Electromagnetic Propulsion of Matter in Violation of Newton's 3rd Law

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The intention of this article to hypothesize a theory of electromagnetic propulsion of matter, using a pulsed electric current, located within a wire conductor that induces a magnetic field, which then interacts with its own current to propel that conductor [Mass or matter] without a propellant. This function is a violation of Newton's 3rd Law. So in this scenario $F = ma$ in one direction does not equal $F = ma$ in the opposite direction.

1. Introduction

Newton's 3rd Law states that for every action there is an equal and opposite reaction. This fact is evident with respect to the propulsion of rockets in outer space. For instance in order to propel a rocket in one direction, matter must be expelled in the opposite direction. In essence, $F = ma$ in one direction is equal to $F = ma$ in the opposing direction. This is true regardless as to whether one employs either classic propellants or else charged particles [ionic engines]. It should be noted that Newton's 3rd Law is only applicable relative to closed local systems. It does not apply to open systems such as the propulsion of a spacecraft using solar sails, which reflect photons from the Sun, thus capturing their momentum. Or alternatively, a spacecraft that generates a magnetic field, which subsequently entraps as well as captures the momentum of the electron solar wind.

This paper is divided into the three following sections:

- **Section 2** demonstrates examples where Newton's 3rd Law does not apply.
- **Section 3** describes the structure and function of rail guns.
- **Section 4** utilizes the concepts described in Section 3 to illustrate how a modified rail gun can propel itself in outer space without the use of propellant, thereby violating Newton's 3rd law.

2. Violations of Newton's 3rd Law

A general examination of scientific literature with respect to Newton's 3rd Law, reveals more often than not, statements such as, "*There is no instance whereby Newton's 3rd Law has ever been violated*." This article demonstrates that this belief is in fact, not factual. It describes a theory of electromagnetic propulsion of matter using a pulsed electric current located within a metal wire conductor that produces a magnetic field, which then interacts with its own current. As a result, that wire conductor is propelled [Mass or matter] in the absence of matter that is being expelled in the opposite direction. So $F = ma$ in one direction does not equal $F = ma$ in the opposite direction. Therefore, this function is a contravention of Newton's 3rd Law. The following two examples of Section 2 demonstrate this violation.

2.1. Magnetic Flux Producers [Example 1]

An appreciation of magnetic flux compression producers aids in the comprehension of Example 1. This apparatus produces an extremely powerful directed magnetic pulse [EMP], which can be used as a military weapon, analogous to a gun.

The next two illustrations [Figs 1 and 2] provide a description of the physical structure, as well as the actual function of two different types of Magnetic Flux Compression Generators. This device is an explosive, self-destructive apparatus good for only one extremely powerful magnet pulse. I have used this model only to demonstrate the underlying physics of the concept. However, I believe there are other analogous or similar devices, which are non-explosive as well as non-self destructive. Even so, they are not readily available for review in the literature, given that they are classified.

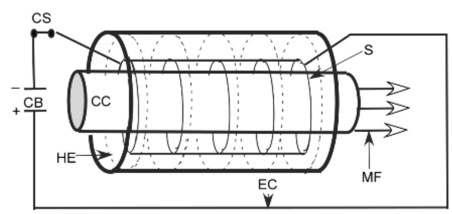


Fig. 1. Hollow Tube Generator (Note the gauss of the emitted directed magnetic field)

S	= Solenoid	MF	= Magnetic Field
EC	= Electric Current	CC	= Copper Cylinder
CS	= Close Switch	HE	= High Explosive
CB	= Capacitor bank		

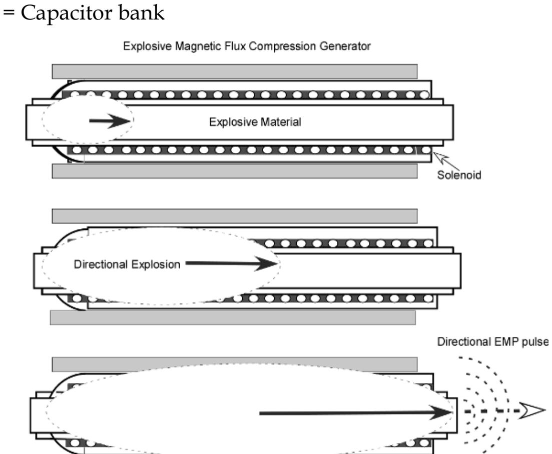


Fig. 2. Helical Generator (Note the directional nature of the magnetic pulse) Magnetic Flux Compression Generators were invented by Sakharov and C.M. Fowler. A Flux Compression Generator is a directed electromagnetic pulse [DEMP] gun.

- A longitudinal magnetic field is induced inside a hollow metallic conductor from the discharge of a bank of capacitors into a solenoid, which surrounds the cylinder.
- The explosive charge, which is located around the tube, is detonated at a time when the current through the solenoid is at a maximum.
- The convergent shock wave caused by the implosion causes a rapid contraction of the central cylinder, compressing the magnetic field and creating a massive increase in the inductive current [hence also a massive increase in the magnetic field] The first experiments were able to obtain magnetic fields of millions of gauss.

With respect to this model, the force on the flux producer, related to the production of the EMP, is in the opposite direction relative to the emitted EMP. Furthermore, an explosion within a closed system (i.e. box containing the compressor) does not propel.

