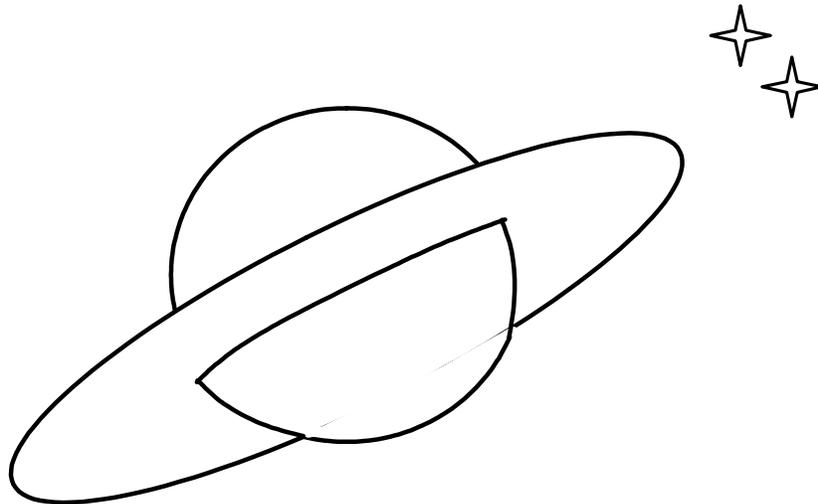


Galactican Group

Engineering Specification

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Crossfield-Homopolar Device



Galactican Group

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PREFACE

The purpose of this document is to serve as a guideline to implementation of a crossfield-homopolar motor-generator (CFHPmg) device described herein. Such a device can function as both an electrical energy generator and a motor. Thus, it can replace batteries and mechanical drivers in many systems. Household applications could free a household from reliance on external power. Power-lines would not be needed. Power outages from weather, overload, or other malfunctions could be eliminated, sense each household would have its own generator.

Automotive applications could use a CFHPmg as both its mechanical power source and electrical power source. A CFHPmg would eliminate the need for internal-combustion. Gasoline-free automobiles could be a cost-effective reality.

A CFHPmg is a device with which several aspects of the energy crisis could be addressed, in an effective and cost-effective manner. As a household or building generator, as an automotive power unit, a CFHPmg would reduce operating costs, eliminate reliance on gasoline and other pollutants, and eliminate adverse environmental impact caused by conventional energy usage. These factors alone, should encourage wide usage of CFHPmg technology.

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1. Introduction

The technology presented herein relates to methods and systems for generating electric power from counter-rotating electromagnetic fields. Electromagnetic fields are created, configured, and aligned so as to generate electric power. Functional details are given in Appendix A. Such technology can be referred to as cross-field generator technology.

Such electric power generation effects are caused by the change in curvature of spacetime. Gravitation is the curvature of spacetime and electromagnetism is the spinning (or torsion) of spacetime. The change in curvature facilitates coupling with the background electric potential energy of spacetime. This background energy (in volts) can then be transferred to power electronic devices. This is the purpose (and primary application) of this technology. A secondary application of this technology is demonstration of Einstein-Cartan-Evans (ECE)-Theory principles. ECE-Theory principles include anti-gravitation via interaction between magnetic fields.

Crossfield device technology is based on the new ECE-Theory. The ECE (Einstein-Cartan-Evans)-Theory [13 -15] is a generally covariant unified field theory, developed by Prof. Myron W. Evans in 2003. The generic ECE-Theory was adapted to practical applications, such as providing energy directly from spacetime. A major principle of the ECE-Theory is that electromagnetism and gravitation are both manifestations of spacetime curvature. More specifically, electromagnetism is the torsion of spacetime, and gravitation is the curvature of spacetime. Since torsion can be viewed as spin, one concludes that spacetime has both curvature and spin. The spinning/torsion of spacetime was neglected in Einstein's Theory of Relativity. Einstein also arbitrarily (and incorrectly) assumed c (*the speed of light*) could not be exceeded. The ECE-Theory also shows that coupling between the background potential of spacetime can be established by appropriate electrical and/or mechanical devices. This coupling manifests as amplification of the potential (in volts) of such devices, as said devices resonate with the background potential energy of spacetime. This phenomenon is called spin-connection-resonance (SCR), [16, 17]. Some engineering principles, for such devices, are discussed in [18]. Fundamentally, ECE-Theory is a combination of Einstein's geometric approach and Cartan Geometry to describe the nature & structure of spacetime. Cartan Geometry [15] adds torsion to the Riemann Geometry used by Einstein in his Theory of Relativity. Thru ECE-Theory, electromagnetism can be expressed as the torsion of spacetime. The basic set of ECE-Theory equations describes both gravitation and electromagnetism.

1.1 Spin Connection Resonance (SCR) Effects

The ECE-Theory allows the interaction of the electromagnetic field and the gravitational field. A generally covariant unified field theory, such as ECE-Theory, allows such interaction. This field interaction is defined in [17]. The significance of ECE-Theory is illustrated by considering two charged masses interacting. There is an electrostatic interaction between the charges, and a gravitational interaction

between the masses. On the laboratory scale, the electrostatic interaction is *orders-of-magnitude* greater than the gravitational interaction. Thus, gravitational interaction has not been measured, on the laboratory scale. In ECE-Theory, the interaction between the electrostatic field and the gravitational field can be controlled by the homogeneous current of ECE-Theory, which is given in [17]. *It is a type of magnetic monopole current.* The homogeneous equation (*in tensor form*) of ECE-Theory is;

$$\partial_{\mu} F^{\mu\nu} = j^{\nu} / \epsilon_0$$

Where; $F \rightarrow$ electromagnetic field tensor

$j \rightarrow$ homogeneous current density

$\mu\nu \rightarrow$ spacetime indices

$\epsilon_0 \rightarrow$ vacuum permeability

given in [19]. It is shown in [17], that for a given initial driving voltage, the effect of the interaction of the electromagnetic field with the gravitational field is significantly amplified (*as is the effect of the electromagnetic field on the Newtonian force*), in a direction opposite to the gravitational field. As shown in [17], the inhomogeneous current is derived from the covariant ECE-Coulomb-Law, [16 - 20]. The inhomogeneous current is the usual electric current.

$$\nabla^2 \phi - \boldsymbol{\omega} \cdot (\nabla \phi) - (\nabla \cdot \boldsymbol{\omega}) \phi = -\rho / \epsilon_0$$

Where; $\phi \rightarrow$ electric background potential of spacetime

$\boldsymbol{\omega} \rightarrow$ vector spin-connection

When the potential energy of the interaction resonates with the background potential energy of spacetime, SCR is achieved. At SCR, amplification of the potential of the interaction term occurs in a direction opposite to gravitation. This produces a counter-gravitation effect.

