A New Design for the Gravelectric Generator

Fran De Aquino
Professor Emeritus of Physics, Maranhao State University, UEMA.
Titular Researcher (R) of National Institute for Space Research, INPE

Usually, the *electromotive force* (EMF) has *electrical* nature. Here, we show that it can have *gravitational* nature (*Gravitational Electromotive Force*). This fact led us to propose an unprecedented system to convert Gravitational Energy *directly into* Electrical Energy. It was previously called of *Gravelectric Generator* [1]. Here we show a new design for the *Gravelectric Generator*. This system can have individual outputs powers of several tens of kW or more.

Key words: Gravitational Electromotive Force, Gravitational Energy, Electrical Energy, Generation of Electrical Energy.

1. INTRODUCTION

The electrical current arises in a conductor when an outside force acts upon the free electrons of the conductor. This force is called, in a generic way, of *electromotive force* (EMF). Usually, it has *electrical* nature. In a previous paper we have shown that this force can have *gravitational* nature (*Gravitational Electromotive Force*), and we have proposed a system to produce Gravitational Electromotive Force, called *Gravelectric Generator*, which converts *Gravitational Energy* directly into *Electrical Energy* [1].

A new design for the *Gravelectric Generator* is shown in this paper. This system can have individual outputs powers of several tens of kW. It is easy to be built, and can easily be transported.

2.THEORY

Consider *a coil with iron core*. Through the coil passes a electrical current i, with frequency f_H. Thus, there is a magnetic field with frequency f_H through the iron core. If the system is subject to a gravity acceleration g, then the *gravitational forces* acting on *electrons* (F_e), *protons* (F_p) and *neutrons* (F_p) of the Iron core, are respectively expressed by the following relations[2]

$$F_e = m_{ge}a_e = \chi_{Be}m_{e0}g \qquad (1)$$

$$F_p = m_{gp}a_p = \chi_{Bp}m_{p0}g \qquad (2)$$

$$F_n = m_{gn}a_n = \chi_{Bn}m_{n0}g \qquad (3)$$

m_{ge}, m_{gp} and m_{gn} are respectively the *gravitational* masses of the electrons, protons and neutrons; m_{e0}, m_{e0} and m_{e0} are respectively the *inertial* masses at rest of the electrons, protons and neutrons.

The expressions of the *correlation factors* χ_{Be}, χ_{Bp} and χ_{Bn} are deduced in the paper [3] and Appendix of [1], and are given by

$$\chi_{Be} = \left\{1 - 2\left[\sqrt{1 + \frac{45.56\pi^2 k_{xe}^{22} r_e^4 B_{rms}^4}{\mu_0^2 m_e^2 c^2 f^2}} - 1\right]\right\} = \\ = \left\{1 - 2\left[\sqrt{1 + 1.5\times10^{23}\frac{B_{rms}^4}{f^2}} - 1\right]\right\} \qquad (4)$$

$$\chi_{Bp} = \left\{1 - 2\left[\sqrt{1 + \frac{45.56\pi^2 r_p^4 B_{rms}^4}{\mu_0^2 m_p^2 c^2 f^2}} - 1\right]\right\} \qquad (5)$$

$$\chi_{Bn} = \left\{1 - 2\left[\sqrt{1 + \frac{45.56\pi^2 r_n^4 B_{rms}^4}{\mu_0^2 m_n^2 c^2 f^2}} - 1\right]\right\} \qquad (6)$$

where $k_{xe} \cong 1.9$ (See [3] and Appendix of [1]) ; $r_e \cong 1.4\times10^{-10}m$; $r_p = 1.2\times10^{-15}m, r_n \cong r_p$. [1].

Note that χ_{Bn} and χ_{Bp} are negligible in respect *to* χ_{Be}.

It is known that, in some materials, called *conductors*, the free electrons are so loosely held by the atom and so close to the neighboring atoms that they tend to drift randomly from one atom to its neighboring atoms. This means that the electrons move in all directions by the same amount. However, if some outside force acts upon the free electrons their movement becomes not random, and they move from atom to atom at the same direction of the applied force. This flow of electrons (their electric charge) through the conductor produces the *electrical current*, which is defined as a flow of electric charge through a medium [4]. This charge is typically carried by moving electrons in a conductor, but it can also be carried by ions in an electrolyte, or by both ions and electrons in a plasma [5].