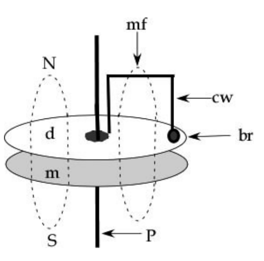
Now envision within your mind a magnetic flux compression producer located in outer space that emits a very powerful magnetic pulse (North or South Pole) in a given direction for an interval of 10 nanoseconds. Next visualize that 100 nanoseconds later this pulse intersects with an electron current located within either a straight conductor, or alternatively a circular conductor. Consequently as the magnetic pulse interacts with either of these two currents, the field is no longer in continuity with the producer.

Once this brief pulse interacts with the current of either wire there is a force or a torque produced on that conductor. Even so, there is no equal force or torque associated with matter moving in the opposite direction. This process is a violation of Newton's 3rd Law.

Nevertheless, one could argue that the equal and opposite force is produced by the magnetic field as it is emitted from the producer. Yet, the force on the producer can be only in one orientation - opposite to the direction to the emitted pulse. In contrast, there is either a torque or a linear force at the location of the interaction of the magnetic pulse with either current, but now notice, potentially in many directions, as a function of the current's orientation relative to the direction of the magnetic pulse. Clearly, these two forces are not always oriented in opposed directions, once again a violation of Newton's 3rd Law.

In addition, it is highly doubtful that the force on the producer from the emitted pulse is always equal in magnitude, compared to the force or torque located at the interaction of the pulse with the current.

2.2. Homopolar Generator [Example 2]



d = disk conductor
m = permanent magnet
mf = magnetic field
cw = closing wire
br = brush
p = pole
N,S= magnetic poles

Fig. 3. Homopolar Generator

While the first example is hypothetical, the next example is an actual physical device that also violates Newton's 3rd Law; it is a homopolar generator/motor, and was originally invented by Michael Faraday. See the following descriptions and figures.

2.2.1. Structure

- The disk [d] is a conductor [defined as disk], furthermore attached to a vertical pole [p].
- The disk is capable of independent rotation with respect to the pole.
- The magnet [m] is a permanent disk magnet [defined as magnet] with its North-South Pole [N and S] axis aligned parallel to the vertical pole.
- The magnet is separated by a space apart from the disk.
- The magnet can independently rotate with respect to the pole as well as the disk.
- The closing wire [cw] consists of a *stationary* copper wire conductor that connects the periphery of the disk, to its center by a brush [br].

2.2.2. Rotation Function (Closing Wire Open)

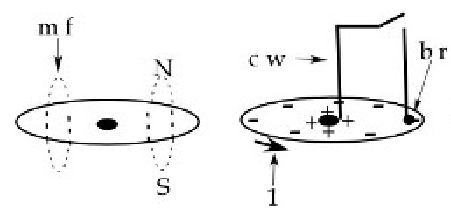


Fig. 4. Production of voltage during rotation

mf = magnetic field
br = brush
cw = closing wire
N, S = magnetic poles

In Figure 4, Black arrow [1] represents the initiating force that drives the rotation of the disk counterclockwise.

Left The physical structure of the device with the South to North magnetic field axis oriented through the disk from the bottom of the page to the top of the page

Right The disk is rotated counter clockwise by force [1] or torque with the closing wire open. Therefore due to the electromotive force the electrons accumulate at the periphery of the disk, thus producing a voltage across the radius of the disk

Assume the closing wire is open, therefore there is no current. Consequently, if the conductor is rotated counterclockwise, a negative charge accumulates at the periphery of the disk, furthermore a positive charge will form at its center. This process is due to the Lorentz force [electromotive force]. Generally although not exclusively, within this paper, a current is defined as a movement of positive charge. Nevertheless in this particular instance, in order to comprehend this concept, it will be necessary to discuss the movement of negative charges, or in other terms the movement of the electron by the Lorentz force. Note; this Lorentz force exerted on the electron is the mirror image of the classic Lorentz force associated with positive charge.

A conductor consists of atoms [e.g. copper] with unpaired outer shell electrons, furthermore loosely held within those outer shells. Moreover these unpaired electrons can move from the outer shell of one atom into the outer shell of an adjacent atom, and so on, and so forth, to form an electron current. In essence the electrons are free to move under the influence of the Lorentz force, whereas the protons are relatively fixed. So with respect to our specific model, when the disk is rotated counter-clockwise, a Lorentz force propels the electrons to the outer side of the disk. In contrast, the protons are relatively fixed so they cannot move. This leaves the negative charge located on the periphery of the disk and the positive charge positioned at the center; a voltage.

Conversely, if the rotation is in the opposite direction or else the magnetic field is reversed, then a negative charge will accumulate centrally and a positive charge peripherally. For future reference, moreover to avoid confusion, this form of the Lorentz force that drives the electron to create a voltage will be defined as the electromotive force.

