Circular motor driven by tangential magnetic force

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1. Force tangential to a circular current

I have done the experiment **Anti-Lorentzian Motor (pdf)**, (**word)** that showed a magnetic force parallel to the current turning a rectangular coil. Someone contends that this movement can be explained with Lorentz force. I agree that there is confusion. He also says that in order to avoid Lorentz force the coil should be circular. I find this idea very good and put a circular coil in a magnetic field to see if it rotates. And it rotates. See the video:
http://www.youtube.com/watch?v=JkGUaJqa6nU&list=UUuJXMstqPh8VY4UYqDgwcvQ&feature=share

The setup is shown in Figure 1. A circular coil is mounted on an axle passing in the center so that it can rotate freely in its plane. In order to avoid any unwanted magnetic force, the wires connecting the current from the center to the coil are twisted so that the overall radial current is zero (Figure 4).

The video shows that the current makes the coil rotate in its plane revealing the existence of a torque on the coil. The sequences 6 and 7 show this torque with constant current. In this static condition, the coil stays still and the equilibrium positions are different for opposite magnets.

The torque on the coil is equal to the product of the total tangential force F_θ and the coil's radius R:

$$\tau = F_\theta \cdot R$$

The non-zero torque shows that the magnetic force tangential to the circular current is not zero. In the contrary Lorentz force has not tangential component whatever the magnetic field is:

$$d\boldsymbol{F}_\theta = \boldsymbol{e}_\theta \cdot (\boldsymbol{I}dl\boldsymbol{e}_\theta \times \boldsymbol{B}) = 0$$

Contradicted by the experiment, the Lorentz force law fails in this case.

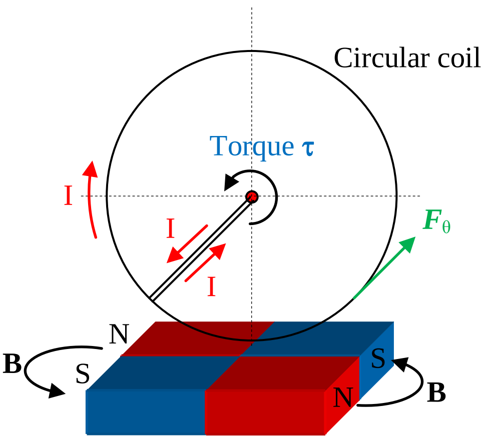

Figure 1

Figure 2 is a photograph of the setup. Figure 3 shows the magnet assembly that is formed by 2 magnets joining their opposite poles. Most of the field lines are horizontal and pass from the poles of one magnet to that of the other just next to it (Figure 1). The coil is placed over the joining surface in its plane where the field intensity is very weak.

Figure 4 shows the twisted wires making the overall radial current zero. Figure 5 shows the second configuration of coil tested, which is 2 semicircle coils joined together. The current flows from one semicircle to the other through U-turn wires at the center so that the overall radial current is zero. This configuration seems to increase the tangential force.

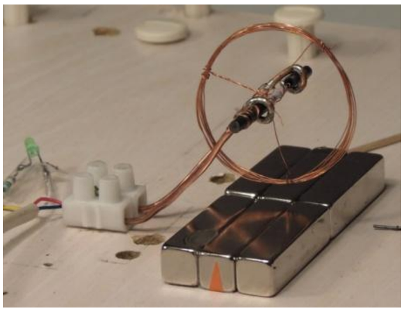

Figure 2

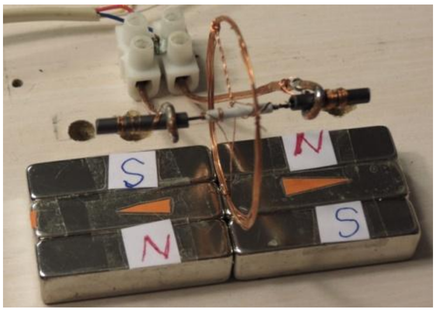

Figure 3

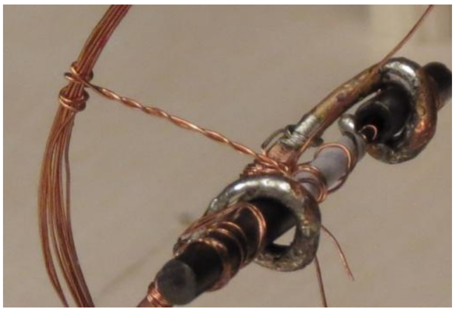

Figure 4

Figure 5

2. How the tangential force arises

The Lorentz force law does not define magnetic force with component tangential to current, but my corrected magnetic force law does:

$$d\boldsymbol{F} = -\frac{\mu_0}{4\pi r^2}(\boldsymbol{dI}_1 \cdot \boldsymbol{dI}_2) \cdot \boldsymbol{e}_r \tag{1}$$