1.1.1 Power Generation with SCR

The application of crossfield technology, presented in this white-paper, is the generation of power by transferring background electric potential energy of spacetime to power electric devices & systems. The transfer of electrical energy (in volts) from the background potential energy of spacetime is accomplished by using the principles of ECE-Theory to tap this background potential energy. It is shown in [18] that (once SCR is achieved) the spin connection diverges (i.e. $\nabla \cdot \boldsymbol{\omega} \neq 0$) in a region between two counter-rotating magnetic fields. This is shown in figs.13 &14 of [18]. This divergence acts as a source of electric energy/voltage. As is also shown in [18], inserting a dielectric material at the divergence point, permits the resulting voltage to be transferred to power an electric load. Thus, fig.13, of [18] is a generic power source configuration (i.e. crossfield generator). Considering fig.13 of [18], Fig.1 is presented as a generic crossfield generator (CFG) device configuration. For the crossfield generator, the magnitude of its counter-rotating magnetic fields and their relative rotation rate are parameters determining the level of voltage transferred.

2. Generic Concepts

2.2.1 Basic Physical Laws (Under ECE-Theory)

Considering the Coulomb Law under ECE-Theory, from [19] we have;

$$\nabla \cdot \mathbf{E} = \rho / \epsilon_0$$

Where: $\mathbf{E} = -\partial \mathbf{A} / \partial t - \nabla \Phi - \omega_0 \mathbf{A} + \omega \Phi$

$$\nabla \cdot (-\partial \mathbf{A} / \partial t - \nabla \Phi - \omega_0 \mathbf{A} + \omega \Phi) = \rho / \epsilon_0$$

In spherical coordinates we have the resonance equation 14.32 of [17]

$$d^2 \Phi / dr^2 + (1/r - \omega_{int}) d\Phi / dr - (1/r^2 + \omega_{int} / r) \Phi = -\rho / \epsilon_0$$

Where; $\omega_{int} \rightarrow$ the interaction spin connection

Considering the Poisson equation $\{ \nabla^2 \Phi = -\rho / \epsilon_0 \}$ of the Standard Model, and introducing the vector spin connection $\boldsymbol{\omega}$ of the ECE-Theory, one has the following:

$$\nabla \cdot (\nabla \Phi + \boldsymbol{\omega} \Phi) = -\rho / \epsilon_0 \quad \text{The ECE Poisson equation}$$

$$\nabla^2 \Phi + \boldsymbol{\omega} \cdot \nabla \Phi + (\nabla \cdot \boldsymbol{\omega}) \Phi = -\rho / \epsilon_0 \quad 9.6 \text{ of [20]}$$

This equation, 9.6 of [20], has resonance solutions. From the ECE-Theory and [15], it is shown that the gravitational field curves spacetime. It is also shown that the electromagnetic field curves spacetime, *but by spinning spacetime*.

2.1 Magnetic Levitation (Mag-Lev)

The equivalence of gravity and electromagnetism has been established in references [6] and [7]. The process of *magnetic levitation* (mag-lev) is described in [11, 12]. This mag-lev process, where;

$M_B \Rightarrow$ strength of base magnet

$M_L \Rightarrow$ strength of levitation magnet

(usually attached to a vehicle, such as a mag-lev train)

is equivalent to the counter-gravitation process presented in this document. The force between the base (M_B) and the vehicle (M_L) is referred to as the heave-force \mathbf{h} , in mag-lev applications. The heave-force neutralizes gravity *locally*. This is a manifestation of spacetime curvature, and one has the following;

$$\mathbf{h} = \mathbf{h}(M_B, M_L)$$

Let: $\mathcal{H} = \mathcal{H}(M_B, M_L)$, be a velocity along a geodesic

Before deriving an elementary set of equations-of-motion for \mathcal{H} , it is useful to summarize these concepts. In a generalized mag-lev application, the base-magnet M_B and the lev-magnet M_L are both used to levitate matter in an anti-gravity region (between M_L and M_B) resulting from the interaction of the magnetic fields of M_L and M_B .

The heave-force \mathbf{h} is now used to derive an expression for $\mathcal{H}(M_B, M_L)$.

2.2 Equations of Motion

The Lorentz force law (in terms of M_L and M_B) can define the heave-force/induced-curvature of the mag-lev effect resulting from M_L and M_B . From document [10], (*noting that a vector is a tensor of rank 1*), one has the expression

$$\mathbf{h} = \mu_0 \mathbf{I}^2 \beta / 2\pi \mathbf{z} = \mathbf{F}_h$$

where: β = coil length

\mathbf{I} = current

μ_0 = a magnetic constant

$$\mathbf{F}_h = \mu_0 \mathbf{I}^2 f(\mathbf{D}/\varphi) \text{ is the heave force description}$$

where: \mathbf{D} = a magnet dimension (*electric flux density*)

φ = separation of M_B (base) and M_L (lev-vehicle)

$\mathbf{F}_g = q\mathbf{E} + (q\mathbf{v} \times \mathbf{B})$ is the EM/gravity description for (Δq) at velocity \mathbf{v} .

$$\mathbf{F}_h \equiv \mathbf{F}_g, \mu_0 \mathbf{I}^2 f(\mathbf{D}/\varphi) = q\mathbf{E} + (q\mathbf{v} \times \mu\mathbf{H})$$

where: $\mathbf{H} = \mathbf{B}/\mu$

$q\mathbf{E} + (q\mathbf{v} \times \mu\mathbf{H})$ is the Lorentz Force law

Again from [10], \mathbf{F} is defined as follows;

$$\mathbf{F} = M_L M_B / r^2$$

(where r is the distance between magnets M_L and M_B)

If \mathbf{F} is an expression of spacetime curvature, one has the following;

$$\begin{aligned} M_L M_B \int dt / r^2 &= \mathbf{h}_v \\ &= \mathcal{G} \end{aligned}$$

With an expression for \mathcal{G} in terms of M_L and M_B , it is possible to define a set of "equations-of-motion".

Definitions:

\mathcal{G} --- the (M_L and M_B induced curvature) geodesic path velocity of a vehicle

$\int \mathcal{G} dt$ --- position (along the induced curvature) geodesic path

$d\mathcal{G}/dt$ --- acceleration (along the induced curvature) geodesic path

The curvature induced by M_L and M_B is equivalent to the heave-force \mathbf{h} (i.e. mag-lev effect) induced by M_L and M_B . This defines a simple set of equations-of-motion for geodesic-fall.

2.2.1 Equations-of-Motion Conclusions

Gravitation and Electromagnetism are respectively the symmetric and antisymmetric parts of the Ricci Tensor, within a proportionality factor. Gravitation and electromagnetism are both expressions of spacetime curvature. Thus the mag-lev heave-force is also an expression of spacetime curvature, and \mathbf{h} and \mathcal{G} are arguably equivalent.

Obviously, a more rigorous derivation can lead to a fully comprehensive set of equations-of-motion. These equations-of-motion can be the basis for a propulsion system, based on the induced curvature of spacetime. They can also be the basis for designing electric power generation devices, based on ECE-Theory.

2.3 Fundamentals

In this section, the familiar Maxwell equations are adapted to ECE-Theory by considering both the curvature and the torsion of spacetime, in accordance with the Cartan geometry. Some solutions to the resulting ECE-Field Equations have resonance capability (i.e. are resonance equations). The properties of these resonance equations are then applied to both electric power generation and to anti-gravity.

