The Marinov Generator

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1. Introduction

The late Stephan Marinov experimented with a form of electric motor that he bizarrely called "Siberian Coliu". This motor has been discussed by Wesley and Phipps who used 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 charge movement through an **A** field, something which classical electrodynamics doesn't recognize. However the 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.

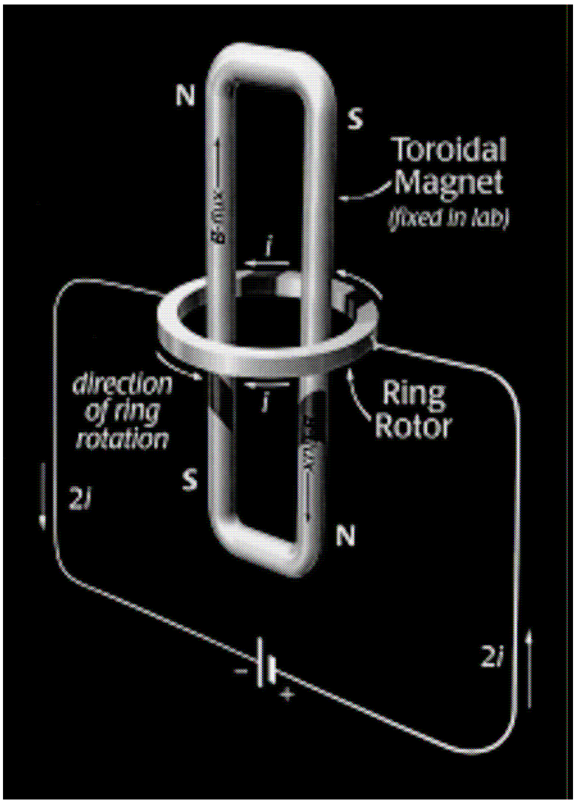

Figure 1. Marinov Motor taken from Phipps

Wesley and Phipps attribute the torque to the presence of an electric field given by the *convective* term $\mathbf{E} = -(\mathbf{v} \cdot \nabla)\mathbf{A}$, which appears if the usual expression $\mathbf{E} = -\frac{\partial \mathbf{A}}{\partial t}$ involving the *partial* time differential of the **A** field is replaced by the *total* differential $\mathbf{E} = -\frac{\mathrm{d}\mathbf{A}}{\mathrm{d}t}$. Thus for an **A** field that is fixed in time but varying in space, where the partial differentiation yields zero **E**, a moving charge will still "see" a time variation in **A** due to its movement through space, and that produces the convective **E** term, which includes longitudinal induction (i.e. along the conductive path). However neither author make clear how a longitudinal force on a moving conduction electron can then manifest as a longitudinal force on the lattice ions. In my opinion such a force merely creates a potential difference across the ends of the conductor, so the presence of that force would merely cause the currents in the two halves of the rotor to be of unequal amplitude. It is possible that lack of conclusive evidence of torque is because there is none generated on the lattice, that the $\mathbf{E} = -(\mathbf{v} \cdot \nabla)\mathbf{A}$ term is valid but would only be evidenced by the unequal currents, and there doesn't appear to be any experiments to validate that claim.

Although the Marinov *Motor* has been the subject of considerable attention, there is no evidence that the same can be said of the *generator* version. In the Marinov Generator the slip-ring is driven mechanically and a DC voltage occurs across the brushes. The only evidence to be found on experiments of this configuration is the Distinti Paradox2 which uses open magnets, hence the **A** field has curl and there is a **B** field present. In this 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, that voltage cannot be explained by the usual $\mathbf{E} = \mathbf{v} \times \mathbf{B}$ induction. It *can* be explained by the $\mathbf{E} = -(\mathbf{v} \cdot \nabla)\mathbf{A}$ term, but Distinti prefers to invent his "New Electronics" to explain the anomaly.

To provide more evidence on the Marinov Generator, with the help of a slip-ring manufacturer I performed some tests using stationary magnets against a rotating slip-ring. That experiment is the subject of this report.

