Electron-Spin Driven Magnetic Motor (Smith Motor)

1. Introduction

This paper describes a magnetic motor that is believed to extract its energy from electron spin, the electron spins in question being those within ferromagnetic material that endow it with ferromagnetic properties, i.e. the aligned atomic dipoles. Essentially the system comprises an electric motor driving a generator that then supplies the electrical power to drive the motor, but both motor and generator are unconventional. The electron spin energy is extracted by electromechanical means where electric power is obtained from moving a conductor, not as in normal generators by moving the conductor at right angles to itself and to a magnetic flux (Fleming's right hand rule) but unconventionally by moving the conductor along its own direction through a magnetic vector potential field. This is the unconventional generator (known as a *Marinov Generator*) where this previously unused longitudinal induction technique delivers very low voltage that has little utility as a source of electrical power, but does have the advantage that the source of that energy is not via the mechanical drive but via the quantum forces that keep the ferromagnetic electrons spinning. By using that electrical power to then drive a very low voltage homopolar electric motor useful power can be delivered mechanically, and that output drives the Marinov Generator continuously with energy to spare.

2. Prior Art

The late Stephan Marinov developed an unusual type of electric motor that he bizarrely called "Siberian Coliu". This motor has been discussed by Wesley [3] and Phipps [1] and [2] who use the more explicit term "Marinov Motor". Essentially the motor consists of an electrically conductive ring rotor that rotates about its major axis, like a classical slip-ring. Two brushes make contact at diametrically opposite positions, and current is passed through them so that the current splits and flows in opposite circumferential directions around each half of the ring. The ring is placed within a large ring magnet, i.e. a toroid ring-core that is permanently magnetized. In the perfect case no **B** field exists outside the toroid core, so the slip-ring sees only an **A** field. Marinov claimed that the slip-ring developed a torque that produced rotation, thus demonstrating a form of longitudinal induction from electron movement through an **A** field, something which classical electrodynamics doesn't recognize. However because the electron movement is so very slow, being the drift velocity of the conduction electrons, the

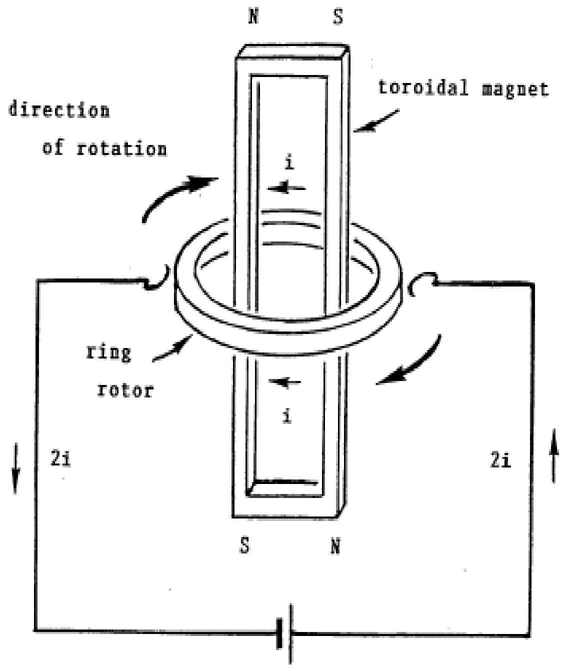

Figure 1. Marinov Motor

torque is so tiny that his experiments used a conductive liquid within a circular channel, where he noted only slight movement of the liquid. Other experimenters have used either a suspended conductor, or a suspended magnet, to attempt to exhibit the torque. None of these experiments have proved conclusive, with some unable to measure any torque while others claim that what little torque was measured could be explained by the presence of a leakage **B** field.

Surprisingly little prior work has been done on the *generator* version of Marinov's motor, where the slip-ring is driven with significant surface velocity far exceeding electron drift velocity (a Google world-wide search on "Marinov Motor" produces 1170 results, while a similar search on "Marinov Generator" produces only 9 results, and 6 of those stem from discussions on the Steorn forum started by this author! Note that the "Marinov Motor" search reveals a book "Quantum Ring Theory" by Wladimir Guglinski that refers to an article on the Marinov motor written by a Cyril Smith and published in Frontier Perspectives. That person is Cyril W. Smith, not I. It is an unfortunate coincidence that two Cyril Smiths, both from the UK, should be discussing the same subject.). This generator produces voltage induction across the brushes which albeit small (millivolts) is nevertheless conclusively measured. Apart from the author's own work, the only evidence to be found on experiments of this configuration is by Robert J. Distinti (he calls it the Paradox 2 experiment [4]) which, like those of the author, uses open magnets, hence the **A** field has curl and there is a **B** field present. In his experiment the slip-ring is held stationary, while the magnets plus brushes are rotated. Because the DC voltage across the moving brushes is now located in a rotating frame, it requires two more brushes to get that voltage out into the stationary frame. Clearly the device produces DC, and although there is a **B** field present, as in the author's experiments, that voltage cannot be explained by the usual flux cutting induction. It *can* be explained by longitudinal induction from the **A** field, but Distinti prefers to invent his "New Electronics" to explain the anomaly.