This force lies on the radial vector $\boldsymbol{e}_r$ joining the 2 interacting current elements $d\boldsymbol{I}_1$ and $d\boldsymbol{I}_2$. See: [Unknown properties of magnetic force and Lorentz force law (Word), (PDF)]

For explaining this experiment, we consider the magnets as a set of equivalent currents $\boldsymbol{I}_{magnet}$ that generates the same magnetic field. The magnetic force arises when the equivalent currents interact with the current in the coil $\boldsymbol{I}_{coil}$. The resulting torque on the coil is the integral of the cross product of the coil's radial vector $\boldsymbol{R}$ (Figure 6) and equation (1), which gives a net value $\boldsymbol{\tau}$:

$$\boldsymbol{\tau} = -\oint \boldsymbol{R} \times \frac{\mu_0}{4\pi r^2}\left(\boldsymbol{dI}_{magnet} \cdot \boldsymbol{dI}_{coil}\right) \cdot \boldsymbol{e}_r \neq 0$$

Figure 6 explains schematically the creation of the tangential force on the coil. The 2 magnets are drawn apart to reveal the equivalent vertical current on the joining surface. This current exerts an attraction force $\boldsymbol{F}_a$ on the left part of the coil and a repulsion force $\boldsymbol{F}_b$ on the right part. $\boldsymbol{F}_a$ and $\boldsymbol{F}_b$ give rise to the net torque on the coil $\boldsymbol{\tau}$.

According to equation (1), the equivalent currents on the horizontal surface of the magnets give no force on the coil because $\boldsymbol{I}_{magnet}$ is perpendicular to the coil's current $\boldsymbol{I}_{coil}$. The vertical equivalent currents on the far sides of the magnets create an opposite force on the coil but with much weaker intensity. This way a net torque is created.

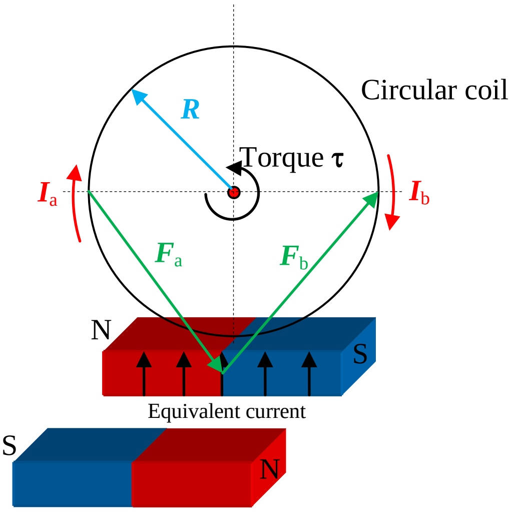

Figure 6

3. Comments

This experiment proves the existence of magnetic force that is parallel to current and by doing so, proves definitely the fail of the Lorentz force law. My theory of corrected magnetic force explains this force.

On the other hand, the energy consumption of the motor shows the existence of an electromotive force (emf) opposite to the applied voltage. However, during the rotation the surface enclosed by the coil and the magnetic flux through it are constant and the circular coil does not cut any field line. In consequence, according to Faraday's law the induced voltage is zero and Faraday's law fails here.

But the tangential magnetic force gives an explanation to the mechanism of electromotive force. Faraday's law explains emf by creating a weird rotational electric field in complete contradiction with electrostatic theory. Here, we see a tangential magnetic force pushing the current in the direction of its flow and changing directly the energy of electrons in a conductor. This is a step forward to understanding how electrons are pushed around when magnetic field changes intensity, that is, the mechanism of Faraday's law. The emf measurement I proposed in **Partial EMF measurement,** blogspot academia will allow the verification of the theory of tangential magnetic force with experimental measurement.

The physical explanation of the force of Faraday's law is in unexplored territory. Until know, Lorentz force and "Faraday force" are considered as fundamental and no deeper research has been done to understand how they work. It is much sounder to first unify electrostatic force, Lorentz force and "Faraday force" before trying to unify electromagnetic force and gravitational force.

The simplicity of this experiment shows the downside of a very successful theory: it hides off an entire world that does not comply with it. As the Maxwell theory is very successful and claims that magnetic force is perpendicular to current, one comes to take this claim as reality and never go further. But it is not reality.

This is bad news for physics because many laws we use now see their validity reduced. In the same time, this is also an unbelievable opportunity for the current generation of physicists. The Lorentz force law has addressed only half of the magnetic problem. The other half, linked to tangential magnetic force hides many properties to be discovered. By overhauling the entire building of physics many physicists will reach the top of the world.

Searching improvement in an established theory is like searching water in desert. Everyone will tell you: there is no water in desert. This is a generally true idea but not reality. We know that there are oases in deserts. What we need is just a good map of the desert. My theory is the map you need.