Thus, the electrical current arises in a conductor when an outside force acts upon its free electrons. This force is called, in a generic way, of *electromotive force* (EMF). Usually, it is of *electrical* nature $(F_e = eE)$. However, if the nature of the electromotive force is *gravitational*

$(F_e = m_{ge} g)$ then, as the corresponding force of *electrical* nature is $F_e = eE$, we can write that

$$m_{ge} g = eE \qquad (7)$$

According to Eq. (1) we can rewrite Eq. (7) as follows

$$\chi_{Be} m_{e0} g = eE \qquad (8)$$

Now consider a *wire* with length l; cross-section area S and electrical conductivity σ. When a voltage V is applied on its ends, the electrical current through the wire is i. Electrodynamics tell us that the electric field, E, through the wire is uniform, and correlated with V and l by means of the following expression [6]

$$V = \int \vec{E} d\vec{l} = El \qquad (9)$$

Since the current i and the area S are constants, then the current density $\vec{J}$ is also constant. Therefore, it follows that

$$i = \int \vec{J}.d\vec{S} = \sigma ES = \sigma (V/l) S \qquad (10)$$

By substitution of E, given by Eq.(9), into Eq.(8) yields

$$V = \chi_{Be}(m_{e0}/e) gl \qquad (11)$$

This is the voltage V between the ends of a metallic cylinder, when it has conductivity σ and cross-section area S, and it is subjected to a uniform magnetic field B_H with frequency f_H, and a gravity g (as shown in Fig.(1)) (The expression of χ_{Be} is given by Eq. (4)). Substitution of Eq. (11) into Eq. (10), gives

$$i = \chi_{Be}(m_{e0}/e)\sigma g S \qquad (12)$$

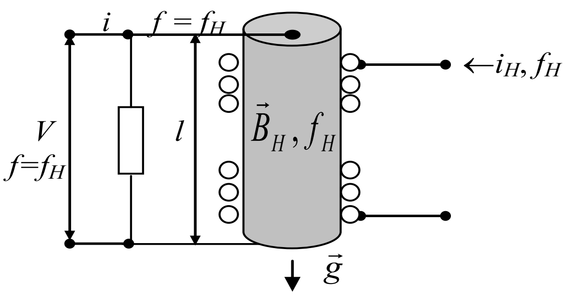

Fig. 1 – *The voltage* V *between the ends of a metallic cylinder when it is subjected to a uniform magnetic field* B_H *with frequency* f_H *,and gravity* g *(as shown above).*

Substitution of Eq. (4) into Eq. (11) and Eq.(12) yields respectively

$$V = \left\{1 - 2\left[\sqrt{1 + 1.5 \times 10^{23} \frac{B_{rms}^4}{f^2}} - 1\right]\right\}\left(\frac{m_{e0}}{e}\right) gl \qquad (13)$$

and

$$i = \left\{1 - 2\left[\sqrt{1 + 1.5 \times 10^{23} \frac{B_{rms}^4}{f^2}} - 1\right]\right\}\left(\frac{m_{e0}}{e}\right)\sigma\, gS \qquad (14)$$

If $B_{rms} = B_{H(rms)} = 1.2T$ † and $f = f_H = 60Hz$, then Eq. (13) and (14) give, respectively

$$V \cong 1.03\ l \qquad (15)$$

$$i = 1.03 \sigma S \qquad (16)$$

Thus, for $l = 215.2m$ ($l_{1pin} = 0.18m$, $l_x = 0.46m$, $l_y = 0.52m$ and $x = 10mm$. See Fig 2), Eq. (15) gives $V \cong 220 volts$. On the other hand, since $\sigma_{iron} = 1.03 \times 10^7 S.m^{-1}$, then Eq. (16) gives

$$i_{\max(theoretical)} = 1.06 \times 10^7 x^2 = 1060\ A.$$

However, the maximum current supported by a 10 *mm* square pin is approximately 300A. Consequently, we can write that

$$P_{\max(theoretical)} = 220 \times 300 = 66kW \cong 88.5HP \qquad (17)$$

3. CONCLUSION

Using two of this Gravelectric Generator in *parallel* it is possible to obtain an out put of **220V**; **60Hz**; **177HP.** This power *is sufficient to feed the electric motor of most electric cars.*

In the US *typical household* power *consumption* is about 1.3 kW per hour. In 2013, the average *annual* electricity consumption for a U.S. *residential* utility customer was 10,908kWh [7]. Then, in order to provide the amount energy of 1.3 kWh it is necessary that the electric generator has power $P = 1300kWh/720h = 1.8kW$. Equation (17) shows that the Gravelectric Generator is able to produce much more than this value.