2.3.1 Maxwell equations to ECE equations

B is the magnetic field, **E** is the electric field, **J** is the current density. The Maxwell equations are as follows;

$$\begin{aligned}\nabla \cdot \mathbf{B} &= 0 \\ \nabla \times \mathbf{E} + \partial \mathbf{B} / \partial t &= 0 \\ \nabla \cdot \mathbf{E} &= \rho / \epsilon_0 \quad \text{Coulomb Law} \\ \nabla \times \mathbf{B} - (1/c^2) \partial \mathbf{E} / \partial t &= \mu_0 \mathbf{J}\end{aligned}$$

Now considering (from the Cartan geometry, [15]) that spacetime is both curved and spinning (the spiral galaxies are an example of spinning spacetime), and that electromagnetism and gravitation are both manifestations of spacetime curvature (wherein electromagnetism is the spin of spacetime, gravitation is the curvature of spacetime), the fields **E** and **B** can be determined relative to the background electric potential energy of spacetime. Considering the concept of “*connection*” on the manifold of spacetime, the spin connection is labeled in vector form as ω , in scalar form as ω_0 for this discussion.

Let;

A → the vector potential of spacetime, Φ → the scalar potential of spacetime

From [15, 17, 18], the field dependencies on potential are:

$$\begin{aligned}\mathbf{E} &= -\partial \mathbf{A} / \partial t - \nabla \Phi - c\omega_0 \mathbf{A} + \omega \Phi \\ \mathbf{B} &= \nabla \times \mathbf{A} - \omega \times \mathbf{A}\end{aligned}$$

These equations constitute the dependence of the electric and magnetic fields on vector potential **A** and scalar potential Φ . Substituting these equations into the Maxwell equations provides the field equations of ECE-Theory [19].

2.3.2 Resonance Solutions

The solutions to these ECE-field equations include some with the form of a resonance equation. These resonance solutions show that the background potential energy Φ of spacetime can be greatly amplified at resonance. From the basic resonance equation, one has a system defined by;

$$d^2q_i(x) / dt^2 + \zeta_1 dq_i(x) / dt + \zeta_2 q_i(x) = f(x)$$

resonance (i.e. amplification of $q_i(x)$) occurs when $f(x)$, *the driving function*, is periodic near $(\zeta_2)^{1/2}$, the eigen frequency. Here, ζ_1 is the damping function, and ζ_2 is *the square of the eigen frequency of the system*. In the case of ECE-Theory, considering the electrical case (i.e. $\mathbf{A} = 0$) for the Coulomb Law,

$$\zeta_2 = -\nabla \cdot \boldsymbol{\omega} \ , \ q_i(x) = \Phi$$

Thus, when the div $\boldsymbol{\omega}$ (divergence of the spin connection) is non-zero

$$\nabla \cdot \boldsymbol{\omega} \neq 0$$

Resonance (spin connection resonance (SCR)) occurs, amplifying Φ . Also, the amplification of the interactive spin connection ω_λ , maximizing the effect of the electric field \mathbf{E} , on Newtonian gravitation, in a direction opposite to the gravitational field. This is an anti-gravity effect [17]. As is shown in [18], the div $\boldsymbol{\omega}$ is a source mechanism to access electrical energy (in volts) from the background potential of spacetime. This energy can be tapped and used as electrical power. Thus, spacetime is an energy source which (for present practical purposes) can be considered unlimited.

2.3.3 Rotating Magnetic Fields

By the ECE-Theory, $\boldsymbol{\omega}$ is defined as the rotating vector of a magnetic field. The necessary spin connection can be realized (in either the anti-gravity case, or an electrical energy case) by counter-rotating magnetic fields. From the interaction Coulomb Law ;

$$\nabla \cdot \mathbf{E} = -\boldsymbol{\omega}_{\text{int}} \cdot \mathbf{E}$$

Where; *from* [17], $\boldsymbol{\omega}_{\text{int}}$ is a spin connection denoting the interaction between electromagnetic & gravitational forces

One can derive the following equation;

$$d^2 \Phi / dr^2 + (1/r - \boldsymbol{\omega}_{\text{int}}) d\Phi / dr - (1/r^2 + \boldsymbol{\omega}_{\text{int}} / r) \Phi = -\rho / \epsilon_0 \quad 14.32 \text{ of [17]}$$

Equation 14.32 of [17] is a resonance equation with variable coefficients. Thus, the resonance behavior of this equation is more complicated than the simple, *basic resonance equation*, discussed above.

A proper choice of $\boldsymbol{\omega}_{\text{int}}$ amplifies Φ by causing resonance according to eq. 14.32 of [17]. Examples of applicable choices for $\boldsymbol{\omega}_{\text{int}}$ are given in sec.14.3 of [17]. The amplification of Φ results in resonance increase of the electric field \mathbf{E}

$$\mathbf{E} = -\partial \mathbf{A} / \partial t - \nabla \Phi + \boldsymbol{\omega}_{\text{int}}$$

from the ECE field equations. The electric field thus effects Newtonian gravitation in an opposite direction to gravitation. This anti-gravity effect can be exploited for propulsion, energy generation, water treatment, and other applications.

3. Device Design Fundamentals

The ECE-Theory also shows that coupling between the background potential of spacetime can be established by appropriate electrical and/or mechanical devices. This coupling manifests as amplification of the potential (in volts) of such devices, as said devices resonate with the background potential energy of spacetime. This phenomenon is called spin-connection-resonance (SCR), [16, 17]. Some engineering principles, for such devices, are discussed in [18]. SCR is exploited to achieve anti-gravity effects for the lift phase. Differential geometry aspects of ECE-Theory, concerning SCR, are given in [12].

3.1 Basic Design Objectives

In general, to counter the gravitational field of spacetime (i.e. at a given point in spacetime), the potential energy (Φ) of spacetime, must be increased. Using ECE-Theory, the background potential energy of spacetime (i.e. the scalar potential Φ) is considered.

3.1.1 Background Potential Energy of Spacetime Φ

Conventionally, gravitational potential energy is related to the gravitational force. Gravitational potential energy (K), of an object is;

$$K = mgh$$

Where; \rightarrow m = mass of object
g = gravitational acceleration
h = altitude above earth

If an object's altitude above the earth *decreases* its, K *decreases*. If an object's altitude above the earth *increases* its, K *increases*.

From ECE-Theory, considering that gravitation & electromagnetism are both expressions of spacetime curvature (where gravitation is the curvature of spacetime and electromagnetism is the torsion/twisting of spacetime), $K \equiv \Phi$ can be viewed as related to spacetime curvature. Thus, the gravitational potential energy (at any point in spacetime), can be regarded as the potential energy experienced by an object at that point. The curvature (i.e. gravitational field) of spacetime at any point, determines the geodesic-path and velocity an object (at that point) would experience. If curvature was induced at a point in spacetime, an object at that point could fall along the resulting geodesic, at a velocity dependant on the degree of said induced curvature. This induced geodesic-fall vector would be different from the natural geodesic-fall vector (e.g. normal gravity, in the earth realm). In the earth realm, raising the altitude of an object opposes gravity (i.e. induces spacetime curvature) and increases the object's potential energy. Therefore, by increasing Φ , anti-gravity effects can be induced.

