling different magnets together, encountering field lines have opposite directions, so both magnets must repell each other in all combinations. This interpretation is the same for ECE theory as long as classical magnets are considered.

The vortex centers have to be interpreted as current sources. The field lines shown in Fig. 1 seem to indicate that there are four current paths perpendicular to the drawn surface. Since the magnet must have rotational symmetry around the main axis (at least approximately in case of a bar magnet), I assume that there are two ring-like currents in 3D. I have modeled this for the calculation, see Fig. 2a. Two current directions parallel and antiparallel have been investigated, where only the second should be adequate to describe the experimental findings.

The calculations were carried out as described in [5]. In Fig. 3a,b the lines of constant magnetic field values are plotted for both relative current directions. The results are not so different with exception of the intermediate region between both types of current rings. Due to the closed structure in 3D, the region within the rings is impacted by the whole ring. The field lines look quite different compared to the experimental picture.

As a configurational alternative, the four currents have been modelled as straight current lines as shown in Fig. 2b, again with parallel and antiparallel currents as depicted therein. The resulting fields are presented in Fig. 4a,b. The intermediate region shows up more similarity with the experimental map by some minor field incisions at the borders, but the similarity is still quite poor.

Much more accordance with the experimental findings is obtained by looking at the secondary electric field created by the configurations of Fig. 2. The results are shown in Figs. 5 and 6. In Fig. 5a and 6a the currents are in parallel again, and antiparallel in Figs. 5b and 6b,c. The conformity with the map of Fig. 1 is remarkable in the latter case. The pattern of Fig. 1 also occurs in a parallel plane in the middle between the conductors (see Fig. 6c).

So far these results are compatible with Maxwell theory. In the light of ECE theory, a homogeneous current of the form given produces a secondary magnetic field being formally identical to that depicted in Figs. 5 and 6. However this field is very weak as already found in [5].

Discussion

The question is if the conformity of Figs. 5, 6 and 1 is a coincidence or a real fact. From the book of Johnson, it is not totally clear if he has investigated a resonance effect or a magnet in off-resonance. Nothing about a resonance is mentioned in the book. On the other hand it is known that Johnson has experimented with magnetic motors (also described in the book) which require some resonance behaviour for functioning. Furthermore, he describes a configuration of magnets which seems to have only one pole. This is similar to the Cook coil, and this device works at resonance definitely. So it may be the case that Johnson's findings refer to resonant magnet configurations, although not explicitely stated.

However this does not yet explain the results since he has measured the field values by a Hall sensor which normally detects magnetic fields only. The principle of such a sensor is shown in Fig. 7. An electron current is deflected by the Lorentz force, leading to a charge separation – and therefore an electric field – beween two sides of the detector. This electric field could be distorted if a strong external electric field is present, giving wrong results for the magnetic field meusurements. Since the electric field considered here is no source field, it cannot be detected simply by measuring the voltage of an electric sensor relative to ground potential and may be hidden from measurements of parasitic fields.

In our case this would mean that the sensor has measured the electric field, not the magnetic field. Due to the Hall sensor geometry, the measured electric field direction is perpendicular to the magnetic field, so the directional information would have to be interpreted differently. This is indeed consistent with Figs. 5 and 6. Here the electric field consists of the Ez component only (perpendicular to the plane). Even the signs of the field (not shown in the figures) are in agreement with the experimental data.

The appearance of a secondary electric field requires some kind of oscillation, for a pure static field such a secondary field would not occur. The interpretation of a static field as a standing wave, composed of a Fourier spectrum, would lead to the calculated structure of the secondary field.

Finally it has to be mentioned that a ferromagnet has no simple internal structure. There are Weiss domains with different magnetic orientation. The macroscopic field is a sum of all molecular magnetic dipoles whose interactions have to be taken into account properly. The molecular structure can be very different, e.g. for ferrite or rare earth magnets.

Obviously a conclusive explanation of Johnson's findings cannot be given at this time. Further experimental and theoretical work is needed. The method of measuring the electromagnetic field by sensors should be considered for further experimentation. It seems that Johnson was the only one who did this for magnetic fields. A repetition and confirmation of his findings would be important. Besides the magnetic field, one should measure the electric field at the same samples, and also the gravitational (acceleration) field if possible. This would also be an appropriate method for investigating the Cook coil and superconducting devices.