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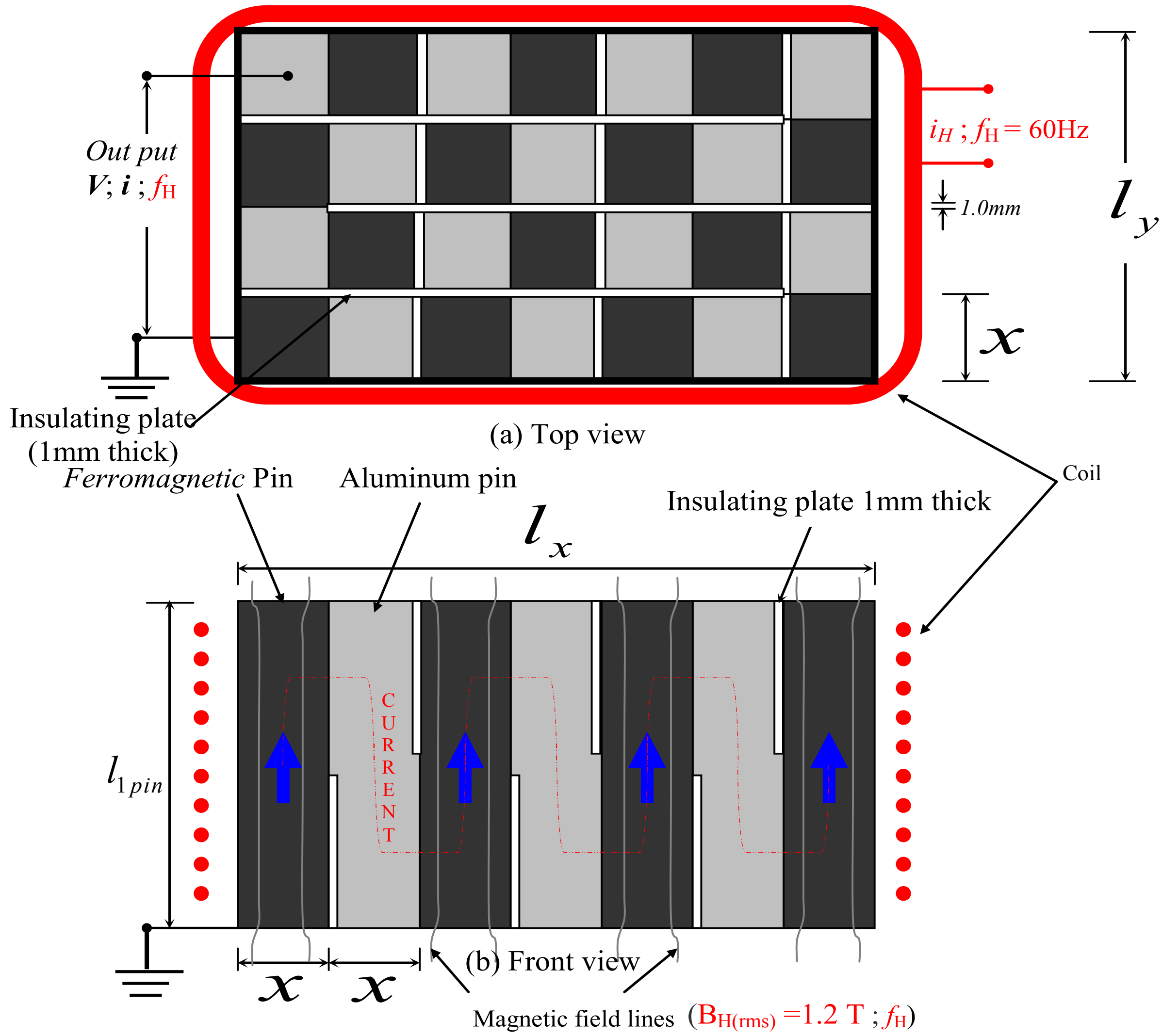
† This value is based on the well-know fact that, a modern 60 Hz power transformer will probably have a magnetic flux density between 1 and 2T inside the core. Thus, 1.2T can be easily obtained in the device here proposed.