The ECE-Theory shows [16, 17] that coupling between the background potential energy (Φ) of spacetime, can be established with appropriate electrical and/or mechanical devices. This coupling can cause a significant increase in Φ (in the neighborhood of such a device). Thus, gravitation is countered in that

device neighborhood. The field equations of ECE-Theory are used below, to show (*analytically*) how this coupling works.

3.1.2 Spin-Connection Resonance (SCR)

ECE-Theory shows that properly designed electric and/or mechanical devices can resonate with Φ . The ECE field equations can be used to define an engineering framework for the design & implementation of devices suitable for coupling with the background potential energy (Φ) of spacetime (i.e. achieving SCR).

3.1.3 Engineering Framework (for an SCR Capable Device Technology)

From the form of a general resonance equation (i.e. differential equation) for generalized item $q_i(x)$, where $f(x)$ is the driving function, we have:

$$\partial^2 q_i(x) / \partial x^2 + \zeta_1 \partial q_i(x) / \partial x + \zeta_2 q_i(x) = f(x)$$

From the ECE-Theory field equations (*where **boldface** denotes a vector quantity*, ∇ is the gradient vector), the following relations are used;

$$\begin{aligned} \mathbf{E} &= - \partial \mathbf{A} / \partial t - \nabla \Phi - \omega^0 \mathbf{A} + \Phi \boldsymbol{\omega} \\ \mathbf{B} &= \nabla \times \mathbf{A} - \boldsymbol{\omega} \times \mathbf{A} \end{aligned}$$

where; \rightarrow $\left\{ \begin{array}{l} \mathbf{A} = \text{vector potential of spacetime} \\ \Phi = \text{scalar} \quad \text{"} \quad \text{"} \\ \omega^0 = \text{"} \quad \text{spin connection} \\ \boldsymbol{\omega} = \text{vector} \quad \text{"} \quad \text{"} \end{array} \right.$

Considering the electrical case, from [18] we let $\mathbf{A} = 0$, which gives the following:

$$\mathbf{E} = - \nabla \Phi + \Phi \boldsymbol{\omega}$$

Using Coulomb Law ($\nabla \cdot \mathbf{E} = \rho / \epsilon_0$), we have:

$$\begin{aligned} \nabla \cdot \mathbf{E} &= \rho / \epsilon_0 \\ &= \nabla \cdot (- \nabla \Phi + \Phi \boldsymbol{\omega}) \\ &= - \nabla \cdot \nabla \Phi + \boldsymbol{\omega} \cdot \nabla \Phi + \Phi \nabla \cdot \boldsymbol{\omega} \\ &= - \nabla^2 \Phi + \boldsymbol{\omega} \cdot (\nabla \Phi) + (\nabla \cdot \boldsymbol{\omega}) \Phi \end{aligned}$$

Changing signs, we have;

$$\begin{aligned} &= \nabla^2 \Phi - \boldsymbol{\omega} \cdot (\nabla \Phi) - (\nabla \cdot \boldsymbol{\omega}) \Phi \\ &= - \rho / \epsilon_0 \end{aligned}$$

The ECE Coulomb Law thus gives the expression:

$$\nabla^2 \Phi - \boldsymbol{\omega} \cdot (\nabla \Phi) - (\nabla \cdot \boldsymbol{\omega}) \Phi = - \rho / \epsilon_0 \quad (1)$$

This is a resonance equation for Φ , the scalar potential. The resonant frequency is $(\nabla \cdot \boldsymbol{\omega})$, the divergence of the spin connection [18]. Thus the term *spin-*

connection-resonance (SCR), is used. If Φ is the spacetime scalar potential, then at SCR, Φ should be maximized. The effect is to induce spacetime curvature in the maximized potential field Φ . The degree of induced curvature, and the resulting geodesic path are determined by the driving function ($-\rho/\epsilon_0$). The induced curvature & resulting geodesic path would be different from the *natural* curvature & geodesic path. Thus, natural gravity is opposed. Fundamentally, by increasing (e.g. maximizing) spacetime gravitational potential energy Φ , anti-gravity effects are generated.

3.1.4 Driving Function Principles for SCR Capable Devices & Systems

From [18], and observation an engineering approach to a device family for coupling with Φ is suggested. Given, that the resonance frequency from eq. (1) is $(\nabla \cdot \omega)$, and ω is a rotation vector of a magnetic field, it is reasonable to consider devices based on rotating magnetic fields. A rotating magnetic field (or two counter-rotating magnetic fields [18]) can be used to achieve resonance, SCR in this case. At SCR, Φ is amplified in the neighborhood of the rotating magnetic fields. Gravitation is countered, and electric energy is available ([18]). The remaining focus of this document will be counter-gravitation devices, based on counter-rotating magnetic fields. Such devices can be referred to as **cross-field devices**.

3.1.5 Specifics for a Generic Driving Function

The objective of a cross-field device is to couple with the torsion of spacetime, to achieve SCR, and maximize Φ . By definition, ω_i is the rotation vector of the i^{th} magnetic source, $\mathbf{B}_i(r)$ is the field of the i^{th} magnetic source, and $\mu_i(t)$ is the magnetic moment of the i^{th} magnetic source. From the engineering prospective [18], the use of two counter-rotating magnetic sources suggests a flexible, effective SCR device technology. This is because a simple, straightforward, magnetic torque-based driving function can be defined. We can use the driving function:

$$\mathbf{F}_{\text{drv}} = \mu_1(t) \times \mathbf{B}_1(r) + \mu_2(t) \times \mathbf{B}_2(r) \quad (2)$$

Φ is maximized in the region between the counter-rotating magnetic sources, countering gravitational effects in that region. *We define this region between the counter-rotating magnetic sources as the "Bubble"*. The dynamics of the Levitron device (and of *levitron-like* devices) [11,12] is an example of this effect.

Additionally, as shown in [18], in the "Bubble" where ω changes sign, is a source of voltage. A proper dielectric material, placed at this sign-transition point inside the "Bubble", can transfer voltage (electrical energy) directly from spacetime. Thus, the nearly infinite reservoir of spacetime background potential energy can be effectively exploited as an electrical energy resource. Appendix A gives a detailed crossfield device description for this exploitation. The variables of the driving function (eq. 2) would be adjustable to application requirements.

4. Implementation Considerations

Figure 1, illustrates the magnetic field component of the device. It consists of two magnetic fields (M_1 and M_2), counter-rotating to produce anti-gravity region (M) between them. At point (P), the spin connection divergence is non-zero (i.e. $\nabla \cdot \omega \neq 0$), and SCR is achieved, amplifying the background electric potential energy of spacetime. At SCR the effect of the electric field on gravitation is maximized in a direction opposite to the gravitational field. This creates an anti-gravity effect. It is called a crossfield device (CFD). Its function is to supply the external magnetic field required for the generator portion of the CFHomopolar device.

Sources for these *boundary magnetic fields* can be implemented as magnetic disks or as arrays of electromagnetic elements. Control mechanisms, are used to control each of the magnetic sources. If a magnetic source is implemented as a simple magnetic disk, its control mechanism can be a simple rotary motor.