2.2.3. Rotation Function (Closing Wire Closed)

- When the disk is rotated counter clockwise by torque relative to the stationary magnet, a current is produced through the disk and the stationary closing wire [due to the voltage as just illustrated] in the direction from the center of the disk to its periphery.
- When the magnet is rotated by torque relative to the stationary disk, no current is produced. This fact in conjunction with the above observation is apparently a violation of Einstein's relative motion concept.
- When both the disk and magnet are co-rotated together counter-clockwise by torque, relative to the stationary closing wire, a current is again induced through the disk and closing wire in the direction from the center of the disk to its periphery. This function is again a violation of Einstein's relative motion concept, furthermore Faraday's induction theory, because a current should only be produced if there is relative motion between the disk and magnet.
- If the disk is initially rotated by a force, and if simultaneously a current is withdrawn from the stationary closing wire, then there will be a reverse force produced on the disk resisting the initial force, or in other words a back force [essentially a homopolar motor function, see the next section]. During this process there is not at all times an equal and opposite back force consistent with Newton's 3rd Law, since if the back force is always equal to the initial force there can be no rotation of the disk.

2.2.4. Rotation of the Closing Wire

Most dissertations concerning homopolar generators either neglect or else deemphasize the closing wire. Nevertheless comprehending this component is very important, assuming one actually wants to understand a homopolar generator/motor. Like the conductor disk, the conductor closing wire also exists within the magnetic field.

Nevertheless assuming it carries a current and is not moving relative to the magnetic field, there is no electromotive force. Remember it is the relative movement of the conductor with respect to the magnet that produces the electromotive force and not vice versa. So even though the magnet rotates, if the conductor closing wire is stationary there is no electromotive force exerted on the wire.

However things change when the closing wire rotates along with the disk. In this scenario, because the closing wire rotates relative to the magnetic field, an electromotive force is created within the closing wire. But observe the magnetic field is a circular structure; furthermore it constantly changes its orientation as it travels from the North Pole to the South Pole outside of the magnet best illustrated in Figure 8. So the interaction of the field with the moving closing wire produces a voltage [from the electromotive force], what's more, and this is crucial, oriented in the opposite direction compared to the voltage driving the current within the conductor disk. Therefore if the closing wire rotates with the disk there is either a reduced overall current or else no current as a function of the shape and position of the closing wire relative to the orientation of its local magnetic field.

Incidentally, if no current is produced when both the disk and magnet are stationary, and if there is a current when they corotate, then this fact necessitates a third frame, perhaps a preferred frame or in other words the old discarded term; the Ether.

2.3. Homopolar Motor [Example 3]

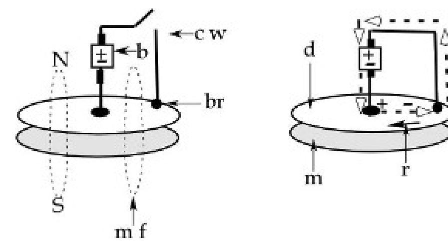


Fig. 5. Homopolar Motor

d = disk conductor	cur = direction of current
m = magnet	+ = positive charge
mf = magnetic field	- = negative charge
cw = closing wire	b = battery
br = brush	r = rotation direction

2.3.1. Structure

- South to North axis through the disk from the bottom of the page to the top of the page.
- On the left, the physical structure of the homopolar motor without a current.
- On the right, the disk rotates clockwise due to the Lorentz force exerted on the current.

2.3.2. Function

- When a current traverses through the disk from its center to its periphery, there is a Lorentz force induced which then produces clockwise rotation of the disk. There is no back torque exerted on the disk consistent with Newton's 3rd Law. Nevertheless there is a back electromotive voltage resisting the current [homopolar generator effect], but again no back Lorentz force.

2.4. Co- Rotating Homopolar Motor [Example 4]

The above homopolar motor example is to some extent puzzling, since the disk is separated from the magnet by a space, and the magnet can rotate independently of the disk. For that reason, a more simplified model is illustrated below, in which the magnet and the disk are one and the same. This is defined as a corotating Homopolar motor. The simplified homopolar motor in

Fig. 6 consists of a battery, a metal screw, a permanent disk magnet, and a copper wire conductor.

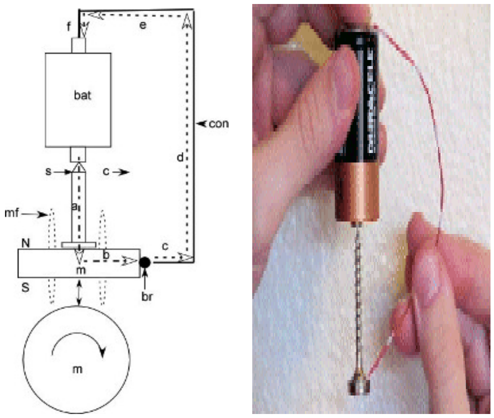


Fig. 6. Simplified Homopolar Motor [1]

bat = battery	s = metal screw
m = conductor disk magnet	con = conductor
c = current magnetic field	br = brush

a, b, c, d, e, f = different sections of the current

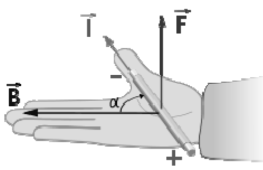


Fig. 7. Right hand rule for a current-carrying wire in a magnetic field B 1=Right hand rule for a current-carrying wire in a magnetic field B. The thumb point in the direction of I (a positive current). The fingers point in the direction of B. The force is out to the palm. [2]

2.4.1. Structure

- The disk shaped magnet is attached to the base of the metal screw, which then magnetizes the screw.
- The tip of the magnetized screw is placed in contact with the battery's lower electrode; what's more, it is attracted to it, as it is now magnetized.
- The stationary copper wire conductor is attached to the battery's upper electrode, while the other end of the conductor gently touches the side of the magnet [like a brush], even so it still allows the magnet to freely rotate.