We conclude that there may be an explanation of Johnson's results by ECE theory, but the open scientific issues concerning the experimental results have to be solved before.

Acknowledgement

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References

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[2] http://www.americanantigravity.com/jeffcook.shtml

[3] http://www.cheniere.org/books/HoJo/p10.htm.

[4] http://en.wikipedia.org/wiki/Hall_effect

[5] H. Eckardt, Interpretation of the homogeneous current of ECE theory, preprint on www.aias.us

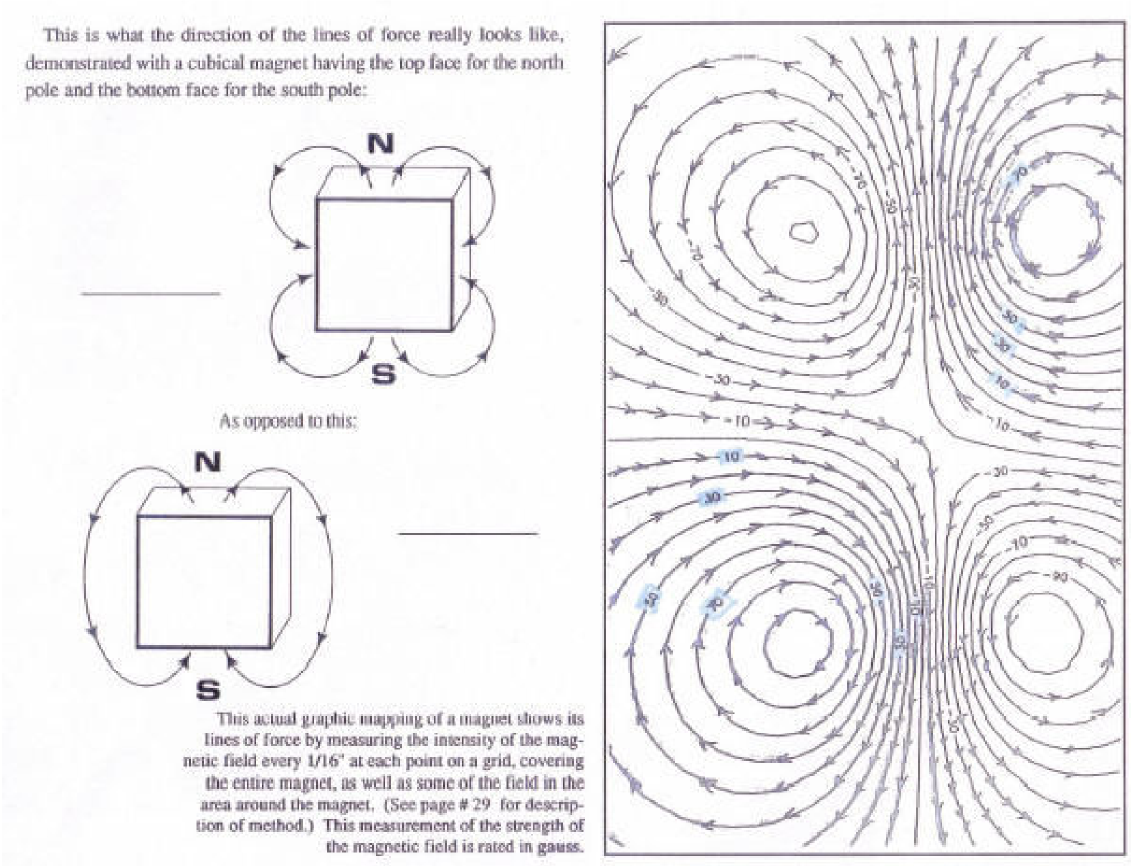

Fig. 1. Magnetic field lines measured by Johnson [1]

