Toroidal Power Unit (TPU) Gains Energy from the Earth's Scalar Magnetic Potential

1. Introduction

The TPU demonstrated by Steven Marks was shown to deliver considerable electrical power without any internal power source. In various forums Marks expressed the view that the power came from the Earth's magnetic field. In this paper we examine a possible TPU and provide calculations showing how it develops forces attributable to the scalar magnetic potential of the Earth's field. The author's previous paper [1] showed how magnetic poles gain electrodynamic inertial mass in the presence of a scalar magnetic field, and the formula are reproduced here for completeness. Annex A gives an overview of how the formula are derived.

2. Induced Inertial Mass

When electric or magnetic systems are charged with energy, it is to be expected that the effective mass of the system increases according to Einstein's mass-energy equivalence $W = mc^2$ (we have used the symbol W to represent energy instead of the usual E to prevent confusion with the use of E as electric field), i.e. the mass increase is given by

$$m = \frac{W}{c^2} \qquad (1)$$

Many texts refer to this as *electrostatic mass* or *electromagnetic mass*, which for practical purposes is negligible because of the large magnitude of c^2.

However there are other inertial contributions induced dynamically which could be called *electrodynamic mass*. This paper deals with these dynamic situations where the mass contribution can be positive or negative. The derivation of this mass involves computation of electrodynamic forces created by acceleration from which the effective inertial mass automatically follows. However it is not necessary to think in terms of inertial mass, those forces exist in their own right and could be put to good use.

There are many duals between electric and magnetic effects where equations follow similar formats, in particular the forces between point charges and between point magnetic poles. Although magnetic poles don't really exist as such, the formulae are still useful for predicting magnetic effects. Thus by analogy to equation (9) in [1] it is to be expected that a magnetic pole of strength Q_m amp-meters, when placed in a scalar magnetic potential of ϕ_m amps, will inherit a magnetically induced inertia which can be represented by an inertial mass m_m kilograms given by

$$m_m = \frac{\mu_0 Q_m \phi_m}{c^2} \qquad \text{Kilograms} \qquad (2)$$

Similar to the electric case, $\mu_0 Q_m \phi_m$ is the potential energy of the magnetic pole Q_m, i.e. the energy involved in moving it from the potential ϕ_m to a far region of space where the potential is zero. And as in the electric case the induced inertial mass can be positive or negative. Note that acceleration of a negative inertial mass involves a force in the opposite direction to that expected from real mass, in other words a force that aids the acceleration whereas classical inertia opposes. Thus an accelerated N pole within a positive scalar potential yields an opposing force opposite to the acceleration direction, while for a S pole the force is in the same direction, Figure 1.

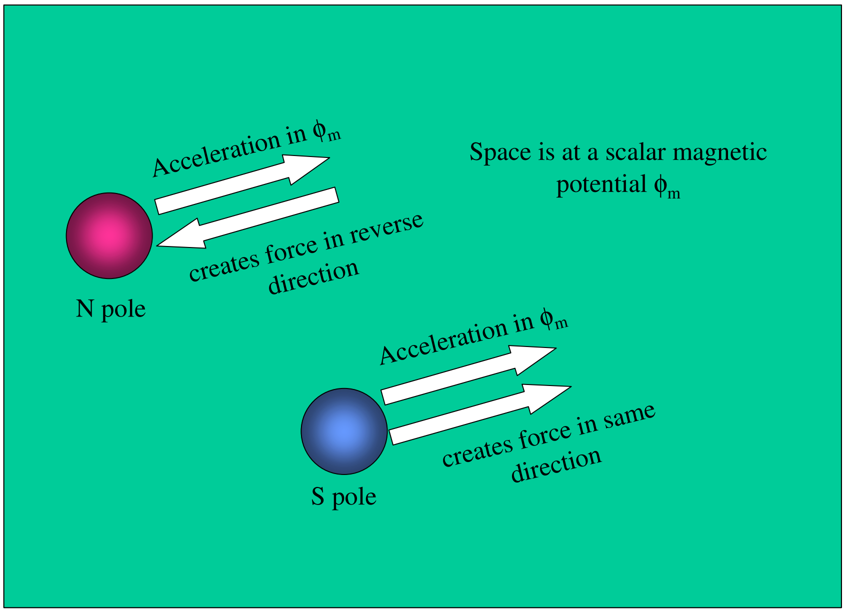

Figure 1. Showing inertial forces

In the case of a permanent magnet or electro-magnet the pole strength Q_m is given by