2. The Experiment

BGB Engineering Ltd., a manufacturer of slip-rings and brushes located in Grantham, Lincolnshire, UK, kindly gave me access to their slip-ring test machine. This drives slip-rings at pre-set rotation speeds so that electrical conductivity and noise measurements can be made. BGB mounted one of their standard 100mm diameter double slip-ring assemblies on the

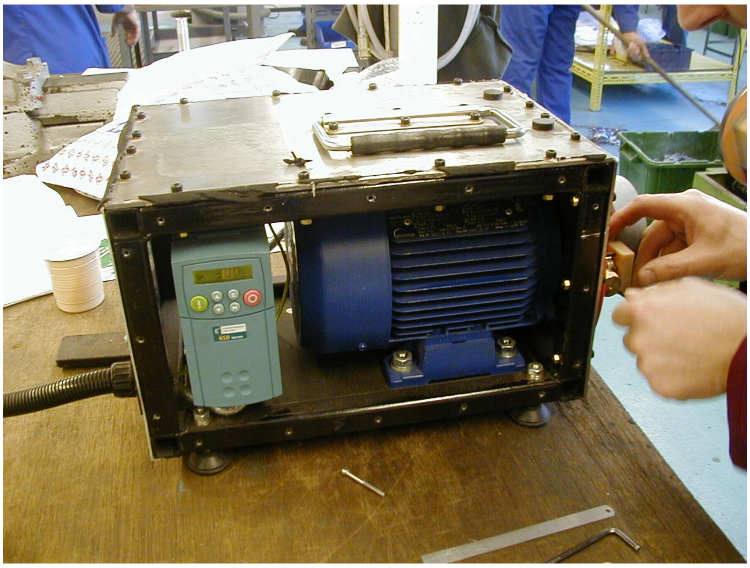

Figure 2. Slip-ring Test Machine

machine, along with diametrically opposing brush connections to one of the rings. The set-up is seen in Figure 3 which includes two NdFeB disc magnets mounted close to the brushes.. The large grey object is a protective cover to prevent injury from the moving mounting studs that would otherwise be present there.

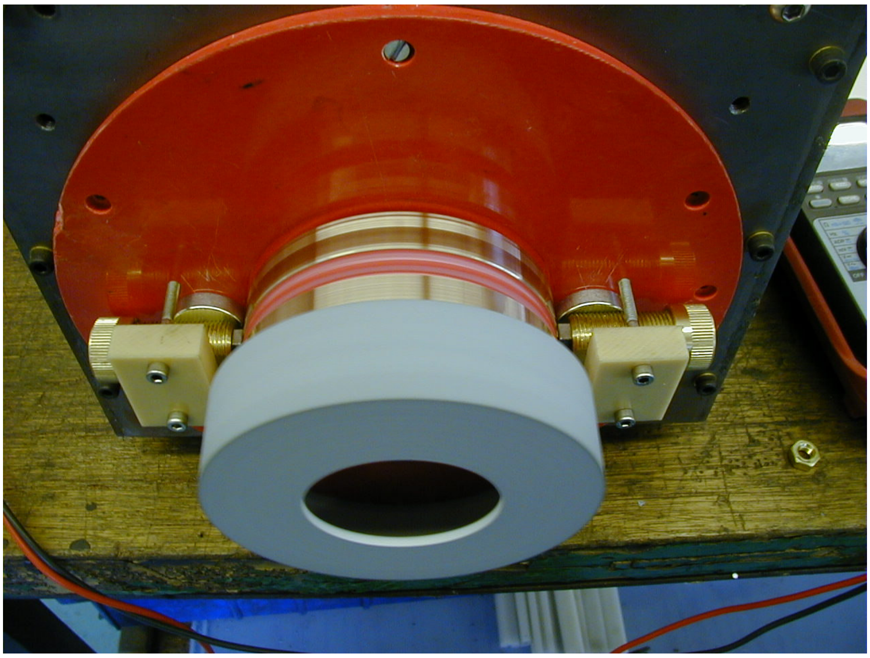

Figure 3. Showing the brushes and Magnets

In the initial experiment no magnets were present, the device was run up to speed to demonstrate that no stray voltage was present across the brushes. Voltage and current measurements were performed using an industrial Megger type M8037. Then a single NdFeB magnet (25mm diameter and 7mm thick) was placed close to the slip-ring surface and moved to various locations around the slip-ring as shown in Figure 4.