2.4.2. Function (Disk)

- The current passes from the battery's lower electrode down through the screw vertically, and then turns horizontally as it traverses through the magnet.
- The current then enters the closing copper wire through the brush whereby it returns to the battery's upper electrode.
- With respect to this model, the only area where the Lorentz force exists, with respect to the disk, is in the region where the current travels horizontally through the permanent magnet (the magnet and conducting disk are one and the same). At this location, the current interacts with the vertical oriented magnetic field, consequently inducing a sideways Lorentz force, which causes both the magnet and screw to rotate clockwise. A brief movie of this homopolar motor can be found at [3].
- To recap, the current traveling through the permanent magnet is oriented at a right angle with respect to the direction of the magnetic field created by that same magnet. Note that the magnet and the conductor disk are one and the same. As a result, there is a sideways Lorentz force that produces rotation of the circular magnet disk as well as the screw.

2.4.3. Function (Disk and Closing Wire)

Nonetheless this concept is considerably more complicated. There is still a current located within the vertical and horizontal portions of the closing wire conductor, as it returns to the upper electrode as illustrated below [c, d, e] which also results in a Lorentz force as illustrated below.

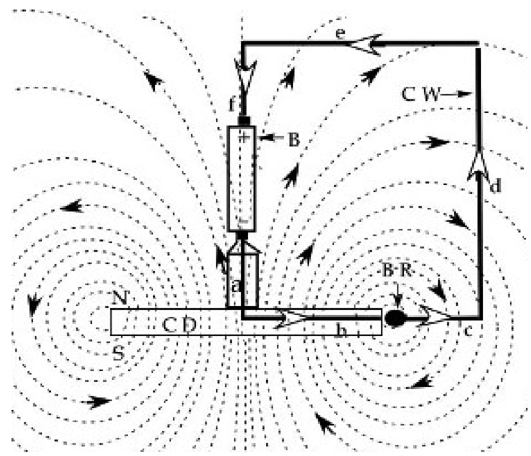


Fig. 8. Homopolar Motor Fields

B	= battery
CW	= closing wire
BR	= brush
CD	= permanent magnet conductor disk
a, b, c, d, e, f	= different sections of the current
Solid arrows	= direction of magnetic field
Hollow arrows	= direction of current

2.5. Lorentz Forces on the Different Sections

Screw is the pyramidal structure attach to the lower electrode of the battery. Note that one can visualize the direction of all of these forces by applying the right hand rule in Figure 7 to the currents in Figure 8. The directions of the Lorentz forces in each section are:

a = no force	d = into of page
b = out the page	e = into of page
c = into of page	f = no force

Section a. As the current passes downward through the screw into the disk, it is oriented parallel to the direction of the magnetic field, thus no force.

Section b. As the current passes through the magnetic conductor disk it is oriented at a right angle with respect the axis of the magnetic field, consequently a Lorentz force is produced in the direction of; out the page.

Section c, d and e. As this current within the closing wire interacts with the non-vertical portions of the magnetic field, as that field returns to the opposite magnetic pole, a Lorentz force is exerted on the wire. Moreover the direction of this force is oriented in the opposite direction compared to the Lorentz force exerted on the conductor disk magnet at [b].

Section f. As the current travels downward through f there is no force, since once again its orientation is parallel to the direction of the magnetic field.

So if the Lorentz force exerted on the disk magnet is equal to the Lorentz force exerted on the closing wire, then with respect to this closed system, there is no net *linear* force or overall *linear* motion— complex rotational motion, possible --translational motion, no.

2.6. Reducing the Lorentz Force on the Closing Wire

Even so this idea is over simplified, because the interaction of the circular magnetic field with the closing wire is extremely complex. As a result, only a portion [or portions] of the closing wire experiences an opposing Lorentz force. So the opposite Lorentz forces may or may not be equal. This asymmetry is as a function of both the position of the closing wire as well as the direction and the intensity of the magnetic field at that same location.