In Fig. 2, a homopolar generator (also referred to as a Faraday Disk) is inserted at (P). The flywheel-conductor assembly rotates in a reduced gravitational field, and an amplified electric potential energy field, due to (SCR) at (P). Thus, the efficiency of rotation is enhanced for the motor aspect of the device. V_{out} exploits the Faraday Disk generator aspect of the device. V_{out} can power an electric load plus the counter-rotating magnets (M_1 & M_2), as shown. Fig. 2A is the flywheel-conductor rotating component. The flywheel also consists of conducting material, to enable the Faraday Disk aspect. The homopolar device plus the crossfield device is both a motor and a generator.

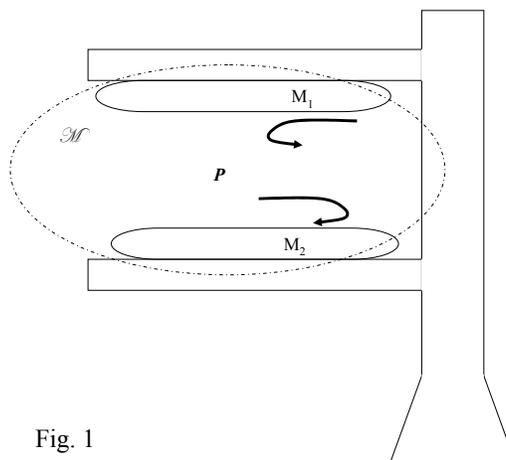


Fig. 1

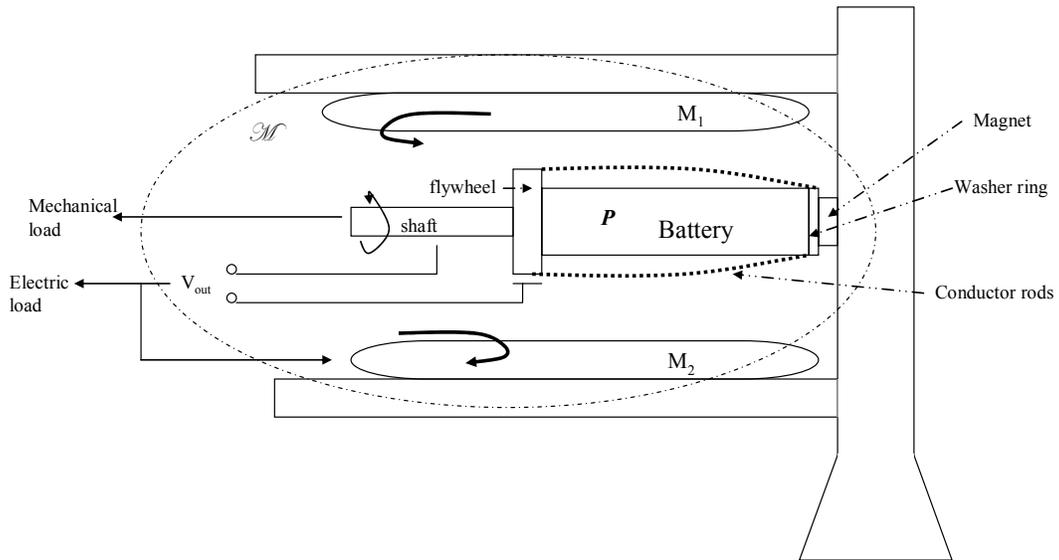


Fig. 2 Crossfield Enhanced Homopolar Motor-Generator

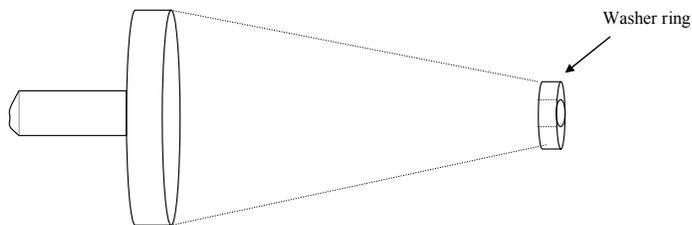


Fig. 2A Flywheel Conductor Assembly

In Fig. 2 the dielectric slab of a crossfield-generator is replaced by a homopolar generator. The crossfield device (hereafter referred to as *CFD*) provides the external magnetic field for the homopolar portion of the device. When the flywheel rotates, voltage is available via the electric potential difference between the rim and the shaft of the conducting flywheel.

Fig. 3 shows a magnetic dipole placed in the flywheel. It equals the diameter of the flywheel in length. The purpose of the dipole is to facilitate control of the rotation of the conducting flywheel, plus overall on/off device control.

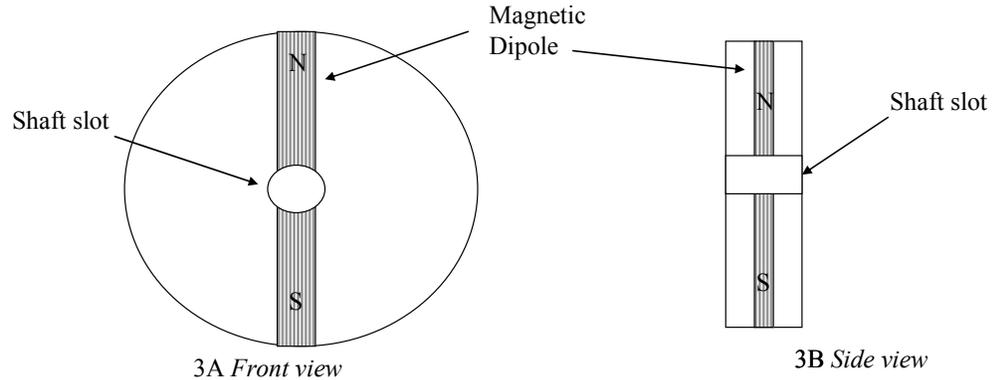


Fig. 3 Advanced flywheel –conductor assembly
(using magnetic-dipole)

Fig. 4 shows the conducting flywheel (of a homopolar generator device) with a magnetic dipole. The purpose of the dipole is the control of the on/off state of the homopolar generator. Its on-state is defined as when the flywheel is rotating. The flywheel rotates in a reduced gravity environment provided by its CFD, in accordance with ECE-Theory. The CFD also provides an amplified background electric potential energy field due to SCR at point *P*. Thus, at a proper frequency, the output voltage from the flywheel could resonate with the amplified electric potential of spacetime, provided by the CFD. This should greatly increase the output electric energy from the homopolar component of the device.