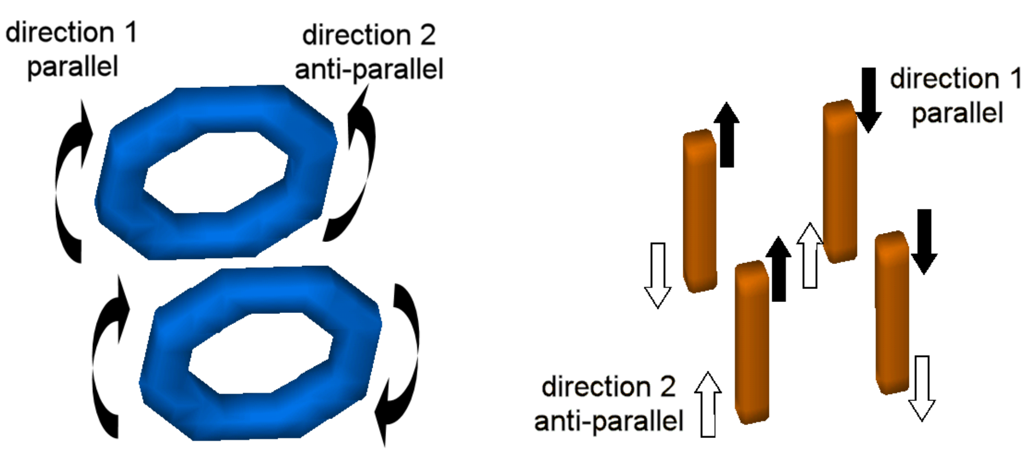

Fig. 2. Permanent magnet models: with two closed current loops (a) and with two open current lines (b)

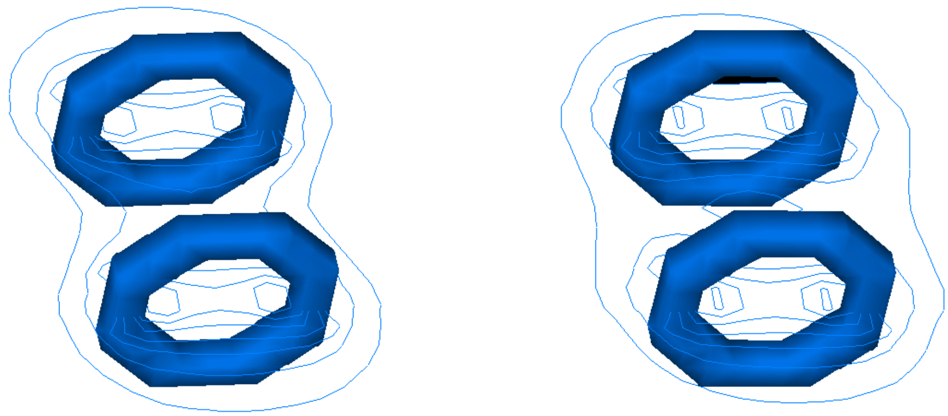

Fig. 3a,b: Lines of constant magnetic field for current loops: (a) parallel, (b) antiparallel current direction

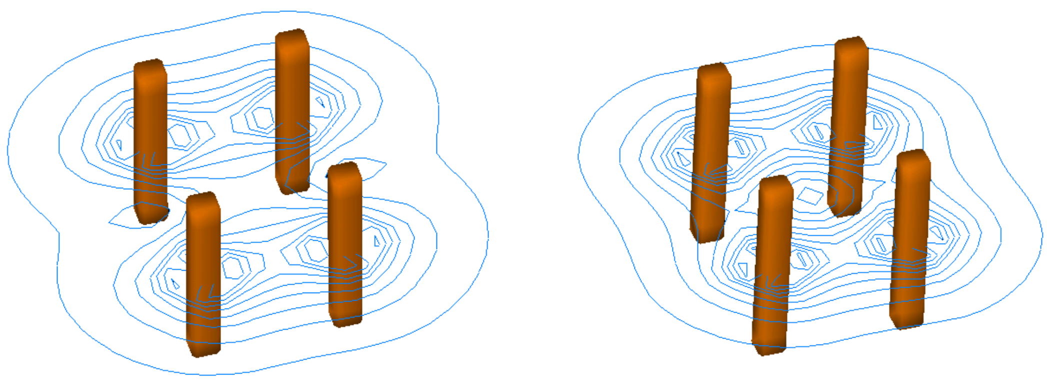

Fig. 4a,b: Lines of constant magnetic field for linear conductors: (a) parallel, (b) antiparallel current direction