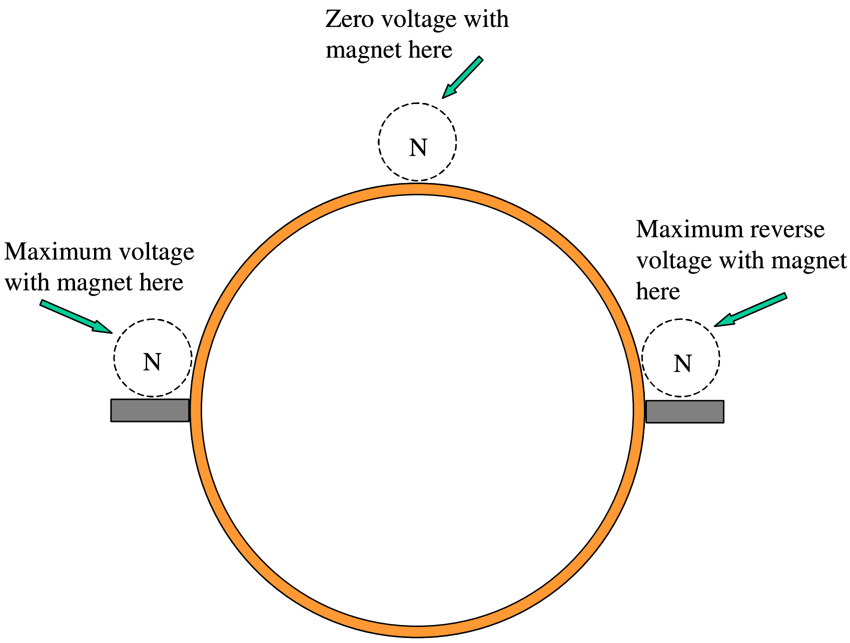

Figure 4. Initial experiments with different magnet positions

DC voltage was observed, having a maximum value when the magnet was closest to one brush (the brush assembly prevented the magnet from being positioned directly over the brushes). As the magnet was moved around the circumference the voltage dropped, reaching a zero value at the mid point, then rising in the opposite polarity to again reach a maximum close to the opposite brush. At any point the voltage could be reversed by flipping the magnet orientation.

The system was then reassembled having magnets clamped at their closest point to each brush, as shown in Figure 5.