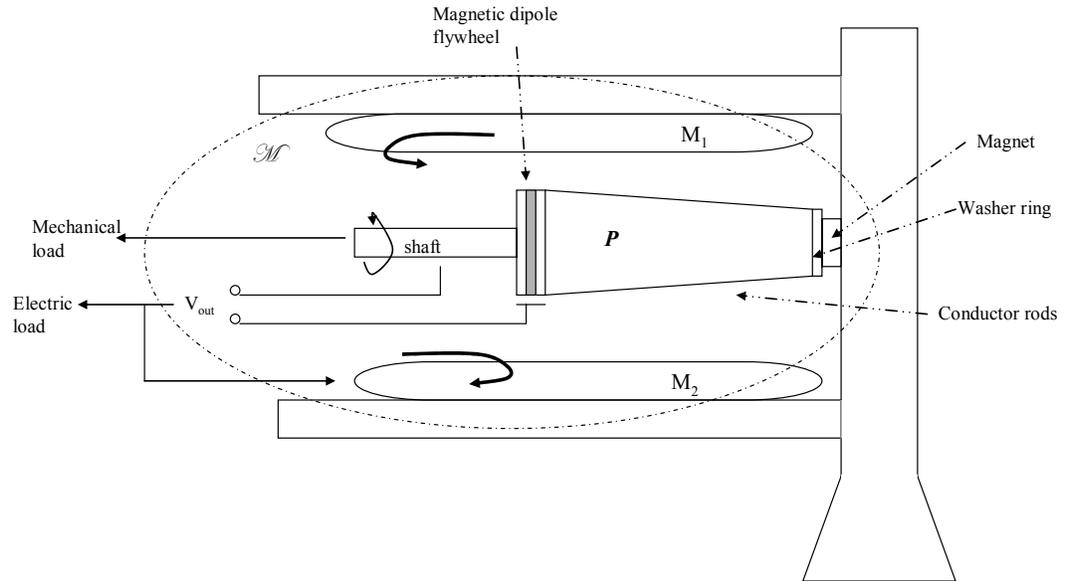


Fig. 4 *Crossfield Enhanced Homopolar Motor-Generator*

Operationally, when either of the counter-rotating magnets M_1 or M_2 is sequentially activated, the dipole of the flywheel is attracted or repulsed, and rotation begins. As rotation begins, the N and S poles of the dipole each react opposite (i.e. repulsion, attraction) to the field of M_1 or M_2 , causing rotation to continue. This function ceases when either M_1 or M_2 is deactivated.

4.1 Device Control

In Fig. 5, a simple on/off mechanism is attached to the crossfield-homopolar device. This on/off circuit controls the overall device on/off state. The on/off control circuit must control both portions (magnetic field generation, voltage generation) of the device separately.

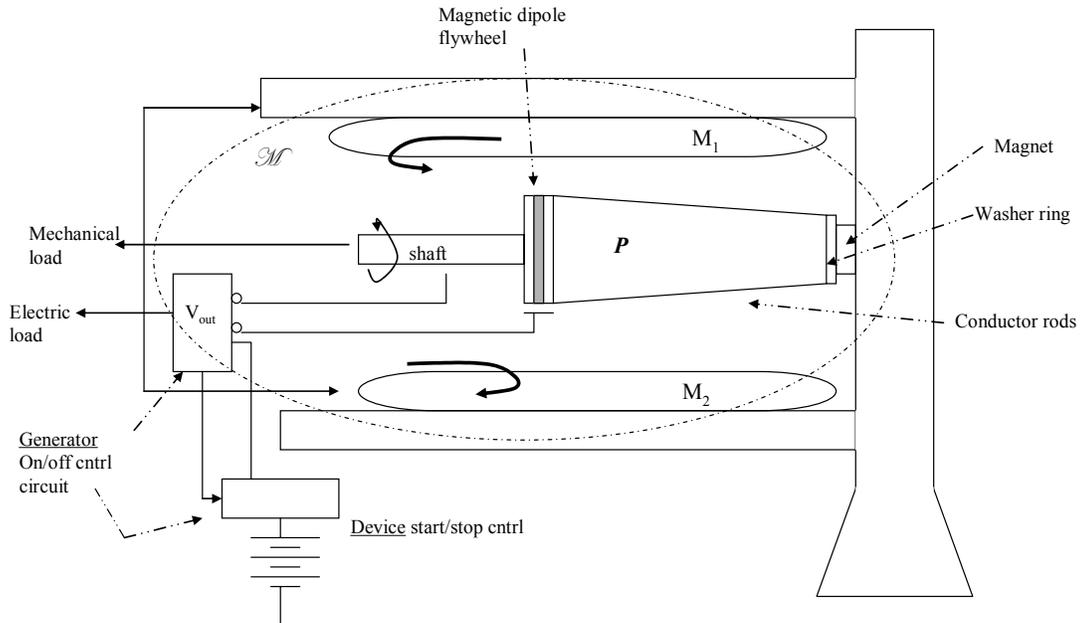


Fig. 5 *Crossfield Enhanced Homopolar Motor-Generator*
(with control components)

Appendix B describes a control circuit capable of controlling both portions of a crossfield enhanced motor-generator. Circuit 65 (V_{out}) of appendix B controls the generator portion of the device. Circuit 69 ($Device\ start/stop\ cntrl$) of appendix B controls the magnetic field portion of the device.

4.2 Specific Functions & Capabilities

A crossfield-homopolar device would provide a method for providing the external magnetic field for a homopolar device, by operating said homopolar device between two counter-rotating magnetic fields, which produce an anti-gravity region between said counter-rotating magnetic fields, such that the spin connection ω divergence is non-zero (i.e. $\nabla \cdot \omega \neq 0$), and spin-connection-resonance (SCR) is achieved, thereby amplifying the background electric potential energy field of spacetime (in the anti-gravity region between said counter-rotating magnetic fields) wherein said homopolar device reacts with said amplified electric potential energy field, thus increasing the operational and rotational efficiency of said homopolar device, Also provides is a method wherein said homopolar device (consisting of a conducting flywheel with a magnetic dipole component, (and a conducting shaft attached at its center)) operates by said flywheel rotating inside said amplified background potential energy field, (wherein said rotation of said conducting flywheel is controlled via interaction between said dipole and said counter-rotating magnetic fields), such that said rotation causes a shaft (attached to the center of said conducting flywheel-dipole)

to rotate with said conducting flywheel-dipole, wherein said connected shaft can drive a mechanical load (in the manner of a rotary motor). The device also provides a method wherein said flywheel also consists of conducting material, wherein electric leads from said rotating shaft, and the rim of said rotating flywheel embody a homopolar generator type device (similar to a Faraday Disk generator), wherein the voltage from the homopolar generator type device can be used to power an electric load, whereby said crossfield-homopolar device operates as both a motor and a generator. Finally a method for controlling a crossfield-device CFD, wherein the counter-rotating magnets of said CDF are turned on or off by said control method. The control method can determine the on/off state of the crossfield-homopolar device it is attached to. This capability enhances the control granularity of the crossfield-homopolar device.

4.3 Typical Device Applications

A crossfield homopolar motor-generator with (for example) 10Kw output voltage, is a generic device that could be applied to household applications. The advantages are many. A particular advantage is independence from power companies, power-line outages, etc.. The parameters of the device (e.g. M_1 , M_2) can be adjusted for the desired output voltage. For required applications, a shaft can be attached to the center of the flywheel, allowing the device to function as both a generator and a motor. Such devices could power household appliances, while the appliance power-units are driven by the main 10kw unit, for example.