$$Q_m = Ms \qquad \text{Amp-metres} \tag{3}$$

where s is the surface area of the pole face and M is the magnetization of the core. Hence (2) becomes

$$m_m = \frac{\mu_0 Ms\phi_m}{c^2} \qquad \text{Kilograms.} \tag{4}$$

Now since for a saturated electro-magnet

$$M = \frac{B_{sat}}{\mu_0} \tag{5}$$

where B_{sat} is the saturation flux density we can rewrite (4) as

$$m_m = \frac{B_{sat} s\phi_m}{c^2} \qquad \text{Kilograms} \tag{6}$$

3. Proposed TPU

The proposed TPU uses a rotating magnetic dipole, shown in figure 2 as two opposite polarity magnetic monopoles. In the presence of a uniform magnetic scalar positive potential the inward acceleration of each dipole creates force on their induced inertial mass. For the N pole that mass is positive, hence the pole endures the classical outward centrifugal force that comes from positive inertial mass. The S pole however has negative induced mass so it endures an inward force.

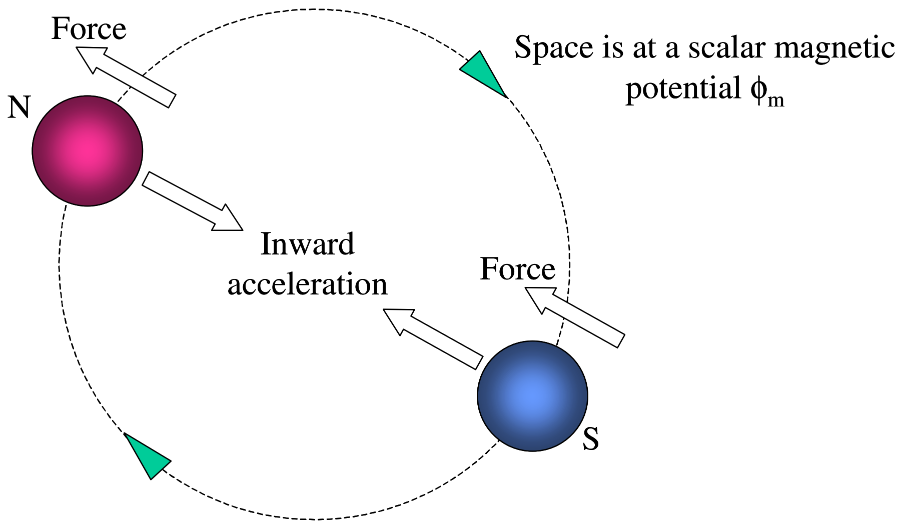

Figure 2. Rotating Magnetic Dipole

It will be shown later that we would need impossible rotation speeds to get useful forces from a rotating permanent magnet, so the TPU uses an electromagnet in the form of a hoop of thin Fe wire. Coils wound over this hoop create poles and with appropriate phasing the poles can be made to travel around the hoop at tremendous speeds while the hoop itself doesn't rotate. Being thin Fe wire of small real mass the acceleration forces on the moving poles cause the wire to deform from being circular as shown in Figure 3.