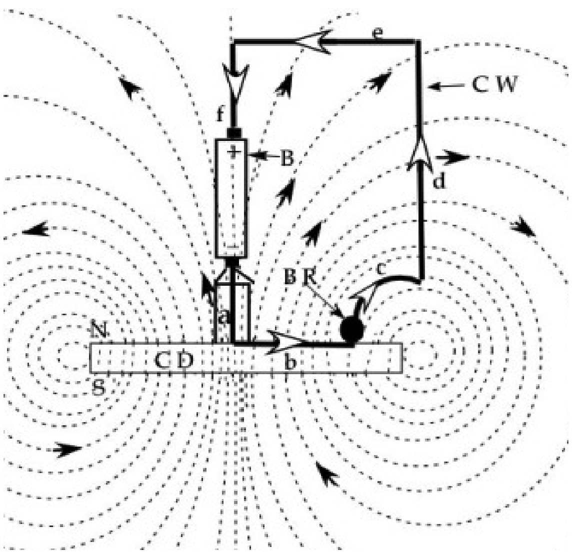


Fig. 9. Homopolar Fields with Forceless Path c

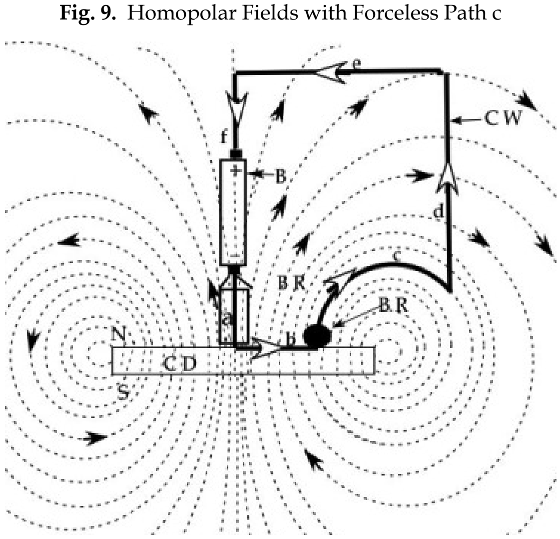


Fig. 10. Homopolar Fields with Forceless Path c (longer path)

Since this article is all about electromagnetic propulsion without a propellant in violation of Newton's 3rd Law, then the objective with respect to this latter example is to design a structure that reduces the opposing Lorentz force exerted on the closing wire as is illustrated in Figures 9 and 10.

The symbols and the direction of the Lorentz force in Figures 9 and 10 are identical with those in Figure 8, except along path c, where there is no force. Current flows force free along path c because the right hand rule in Figure 7 generates no thrust. So observe Figure 10 as compared to Figure 8.

Section a. There is no Lorentz force produced as the current travels vertically downward from the lower electrode through the screw and into the magnet, because at this location the current and magnetic field are parallel to each other, accordingly no force.

Section b. The current interacts with the right angled magnetic field to produce a Lorentz force oriented out of the page.

Section c. *The current as it leaves the magnet within the exiting closing wire is oriented parallel to the magnetic field lines, in this case a curve towards the other pole, so again there is no force.*

Section d and e. Observe; in order to complete the circuit the closing wire must necessarily return to the upper electrode and not towards the other magnetic pole. Consequently to accomplish this feat the closing wire follows along parallel with the curvilinear magnetic field's path [c] until positioned at some significant distance from the magnet where the field is considerably reduced. At this point instead of following the field lines to the opposite pole, the conductor turns vertically [d] towards the top of the page, then horizontally [e] back to the upper electrode. Recall the strength of the magnetic field created by a magnet does not obey the inverse square law. This concept is unlike the electric force or the gravitational field. In essence, the strength of the magnetic field produced by a magnet decreases much more rapidly the further it is from the magnet, as compared to the inverse square law. Notice; the interaction of the current and the magnetic field, when located inside of the magnetic disk [b] is at a maximum, since they are oriented at right angles with respect to each other, moreover at the full strength of that magnetic field. In contrast, only when the exiting closing wire veers from the direction of the magnetic field, as it returns to the upper electrode [d and e], does it then experience a Lorentz force. Furthermore this force is oriented in the opposite direction compared to that force exerted on the magnet. What is more, the magnetic field in this region of [d and e] is relatively weak. Therefore the opposite Lorentz force exerted on the closing wire is significantly less than the Lorentz force exerted on the conductor magnet.

Section f. The current is again parallel to the direction of the magnetic field, so no force.

To recap, on one hand, the Lorentz force exerted on the current located within the conductor disk magnet is at a maximum, given that it experiences the full strength of the right angled vertically oriented magnetic field [b]. On the other hand the current within the closing wire interacts with the magnetic field only in the sections where it deviates from parallel to that field [d and e]. Take note of; this latter interaction is situated away from the magnet where the field is relatively weak. As a result the Lorentz exerted on the magnet producing rotation [b] is much greater than the opposing Lorentz exerted upon the upper sections of the closing wire [d and e]. In addition with respect to this example there are no other Lorentz forces. So here again in the latter example there is a violation of Newton's 3rd Law.

By the way, if the current located within the disk and closing wire both move relative to the uniform magnetic field then an electromotive force is created which opposes the direction of those currents, therefore this overall process is extremely complex.

It is arguable that the equal and opposite force, associated with the torque, is positioned where the tip of the screw touches the battery's lower electrode. Yet, if this apparatus was placed in outer space, there would be a forward net force exerted on that lower electrode, moreover not countered by an equal and opposite force (given that it is free floating), once more an infringement of Newton's 3rd Law. As an analogy, envision a wheel 'free floating' in outer space. If a Lorentz force is applied to the periphery of the wheel, relative to its plane, the wheel will rotate, but at the same time, there will also be forward translation movement of that entire wheel. A force is different than a torque.

Now if the Lorentz force exerted on the disk magnet is not equal to the Lorentz force exerted on the closing wire [since the opposite Lorentz force exerted on the closing wire's current is now reduced as illustrated in figures 9 and 10], then with respect to this specific closed system, there is again no net *linear* force or overall *linear* motion— complex rotational motion, possible -- translational motion, no, nevertheless once again a violation of Newton's 3rd Law.