Another application area could be automotive. The device could replace the battery, as the electrical power source, for most automobiles. The motor portion of the device could power the automobile's engine. For example, the motor portion of the device could serve as the crankshaft of a piston-driven engine. Considering a conventional V-8 type engine structure, the crankshaft rotation could be realized, without the need for (internal-combustion driven) pistons. This could make automotive engines smaller, cheaper, and more efficient, [30].

These diverse applications illustrate the wide utility of the crossfield-homopolar motor-generator. The device's potential as a cost saver, and as a solution to the energy crisis should facilitate the adoption of this technology.

5.0 Summary

Fundamentally, the equivalence of electromagnetism and gravitation is shown in [7]. In [14], the overall constraints of Einstein's Theory of Relativity are generalized to the more comprehensive ECE-Theory. This leads to several significant ramifications [10], [19-23]. Practical, *cost-effective*, safe space travel can be within reach. The new ECE-Theory offers a technology free of internal-combustion, nuclear costs & dangers, independent of fossil-fuels (*and other costly energy requirements*), and applicable to most forms of vehicular transport. This is fundamental, *if* present environmental and economic concerns are to be *effectively* addressed.

Ability to access the background electrical energy of spacetime provides a virtually unlimited reservoir of clean energy. The example applications discussed in this short paper, fit/retro-fit easily into existing systems & infrastructure. The only operational changes, for vehicles using this technology, are removal of fueling requirements.

The new ECE-Theory, and its crossfield technology, provides a pathway to solve the energy crisis. Elimination of internal-combustion eliminates the need for petroleum, and jet-fuel. Petroleum products are major cost-factors in dollars, environmental impact, and geo-politics. *With independence from oil, the Western Powers can effectively & strategically withdraw, from oil producing regions, and no longer be held hostage by Middle East oil.*

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Crossfield Generator Device ***(Energy Transfer Operation)***

Appendix A

Energy Transfer Device ***(Operational Overview)***

The crossfield generator (CFG) is an energy transfer device. The purposes of the energy transfer device are production of electric energy and production of anti-gravity conditions. The device works by using background potential energy of spacetime to power electrical mechanisms.

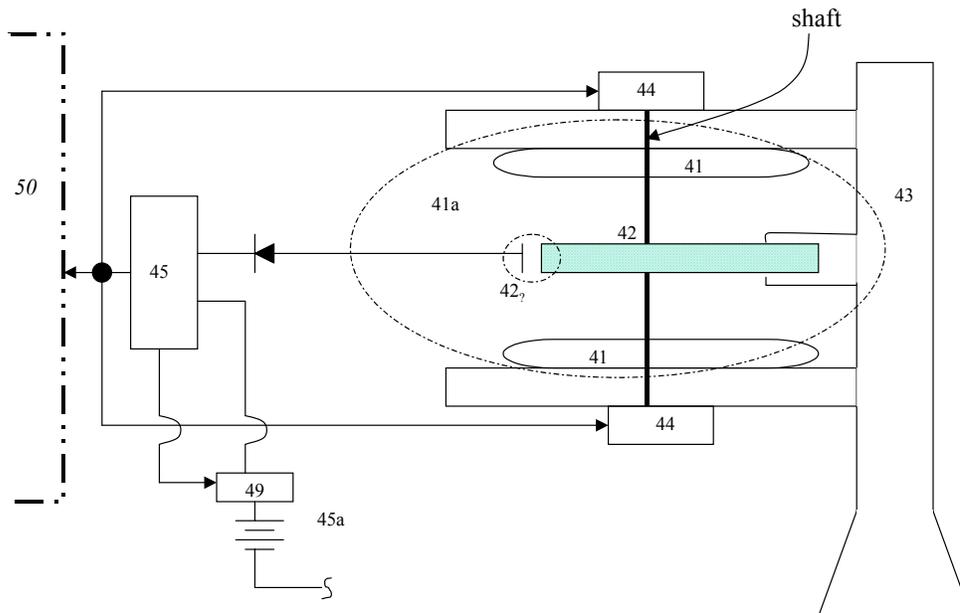
The energy transfer device is based on the new ECE-Theory of cosmology. The ECE (Einstein-Cartan-Evans)-Theory is a unified field theory, developed by Prof. Myron W. Evans in 2003. A major principle of the ECE-Theory is that electromagnetism and gravitation are both manifestations of spacetime curvature and spin. Electromagnetism is the spinning (or torsion) of spacetime. Gravitation is the curvature of spacetime. By properly amplifying the interaction between these forces, anti-gravity effects can be produced.

The ECE-Theory also shows that tapping between the background potential of spacetime can be established by appropriate electrical and/or mechanical devices. This tapping manifests as amplification of the potential (in volts) of such devices, as said devices resonate with the background potential energy of spacetime. This phenomenon is called spin-connection-resonance (SCR). The device can be used to demonstrate SCR, to refine methods of attaining SCR, and to examine SCR related conditions. The device can be implemented on the laboratory-scale, or up-scaled for real applications.

It is well known, through research & experiment, that counter-rotating magnets can produce anti-gravity effects. This is an example of SCR. A dielectric material, in the resulting anti-gravity field, can cause energy transfer from the background potential of spacetime. This energy (in voltage) can be used to power electric devices, as the demonstration shows. This energy is a property of spacetime, thus in limitless supply. Dr. Horst Eckardt derived this concept in 2008.

The basic structure of the device includes two magnetic sources mounted on a stand, which separates the magnetic sources by a given space, such that a counter-gravitational region is induced in said space. Matter in this induced counter-gravitational region levitates, or in other words behaves as matter in a zero-gravity environment, such as outer-space.

The basic device structure is illustrated in the figure below. Components of the device are numbered to simplify the figure, and for clarity of description. The device consists of two magnetic sources 41, which can be implemented as basic magnets, magnetic disks, or as arrays of electromagnetic elements.



A Generic Device Configuration
(for Electric Power Generation)

A generic configuration, primarily for electric power generation is shown. The stand 43 can be any suitable material. The dielectric material 42 is used in the process of electric energy generation. The electric energy is generated by dynamics of the magnetic field, produced by the counter-rotating magnetic sources 41, interacting with the dielectric material 42. This is the initial demonstration unit. The magnetic sources 41 remain stationary, while the dielectric material 42 is rotated. The dielectric is implemented as a (*magnetic dipole*) flywheel type device. The motors 44 are used to spin/rotate the flywheel 42. Counter-rotation of the magnets is achieved by the spinning flywheel, because a rotating magnet (*with its poles rotating/spinning*) in the field of a stationary magnet, is the functional equivalent of two counter-rotating magnets. The area 41a, between the magnetic sources becomes an anti-gravity “bubble”, wherein anti-gravity effects can be examined and utilized. The control circuit 45, and its initialization battery power subsystem 45a, is used to turn on the system, and to control the electric energy feed, from the device when the electric power transfer application is in operation. An alternate configuration, utilizing counter-rotating magnetic fields, generated by solenoid type devices was constructed & tested by ECE Technologies, Ltd. This configuration could have several *engineering* advantages over the above experimental configuration.