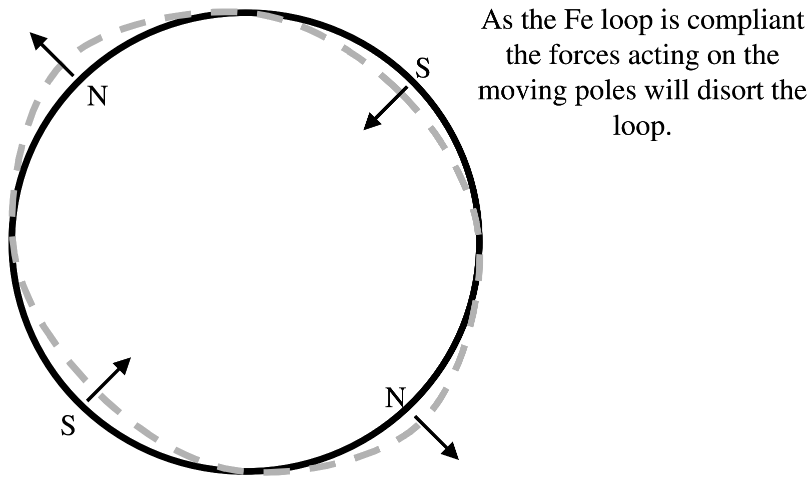

Figure 3. Showing the induced forces distorting the hoop

Of course those deformations travel around the hoop so at any fixed position the wire is seen to vibrate in the plane of the hoop. It is those vibrations that are used as a power source, and since it is a magnetic pole that is vibrating we can use appropriately placed coils to obtain induced voltage from those vibrations. The coils must not obtain voltage from the circumferential movement of the pole, else we would load the system that drives the poles around the hoop. This is achieved by having pairs of series connected curved coils either side of the Fe wire as shown in figure 4.

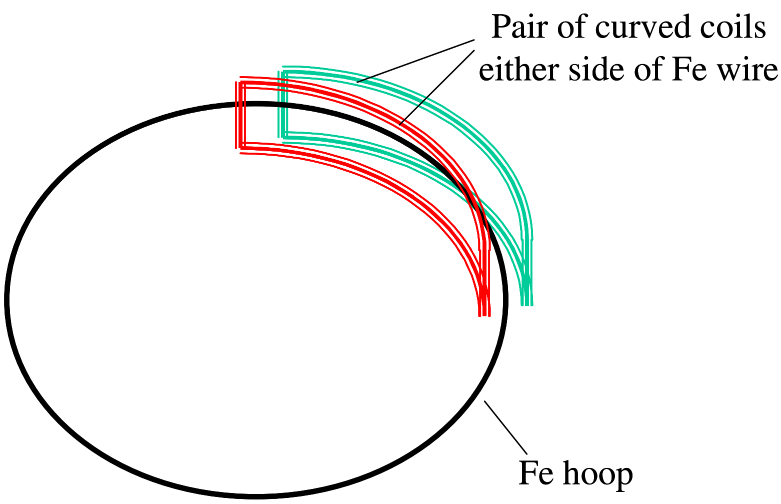

Figure 4. Showing output coil pair

Without the radial vibration of the Fe wire a pole travelling centrally between the coils will not induce voltage, but with that vibration the coils will obtain a voltage pulse of polarity determined by the pole polarity. Thus with alternating N S poles travelling around the hoop each pair of output coils will receive alternating voltage pulses that can be rectified to produce DC.

A number of thin Fe wire hoops are supported on a former made of thin, lightweight pliable material (such as sheet cork), figure 5. This assembly is encased within a plastic tube and is hung by thin filaments so that the former and Fe wires can freely vibrate. A number of toroidal coils wound over the plastic tube are sequenced so as to drive the magnetic poles around the hoops.