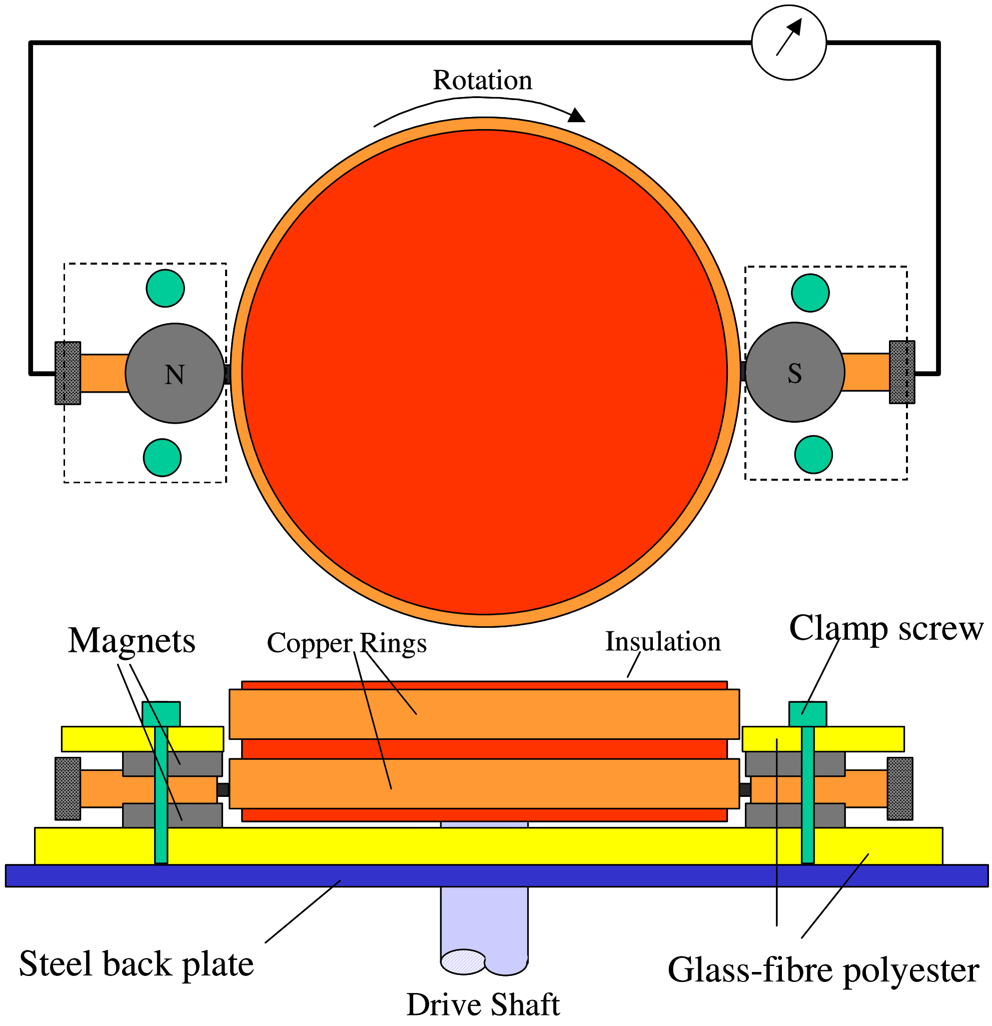

Figure 5. Showing complete assembly with magnets

Figure 5 shows two magnets clamped at each brush location. Some tests were also conducted with just one magnet at each brush.

3. Test Results

Voltage measurements were taken at four set rotation speeds, 300, 500, 800 and 1000 RPM, with the results given in Table 1.

Table 1. Test results

Rotation Speed	1 magnet per brush	2 magnets per brush
300 RPM	0.94 mV DC	0.96 mV DC
500 RPM	1.55 mV DC	1.60 mV DC
800 RPM	2.47 mV DC	2.55 mV DC
1000 RPM	3.30 mV DC	3.16 mV DC

With two magnets per brush as in Figure 5, and at 1000 RPM, the Megger was switched to measure short circuit current. This was performed with two different types of brush, copper-loaded or silver-loaded. The silver-loaded brushes gave 1.47mA while the copper-loaded brushes gave 1.43mA. All measurements were witnessed by Mark Chappel and Chris Richards from BGB Engineering Ltd.

4. Discussion

Clearly the experiment demonstrated a form of DC induction. Because of the set-up it was not possible to perform tests using a closed magnetic circuit where the slip ring would rotate in a zero **B** field, hence this is not absolute proof of the $\mathbf{E} = -(\mathbf{v} \cdot \nabla)\mathbf{A}$ induction. The slip ring had significant radial thickness of several mm hence could endure the classical $\mathbf{E} = \mathbf{v} \times \mathbf{B}$ radial homopolar induction. The presence of that radial component would create eddy currents within the ring, as depicted in exaggerated form in Figure 6, so the measured DC voltage could come from IR voltage drop along the outer surface.

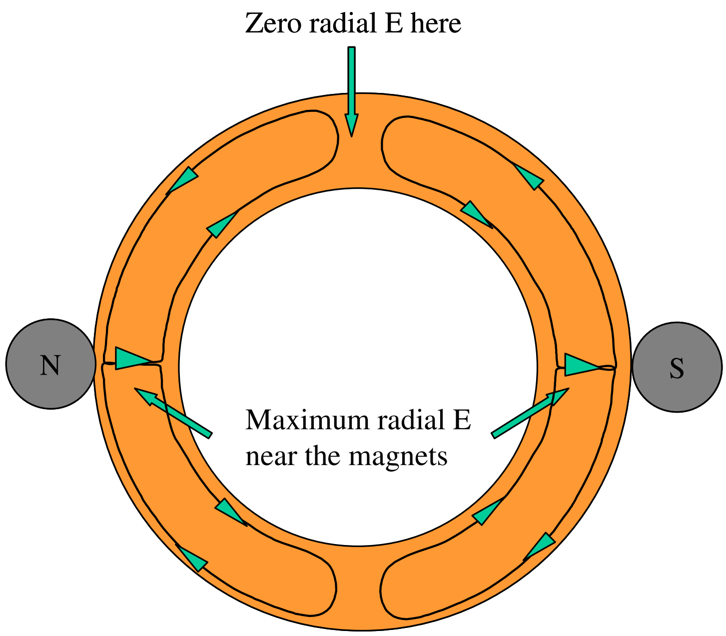

Figure 6 Possible Eddy Current Loops

However because of the high conductivity of the copper, this explanation is considered unlikely. Also FEMM simulations of the magnetic field close to the brushes indicates that in the case for one magnet at each brush location (Figure 7) the field lines tend to enter the ring radially, which is the wrong orientation for radial induction.