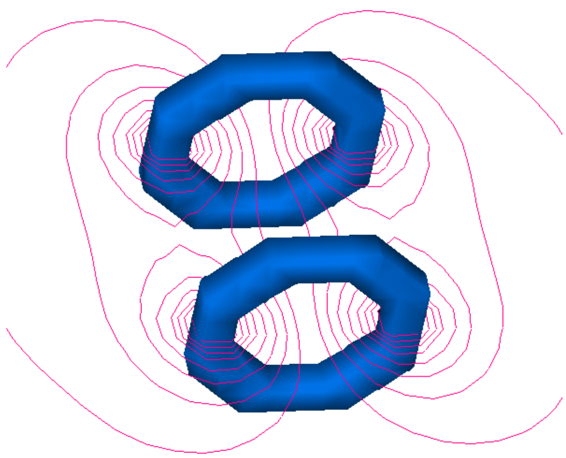

Fig. 5a,b: Lines of constant secondary electric field for current loops: (a) parallel, (b) antiparallel current direction

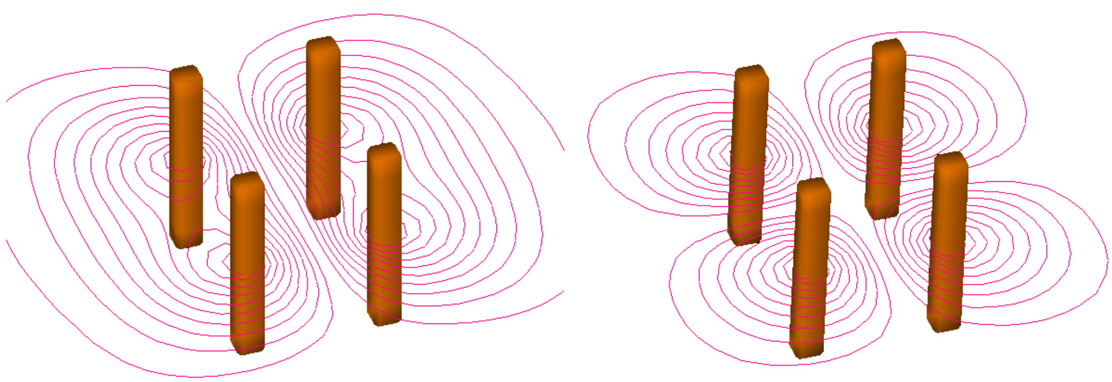

Fig. 6a,b: Lines of constant secondary electric field for linear conductors (a) parallel, (b) antiparallel current direction

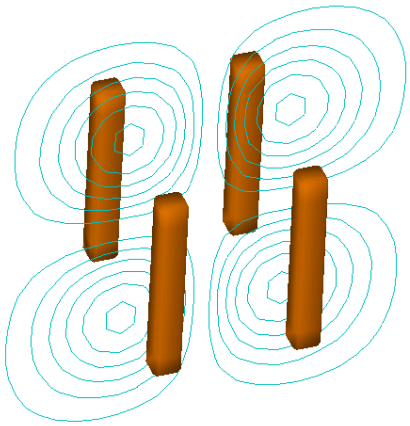

Fig. 6c: same as 6b, but middle plane between conductors

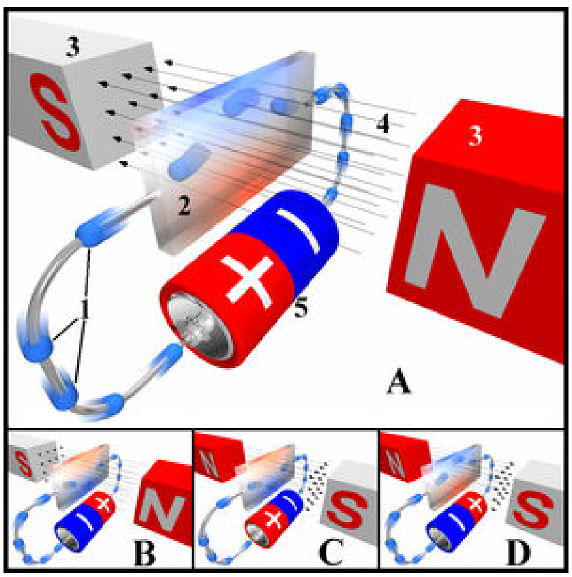

Fig. 7: Hall effect (source: wikipedia.org [4])