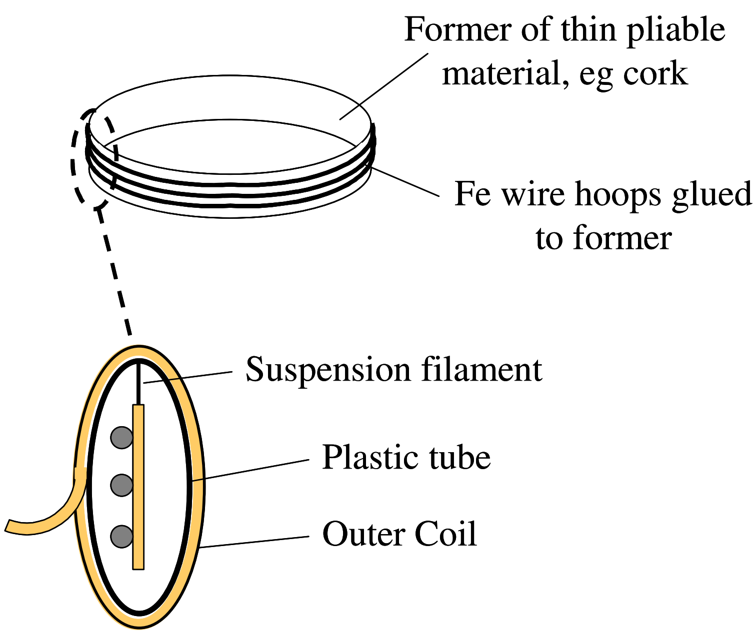

Figure 5. Showing Fe wire on suspended former

4. More formula

With a hoop radius of R a pole with inertial mass m orbiting at an angular velocity ω will endure an inward acceleration $r\omega^2$ hence an outward centrifugal force $mr\omega^2$. If that force does work over a small radial distance δr the energy W given up is

$$W = mr\omega^2\delta r \quad \text{Joules} \tag{7}$$

As that is the energy available from each voltage impulse it is repeated at a rate of $\frac{\omega N_p}{2\pi}$ joules per second where N_p is the number of poles around the hoop. Hence the power P available from one pair of coils is

$$P = \frac{mr\omega^3 N_p \delta r}{2\pi} \quad \text{watts} \tag{8}$$

Using (6) for m and with N_c the number of coil pairs around the hoop we obtain the total power output as

$$P = \frac{B_{sat} s \phi_m r\omega^3 N_p N_c \delta r}{2\pi c^2} \quad \text{watts} \tag{9}$$

Note that although the denominator contains c^2 the numerator contains ω^3 so there is the possibility that we can obtain useful power if ω and ϕ_m are large enough.

5. The Earth's scalar potential.

Although the magnetic ***field*** from the Earth is quite weak, the same cannot be said for the magnetic scalar ***potential*** ϕ_m. The magnetic Earth can be modelled as a magnetic dipole at its centre whose dipole moment μ_E is 8.24×10^{22} amp-m^2 [2]. By comparison with the scalar electric potential from an electric dipole [3], the scalar magnetic potential for a magnetic dipole is given by

$$\phi_m = \frac{\mu_E \cos\theta}{4\pi r^2} \quad \text{amps} \tag{10}$$

where r is the radial distance and θ is measured from the dipole axis. (Note that some authors define the scalar potential as that whose gradient is B, the magnetic flux density, in which case μ_0 should be included in (10) and should not be included in (2). We have chosen to define the scalar potential as that whose gradient is H, the magnetic field intensity. The important thing is that the power (9) is dimensionally correct.) The notional radius of the Earth is 6.37×10^6 meters. At the equator where θ is 90° the potential is zero, but at a latitude of say 30° where $\cos(\theta)$ is 0.5 we get a value of $\pm8\times10^7$ amps, and at the Earth's magnetic poles the value would be $\pm1.6\times10^8$ amps. The presence of this huge scalar potential is not taught hence is little known, perhaps because until now there has been no method of using it to practical purpose. For calculation purposes the notional scalar potential will be taken as that 8×10^7 amps value.

We can now perform some preliminary calculations using (9) with $\phi_m = 8\times10^7$ amps. Taking a hoop radius r of 15cm, a vibration movement δr of 1mm, a pole area s of say 5mm^2 (that is a 5mm length of 1mm diameter Fe wire), an induced pole rotation frequency of 1MHz, 4 poles and 4 pairs of coils around the hoop we obtain an output power of 842 watts. Apart from the assumption that a 1mm Fe wire can vibrate at 1MHz this figure does indicate the possibility of this approach. It is quite possible that the Earth's scalar potential is much larger than the figures quoted since they assume a dipole of infinitely small length at the Earth's centre. If indeed the Earth's magnetic field arises from its rotating inner core of molten Fe, that is not of small dimension, hence its effect at the surface could be much greater.