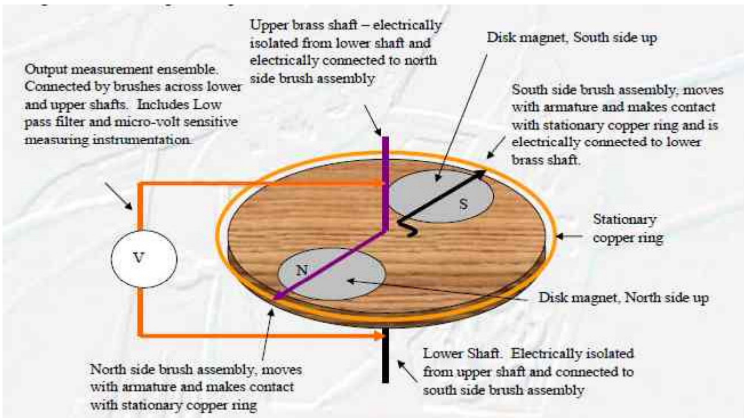

Figure 2. Distinti Paradox 2

3. The Marinov Generator

The Marinov Generator is an integral part of the proposed motor. It is described here with a reference to the analysis that shows the energy is extracted from the electron spins within the permanent magnets. It consists of a slip-ring engaged by two diametrically opposing brushes. Close to each brush is a disc magnet magnetized along its primary axis so that the flat surfaces are the pole faces. The magnet discs and the slip-ring lie in the same plane, see Figure 3. When the slip-ring is caused to rotate by an external mechanical drive, a DC voltage is developed across the brushes. Thus this is a form of homopolar generator, and like other homopolar devices it produces low voltage. Typically for a 100mm diameter slip-ring driven at 1000rpm the voltage is about 3mV. Thus to extract electrical power of a few watts the generator must see a load resistance in the order of 3μΩ and deliver a current of ~1000A.

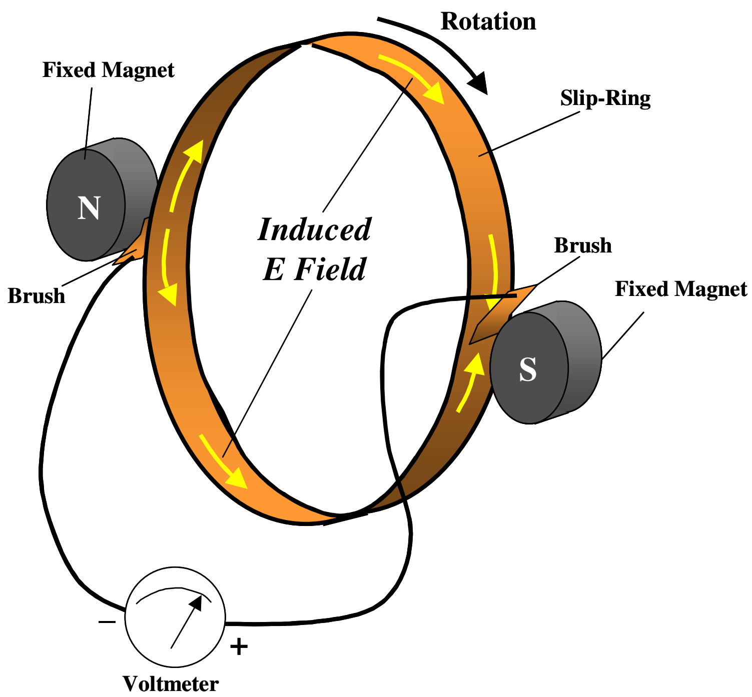

Figure 3. Marinov Generator

Figure 3 shows a sketch of the Marinov Generator. The conduction electrons carried around the ring at its surface velocity **v** endure an electric field **E** given by

$$\mathbf{E} = -\mathbf{grad}(\mathbf{v} \cdot \mathbf{A}) \qquad (1)$$

where the gradient applies to the changing scalar product **v**·**A** as seen by the electrons moving through the non-uniform magnetic vector potential **A** field. This is a longitudinal induction parallel to the velocity direction as shown, and its integral along each half of the slip-ring yields the voltage output.