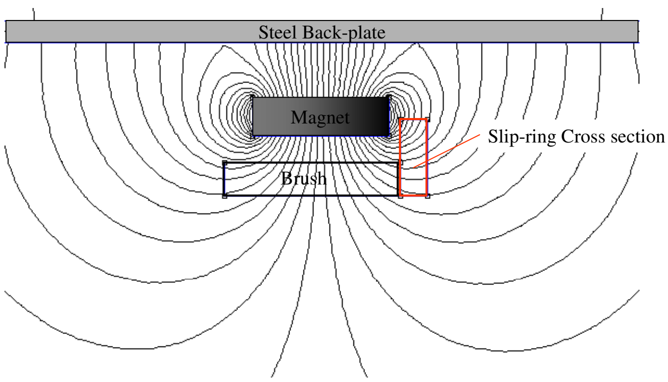

Figure 7. Magnetic Field at brush location

Also for two magnets at each brush (Figure 8) the slip-ring cross section tended to be close to a magnetic null, hence the radial induction would be small.

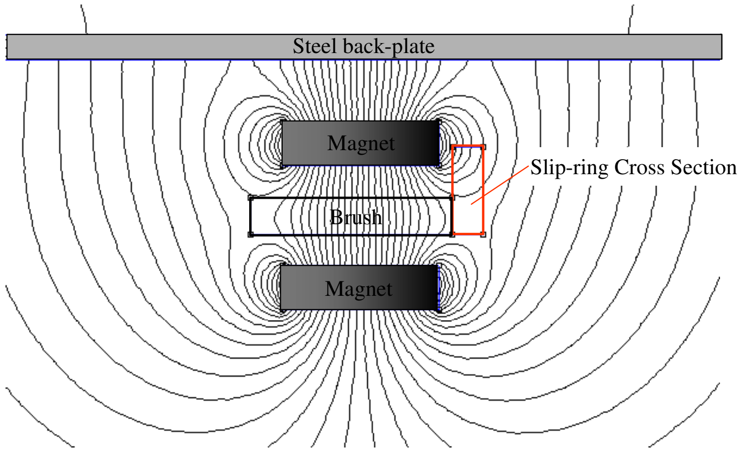

Figure 8. Magnetic Field at brush location

Further evidence that the measured results likely come from the $\mathbf{E} = -(\mathbf{v} \cdot \nabla)\mathbf{A}$ induction appears from simulations of the **A** field and evaluation of that induction. An Excel program was written which models the disc magnets by their equivalent current loops, calculates the **A** field at 1 degree increments around the slip-ring then evaluates the induced voltage. This yielded results in complete agreement with the measurements, Figure 9.

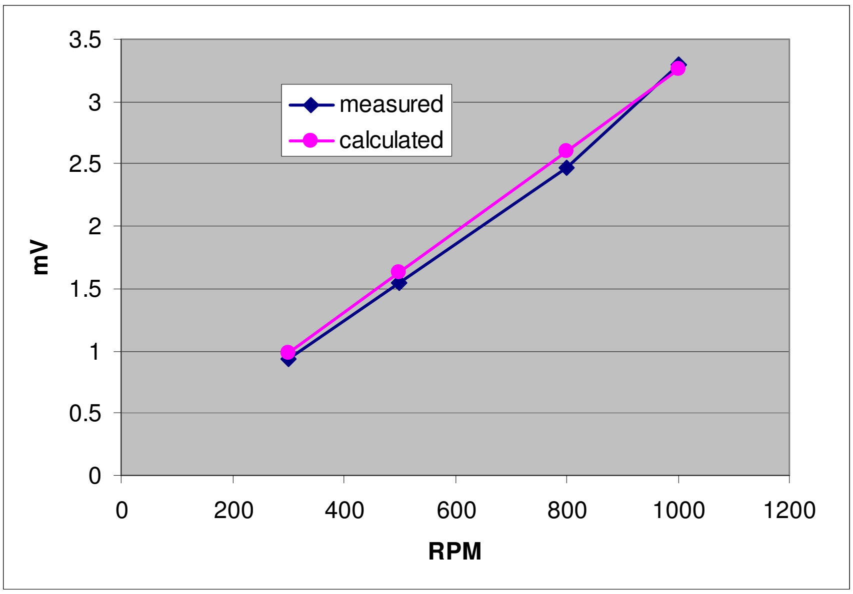

Figure 9. Comparison of measured and calculated results.

5. Conclusion

A generator version of the Marinov Motor has been found to exhibit longitudinal induction which agrees with calculations using the convective term $\mathbf{E} = -(\mathbf{v} \cdot \nabla)\mathbf{A}$. This form of induction is not recognized by classical electromagnetic theory, and offers new possibilities in the search for alternative forms of energy production.

Acknowledgement.

The help and assistance given by BGB Engineering Ltd is gratefully acknowledged.