Fundamentally, with reference the these two examples of section 2, if one still assumes Newton's 3rd Law is always correct, then somehow the magnetic field carries momentum with it, equivalent to the momentum exerted on the current carrying wire. Yet, for all intents and purposes, since we cannot observe the magnetic field, all we really recognize is that when the current interacts with the magnetic field, then the force exerted on the conductor is not always associated with matter being propelled in the opposing direction. What actually happens to the magnetic field during this interaction is presently unknown.

So what does this signify? In essence, it means that one can propel an object in outer space without a propellant, using only a current located within a conductor and its interaction with its own generated magnetic field. A hypothetical device of this nature is described in section 4 of this article.

3. Discussions of Rail Guns

There are scientific literatures available, with respect to rail guns, that support the ideas that its physical functions are always consistent with Newton's 3rd Law, [4] while others state that the recoil of a rail gun is either absent or else markedly reduced, making it incompatible with Newton's 3rd Law, [5] and as illustrated in Section 4.

The two examples [3 and 4] described in this section are of different structure and function, moreover neither device violates Newton's 3rd Law. Nevertheless the concepts explained here will be used to help describe a hypothetical rail gun like device that can propel itself in outer space without the use of a propellant (Section 4).

3.1. Closed Circuit Rail Gun [Example 5]

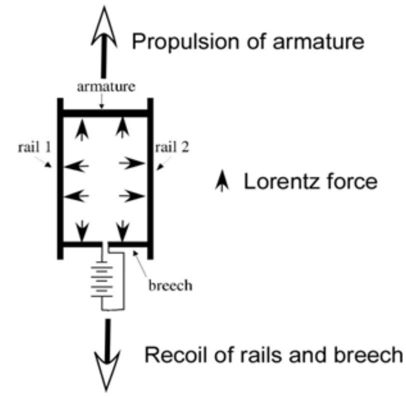


Fig. 11. Closed Circuit Rail Gun

Example 5 shows a closed circuit rail gun. A closed circuit cannot exert a net force upon itself. In this model, the Lorentz force on the armature is equal to the Lorentz force on the breech, but in the opposite direction. The Lorentz force on rail 1 is equal to the Lorentz force on rail 2, but again, occurring in opposite directions. When the armature is propelled forward, there is recoil located at the breech, which subsequently pulls the rails along with it. Furthermore, the opposing Lorentz forces of the two rails counteract one another. The function of this device is consistent with Newton's 3rd Law, so it cannot be used for electromagnetic propulsion in outer space devoid of a propellant.

3.2. Pendulum System [Example 6]

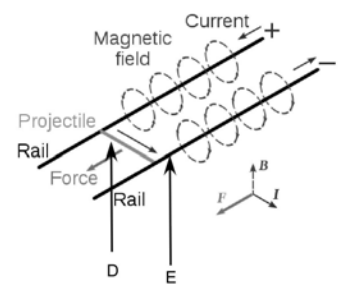


Fig. 12. Rail gun (Wikipedia)

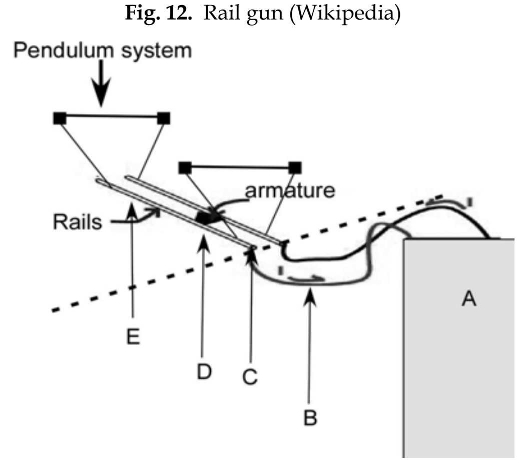


Fig. 13. Pendulum system

A = batteries, capacitors, copper wires, which complete the circuit
B = copper wire conductor delivers current to and from the rails
C = freely moveable attachment of copper wire conductors
D = armature
E = rails

Example 6, illustrated in Figs 12 and 13, is an actual experimental device built for a master's thesis at the Naval Postgraduate School Monterey California. [6]

> "An interesting debate in railgun research circles is the location, magnitude, and cause of recoil forces, equal and opposite to the launched projectile. The various claims do not appear to be supported by direct experimental observation. The goal of this research paper is to develop an experiment to observe the balance of forces in a model railgun in a static state. By mechanically isolating the electrically coupled components of such a model, it has been possible to record the reaction force on the rails and compare that force with the theoretical force on a projectile. The research is ongoing, but we have observed that the magnitude of the force on the armature is at least seventy times greater than any predicted equal and opposite reaction force on the rails."