Note that: *A modern well-designed 60 Hz power transformer will probably have a magnetic flux density between 1 and 2 T inside the core.*

(↑ *Gravitational* Electromotive Force(Gemf); The Gemf produced in the Aluminum pins have opposite direction to the produced in the ferromagnetic pins. But, it is negligible in comparison with this one because $B_{H(rms)}$ in the Aluminum pins is << 1.2T. See Eqs. (13) and (14)).

Number total of *ferromagnetic* pins: $N \cong l_x l_y / 2x^2$; Total length of the ferromagnetic pins: $l = N l_{1pin} = l_x l_y l_{1pin} / 2x^2$

(l_{1pin} is the length of 1 pin). For $l_{1pin} = 0.18m$, $l_x = 0.46m$, $l_y = 0.52m$ and $x = 10mm$, we get $l = 215.2m$.

Fig. 2 - *Schematic diagram of a more compact and powerful type of Gravelectric Generator.*

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Appendix: Micro Gravelectric Generator for Mobile Phone

Consider a pure iron disk ($\mu_r = 20{,}000$ and $\sigma_{iron} = 1.03 \times 10^7 \, S.m^{-1}$), with the following dimensions: $\phi = 3mm$ and $h = 5mm$. This disk is the core of a coil with $24 turns$ of # 32 AWG $\phi_{wire} = 0.203mm$ (length of the wire $= l = \pi\phi(24turns) = 0.22m$; Area of the Cross-section of the wire $S = \frac{\pi}{4}\phi_{wire}^2 = 3.23 \times 10^{-8} m^2$). Under these conditions, and for an electrical current of 1.7 mA (For # 32 AWG $i_{max} = 0.1A$) through the coil, it is possible to produce a magnetic field through the core with intensity $B_{rms} = B_{H(rms)} = 0.2T$, and $f = f_H = 1Hz$. Then, Eqs. (13) and (14) tell us that

$$V \cong 1.72 \; l = 0.37 volts \qquad (I)$$

$$i_{max\,(theoretical)} = 1.72\sigma S = 0.57A \qquad (II)$$

Since the maximum current supported by # 32 AWG is $i_{max} = 0.1A$, then we can write that the maximum outlet power of this *Micro Gravelectric Generator* is

$$P_{max\,(theoretical)} = 0.37 \times 0.57 \cong 0.2W \qquad (III)$$

This power is sufficient to feed the most of modern mobile phones.

Now consider this *Micro Gravelectric Generator* inside a mobile phone. As shown in Fig. 4, the *Micro Gravelectric Generator* produces the electrical current *i at any position* of the mobile phone, in respect to Earth's surface. Also note that, the direction of the *Gravitational Electromotive Force* (*vector in blue*) is always in opposition to gravity (g), because χ_{Be} is *negative*.

Finally, the most important fact to be observed here is that the electrical energy, which comes from the Gravelectric Generator, is directly converted from the Gravitational Energy, which is a type of *renewable* energy, always available for use, and that never ends.

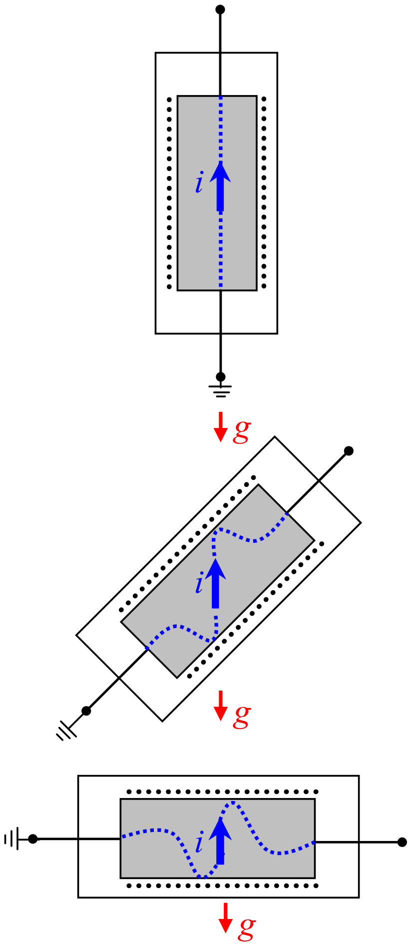

Fig. 4 – Schematic diagram of a *Micro Gravelectric Generator* inside a mobile phone. Note that the *Gravelectric Generator* produces the electrical current *i at any position* of the phone, in respect to Earth's surface. Also note that, the direction of the *Gravitational Electromotive Force* (*vector in blue*) is always in opposition to gravity (g), because χ_{Be} is *negative*.