This electric power is transferred from the spacetime background energy to the electric mechanism 50. The circuit 49, of the *initialization-battery-power* subsystem, detects the spacetime energy transfer, indicating the device is in operation. Once the device is operating, the circuit 49 causes the *initialization-battery-power* subsystem to shutdown. Then a portion of the electric power (*transferred from background potential energy of spacetime*) is distributed to the motors 44, to maintain device operation. A capacitor type arrangement 42_λ is used to extract resulting energy. The anti-gravity effect will increase the efficiency of the flywheel rotation. The dielectric material 42 is properly magnetized, for optimal operation of the device.

This device, an energy transfer unit, can be viewed *functionally* as a battery. Depending on device size, it can be used to power anything from cities, households, to vehicles, to handheld devices. *The household generator application would be of extreme benefit, as power outages (and related problems), and utility bills could be eliminated.* A low cost, efficient, environmentally-friendly energy resource is now continuously available. Requirements for gasoline (and other organic/fossil fuels) can be eliminated. Wind-farms, costly nuclear-energy, coal, and other pollutants can be put aside. *The environment can be saved.* An unlimited energy resource (spacetime) is all around us.

Proper utilization of the background energy reservoir of spacetime should prevent any future energy crisis (environmental or economic), in the foreseeable future of mankind.

Generic Crossfield Generator Device *Startup & Control* Subsystem

Appendix B

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G2/CFDHp ESPEC-01*

Fig. B1 shows a Crossfield Generator (CFG) device with control-system components 65, 65a, and 69. Fig. B2 shows control system details.

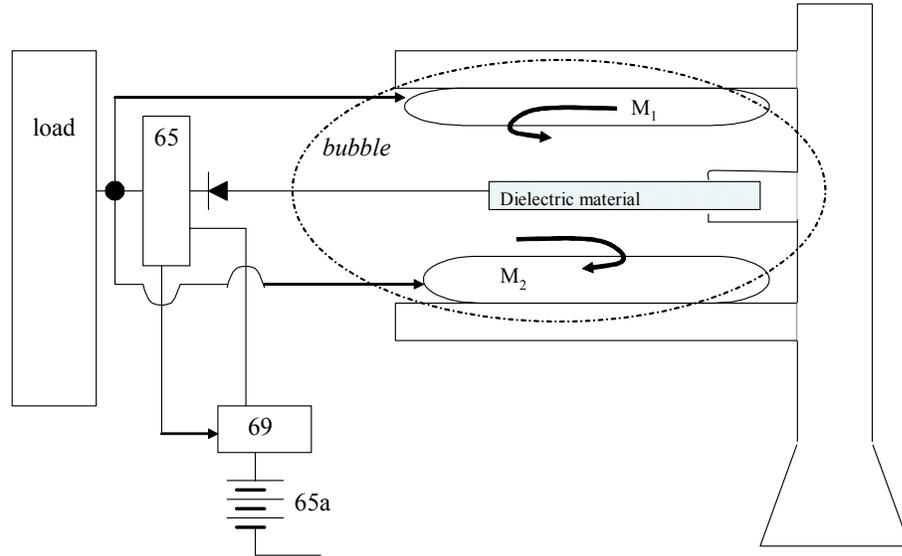


Fig. B1

The startup & control sub-system, of Fig. B2, consists of an initialization battery component 65a, an XOR-gate device 66, an OR-gate device 67, and an optional delay circuit 68.

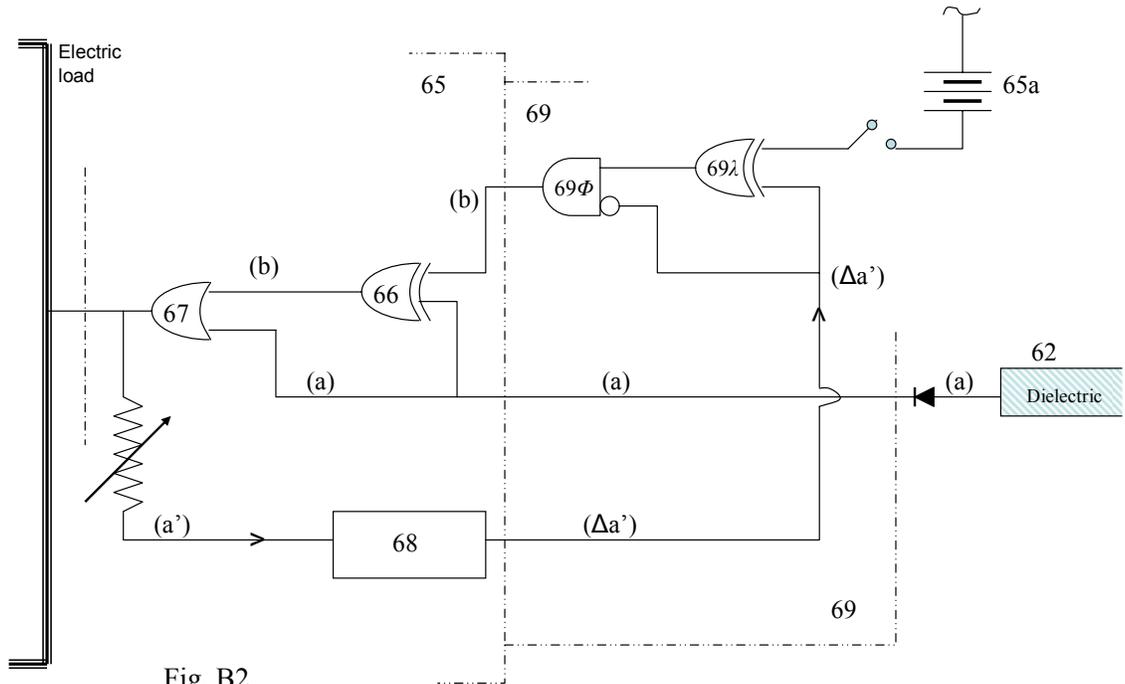
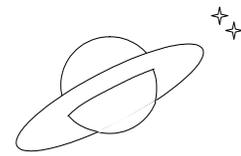


Fig. B2

The purpose of the delay circuit 68 is to shut-off the battery component 65a, after the electric power generation process has started. The start of the power generation process is indicated when line $(\Delta a')$ becomes active. When line $(\Delta a')$ becomes active, line (b) cuts-off, and only line (a) powers the load. The electric load, in this case, includes the units realizing the counter-rotating magnetic fields (M_1 and M_2) of the electric load, and the similar units of the generator device itself. The optional delay circuit 68, prevents premature cut-off of power from the initializing battery component 65a, by delaying the active (i.e. *power transfer process active*) signal indicator (a') to the control switch component 69. When 69 receives an active input signal $(\Delta a')$, it zeros the signal between 65a and XOR-gate 66. Circuit 68 could be implemented as an amplifier type circuit. An example would be a grounded-emitter type digital amplifier. As an engineering note; *If the battery component (65a) is rechargeable, the recharging process could be accomplished using the delayed output signal $(\Delta a')$. This is a concept similar to that used for the electrical sub-system of current automobiles. However, no gasoline is required.*

Notes



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