When the Marinov Generator delivers electrical power to a load, the question must be asked where does that power come from? Because the induced electric forces in the two halves of the slip-ring are in opposite rotational directions, they cancel with respect to torque, hence they do not load the drive shaft. Similarly, although conduction electrons travelling from a brush onto the slip-ring are accelerated from trivial drift velocity up to slip-ring velocity, those at the opposite brush are decelerated by the same amount and again the necessary inertial forces cancel with respect to load torque.

The analysis given in [5] answers the question and shows that an electron charge e travelling at velocity **v** within a magnetic vector potential field **A** has potential energy e(**v**·**A**) that can be extracted as an EMF resulting from moving out of the **A** field, equation (1). The potential energy e(**v**·**A**) is exactly accounted for by considering the radiation from the electron accelerating up to velocity **v** at the brush tip, that radiation applies a load to the current source of the **A** field, be it current within a single loop or an array of atomic current loops. Thus the Marinov Generator is unique in the fact that it draws its power, not from the drive shaft but from the atomic dipoles within the magnet.

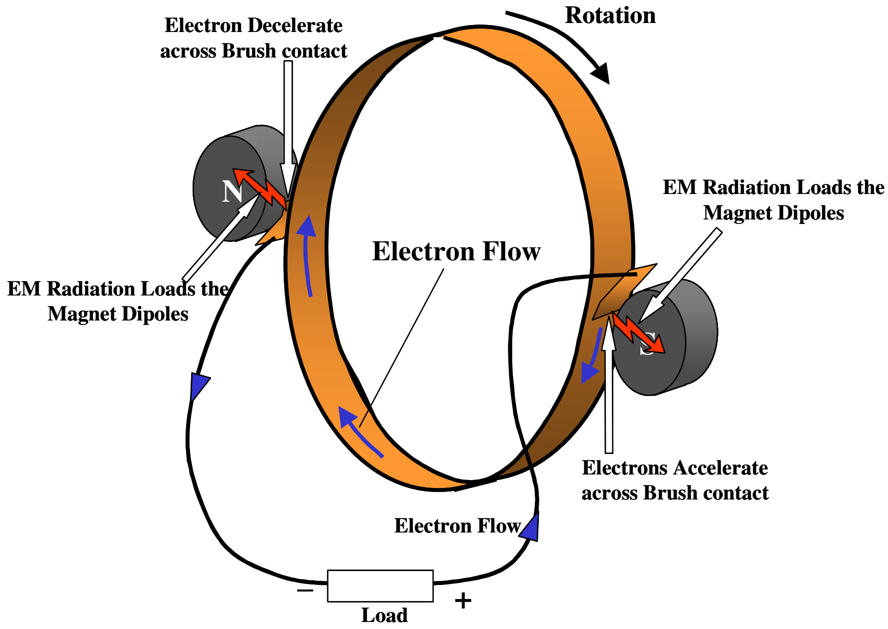

Figure 4. Marinov Generator Loaded

It is virtually impossible to utilise the low DC voltage and low impedance characteristic of this generator in any electric power transmission system, but fortunately there is a class of electric motor that requires that very same characteristic as an input. The Faraday Disc homopolar motor is little used because of its low voltage high current demand that is unmatched to normal power supplies. By combining a Marinov Generator with a Faraday Disc Motor the low voltage high current loop remains within the combined system where it can be designed to accommodate this. The result is a free running motor whose shaft output can be used conventionally. Also, since both the Marinov Generator and the Faraday Motor need magnets, it is possible to use the same magnets for both functions. This insight leads to the Smith Motor described in the next section

4. The Smith Motor

It is clear that the contact resistance of the brushes needed in both the Marinov generator and the Faraday Motor is the limiting factor for performance. Also, if a free running demonstrator is to be built, that limited torque may not be enough to overcome brush friction. For these reasons the Smith Motor has been designed to eliminate brush friction by using rolling contacts everywhere. Figure 5 illustrates the principle where there are two Marinov Generators connected electrically in series in a closed loop. The electric current from the generators passes radially through the magnets which themselves rotate to each form a Faraday Motor. The rotating magnets drive the generator slip-rings via small rollers which also provide the electrical connections. Connecting shafts between the two generators carry the circulating current, hence there are no sliding contacts.