Within the available literature, and with respect to rail gun physics, there is considerable theorizing as well as speculation, though very little experimentation accessible for review, which is not classified. The above experimental thesis is the best article that I have ever come across. The experiment as constructed is pictured below:

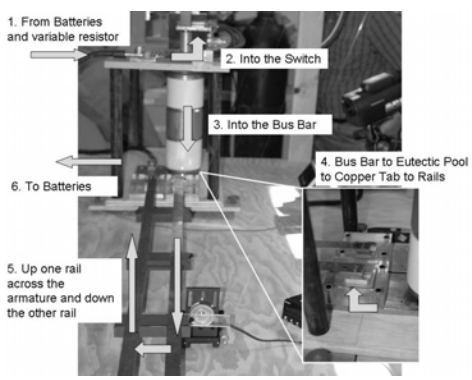


Fig. 14. Rail gun experiment

This picture of the actual experimental apparatus is highly complex, therefore difficult to understand. Consequently, for ease of comprehension it will be broken down into its individual components:

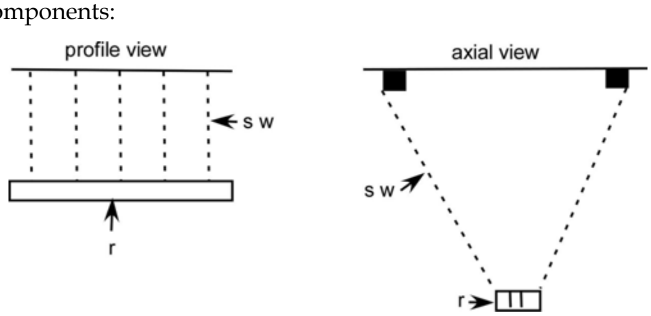


Fig. 15. Pendulum system details

r = rails s w = suspension wires for pendulum

3.2.1. Structure

- The rails and armature [D and E] are suspended by a pendulum system as illustrated above [also in Figure 13 from the dotted line and to the left]. The remainder of the circuit is fixed on the ground [A , B , C]
- The rails along with the armature [D and E] can move independently [by the pendulum system] relative to the immobile copper wire conductors [B], the latter of which delivers current to the rails, as well as receives current from the rails. Even so, during this movement the rails still maintain physical contact with the copper rail conductors by a brush [C]
- While in suspention, the armature can independently move relative to the rails and vice versa. Alternatively, they can also be fixed to one another
- Furthermore, during suspension in the presence of a current, pressure sensitive devices measure the Lorentz force:
  - When both the armature and rails are fixed together.
  - When the rails are fixed and the armature is free to move.
  - When the armature is fixed and the rails are free to move.

3.2.2. Function

(Experimental results when a current is passed through the armature by the rails) When the armature and rails are fixed with respect to one another, there is a forward net Lorentz force exerted on only the armature. All other Lorentz forces negate one another. As a result, the armature with the attached rails, move together as illustrated by the two dotted lines; there are no recoil forces (Fig 16].

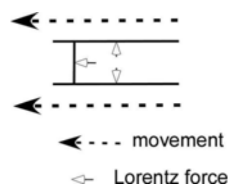


Fig. 16. The armature and rails both move to the left.

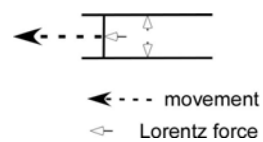


Fig. 17. Only the armature moves to the left.

When the armature is free to move, and the rails are fixed, there is a forward Lorentz force on the only armature. The Lorentz forces exerted on the rails still negate one another. Thus, only the armature moves as depicted by the single dotted line; there are no recoil forces (Fig 17).

When the armature is fixed and the rails are free to move, there is no measureable recoil force exerted upon on the rails, therefore no movement or dotted line (Fig 18). The sensitivity of the experiment, with respect to the amount of recoil force exerted upon the rails, is at least 70 times less than the Lorentz force exerted upon the armature.

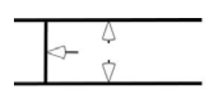


Fig. 18. No movement

There is considerable debate within the scientific literature available, as to whether the recoil forces of rail guns occurs at the junction of the rails with the armature, or alternatively at the breech.

What this experiment demonstrates is, that there is no measurable recoil force exerted on the rails located at the juncture of the rails with the armature. Rather, the recoil force is located at the breech, analogous to Example 5 Section 3. But notice in this example that the breech includes the copper wires, batteries, capacitors, and other parts that complete the circuit. They are positioned to the right side of the dotted line, labeled A in Figure 13.

*This is not the conclusion as written by Matthew K. Schroeder, [6] rather the opinion of the author of this article. The device built by Matthew K. Schroeder did not even attempt to measure any forces, other than those associated with the armature and rails. Therefore, this author again only presumes the idea that the recoil forces are positioned at location A.

This device cannot propel itself in outer space in the absence of a propellant assuming a closed circuit, for again a closed circuit cannot exert a net force upon itself.

4. Propulsion in Violation of Newton's 3rd Law

Most importantly, a rail gun could be redesigned to propel itself assuming that the circuit is not complete, and moreover presuming as well that Newton's 3rd Law does not always apply with respect to the interaction of currents with magnetic fields. The modified rail gun designed is shown below in Example 7. Note that the armature is fixed to the rails. Furthermore assume superconductivity.