6. References.

[1] Cyril Smith (Smudge), “On Electro-Magnetic Inertia and Thrust”, revised August 2014.

[2] Erik Hallen, “Electromagnetic Theory” page 153.

[3] Warren B Boast, “Vector Fields”, page 28.

Annex A

On Magnetic and Electric Vector Potentials

- **Magnetic Vector Potential**

The subject of magnetic vector potential is well covered in the literature. Briefly any moving electric charge Q creates this magnetic vector potential usually represented by the letter **A** (bold text denotes a vector).

$$\mathbf{A} = \frac{\mu_0 Q \mathbf{v}}{4\pi r} \qquad \text{(A1)}$$

where **v** is the charge velocity. Then this movement creates a magnetic field **H** given by

$$\mathbf{H} = \frac{1}{\mu_0} \operatorname{curl} \mathbf{A} \;\text{ or }\; \mathbf{H} = \frac{1}{\mu_0} \nabla \times \mathbf{A}. \qquad \text{(A2)}$$

Also if **A** changes with time (e.g. if the movement is an acceleration) then we get an electric field **E** given by

$$\mathbf{E} = -\frac{\partial \mathbf{A}}{\partial t}. \qquad \text{(A3)}$$

Note this all comes from an electric charge that is moving, thus representing an electric current, and there are related formula that deal with the many charges that constitute electric current flow. Note also that starting with *electric* charge, its movement creates both a *magnetic* field (A2) and also another *electric* field (A3) additional to its electrostatic (Coulomb) field. That additional electric field (A3) falls off slowly with distance being proportional to $1/r$, whereas the Coulomb field falls off more rapidly being proportional to $1/r^2$; hence it is the radiation field from an electric antenna.

The induced electrodynamic inertial mass is derived from (A1) and (A3) where acceleration of Q_1 while within the scalar electric potential of Q_2 is equivalent to Q_1 held static while Q_2 accelerates in the opposite direction. Hence Q_1 endures a force proportional to its acceleration.

- **Electric Vector Potential**

Similar equations exist for magnetic "charge" Q_M (a magnetic monopole) that is moving, but because such monopoles are considered not to exist, this branch of physics is not well taught. A permanent magnet can often be well represented by a pair of opposite polarity monopoles, and if the magnet is rotating those monopoles are moving so this little known branch of physics should apply. In this case the moving magnetic "charge" creates an electric vector potential, sometimes represented by the letter **F**.

$$\mathbf{F} = \frac{\varepsilon_0 Q_M \mathbf{v}}{4\pi r} \quad \text{(check)} \qquad \text{(A4)}$$

Then we obtain an electric field **E** given by

$$\mathbf{E} = \frac{1}{\varepsilon_0} \nabla \times \mathbf{F}. \qquad \text{(A5)}$$

Note that starting with *magnetic* charge, its movement creates an *electric* field (A5). This formula is never taught; instead current teaching relies on the motional induction

$\mathbf{E} = \mathbf{v} \times \mathbf{B}$ that gives the same answer. Also if **F** changes with time (e.g. if the movement is an acceleration) we obtain a magnetic field **H** given by

$$\mathbf{H} = -\frac{\partial \mathbf{F}}{\partial t}. \qquad (6)$$

The acceleration creates a *magnetic* field (A6) additional to its magnetostatic field. That additional magnetic field (A6) falls off slowly with distance being proportional to $1/r$, whereas the magnetostatic field falls off more rapidly being proportional to $1/r^2$; hence it is the radiation field from a magnetic antenna. ***These formula are never taught, yet they could hold the secret for how the TPU reacts with the Earth's spinning core, the orbiting poles act as a magnetic antenna and the radiation field applies magnetic forces to the Earth's spinning core.***