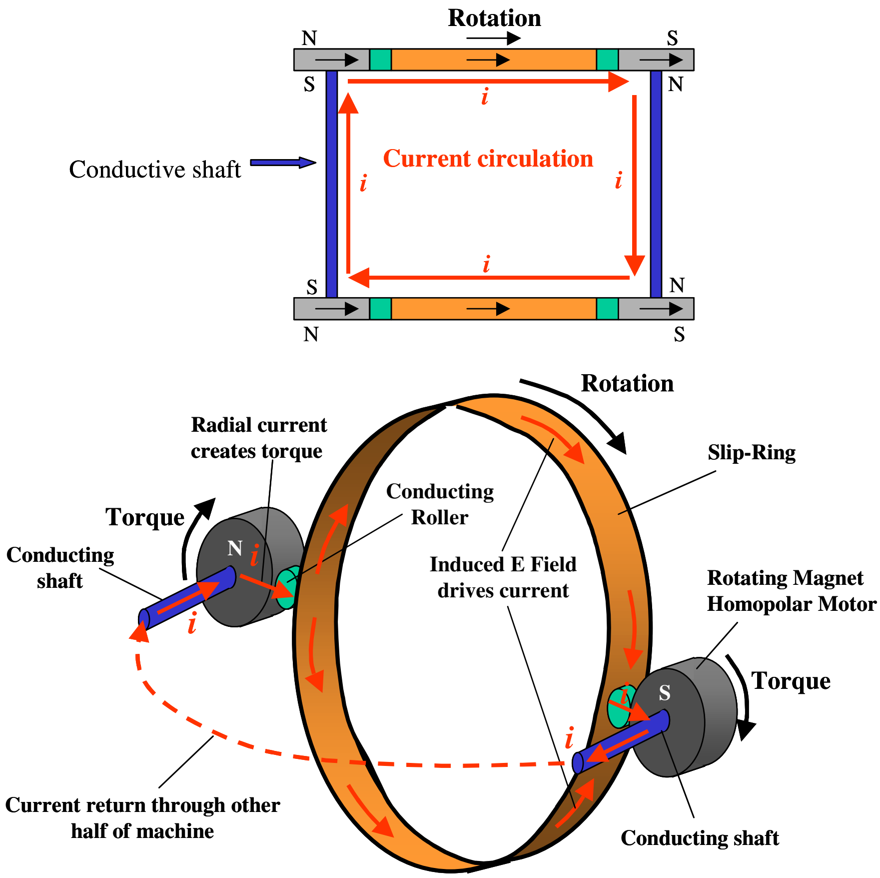

Figure 5. Smith Motor

The Faraday Motors in Figure 5 are shown as rotating disc magnets where the magnet is electrically conductive. The system could use ceramic magnets held fixed, with conductive discs that rotate close to their pole faces.

5. Discussion

It can be expected that the initial attempt to build a free-running Smith motor will end in failure! This could be because the theory behind the device is flawed, in which case experiments carried out during the evolution of the design should show where the flaw lies. Assuming that those experiments validate the voltage induction and the lack of shaft load in the Marinov Generator, then the failure will be down to contact resistance across the rolling contacts. The generator voltage multiplied by the contact-resistance-limited current could yield a power below that needed to overcome friction and windage, in which case the system will not free run. It is expected that the system will be designed to apply some pressure on each rolling contact, but this might not be enough to obtain the low resistance needed. It could be that some clever surface treatment of the rolling contacts may be necessary, perhaps involving some nano-scale engineering. Or it may be necessary to abandon the rolling contacts and use sliding contacts that have been specifically developed for homopolar generators.

6. References.

[1] Thomas E. Phipps, Jr., "Invariant Electromagnetism: Necessity and Sufficiency"

[2] Thomas E. Phipps, Jr., "Observations of the Marinov Motor", APEIRON Vol. 5 Nr.3-4, July-October 1998.

[3] J. P Wesley, "The Marinov Motor, Notional Induction without a Magnetic B Field", APEIRON Vol. 5 Nr.3-4, July-October 1998.

[4] Distinti Paradox 2 http://www.newelectromagnetism.com/

[5] Cyril Smith, "On Charge Movement through a Magnetic Vector Potential Field", revised August 2009.