4.1. Superconductive Rail Gun [Example 7]

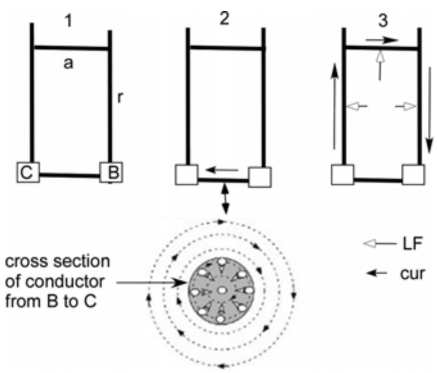


Fig. 19. Notice the direction of the net Lorentz forces relative to the different times 1, 2 and 3

a = armature	r = rail
B = battery	C = capacitor
cur = current	LF = Lorentz force

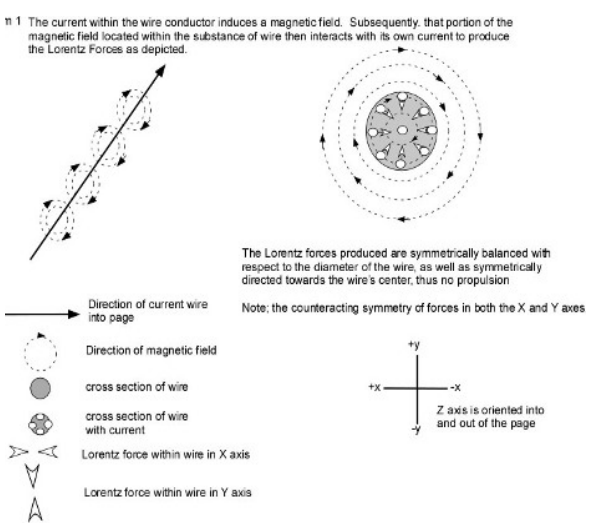


Fig. 20. Notice the direction of the net Lorentz force in a straight wire conductor = no overall propulsion

- Time 1 represents the initial structure of the device in the absence of a current.
- Time 2 is when the current passes from the battery to the capacitor only, through the lower straight conductor (B to C). Consequently, at this time the Lorentz forces which are exerted on the lower wire conductor are all oriented towards its center, as illustrated above thereby creating no propulsion.
- Time 3 is when the current passes from the capacitor (C) through the fixed armature and then returns to the battery (B). Recall, if the armature and rails are fixed relative to one another, there is a forward Lorentz force exerted on the armature, which then pulls the attached rails along with it, yet there is no recoil force, as shown in Section 3, Figure 16.

Notice that in this scenario, in contrast to Example 6, Section 3, there is no functional breech involving the battery, copper cables, capacitor, and ECT, and therefore no recoil. As a result, during this single brief pulse, the rail gun propels forward in defiance of Newton's 3rd Law. This sequence could be repeated in rapid succession. Accordingly, and assuming again that Newton's 3rd Law does not always apply with respect to the way magnetic fields interact with currents, there will be a continuous forward translational propulsion of the entire apparatus.

Incidentally, I have written a previous article, [7] in which the hypothetical device discussed there also contravenes Newton's 3rd Law, and is based on similar principles as those that are discussed here. The revised abstract, with figures, are as follows. However before viewing Figures 22 and 23, keep in mind the concept as noted below in figure 21.

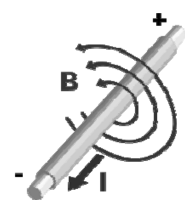


Fig. 21. Orientation of magnetic field relative to the direction of current. Current (I) through a wire produces a magnetic field (**B**) around the wire. The field is oriented according to the right hand grip rule. (Wikipedia)

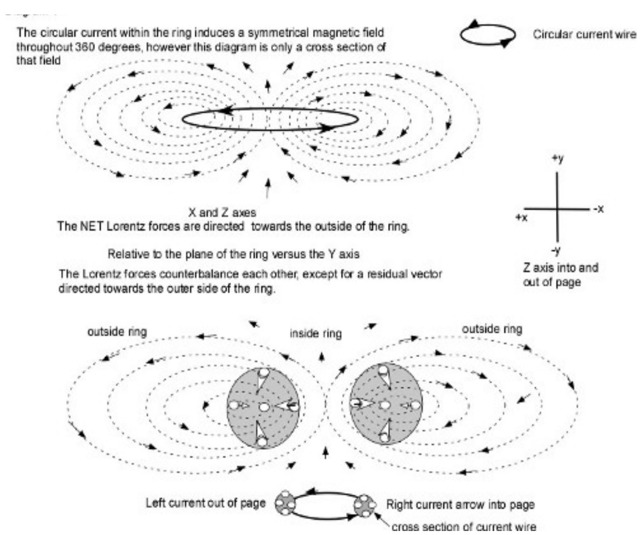


Fig. 22. Notice the direction of the net Lorentz force located within the ring = no overall propulsion

A single circular loop conductor (ring) with its current induces a magnetic field not only surrounding the ring, but also within the substance of the ring itself. Subsequently, that portion of the magnetic field, which is located within the body of the ring, interacts with its own current to produce Lorentz forces. Electromagnetic propulsive forces are thereby produced from this process. However, these forces are either blocked by the intact structure of the ring, or they are symmetrically oriented in opposing directions. As such, these later forces counteract each other. Essentially, all the forces are balanced; consequently, there is no propulsion of the ring as depicted in Fig. 22.

All the Lorentz forces [hollow white arrows] which are located within the ring are either blocked by the intact structure of the ring or else they symmetrically oppose to one another. So there is no propulsion of the ring.

However, if a directed magnetic pulse emitted from the center of the ring (attached magnetic flux compression producer –EMP), directed towards [+y] distorts the magnetic field relative to both sides of the plane of the ring, then for the duration of this pulse there will be within the ring some Lorentz forces that are neither blocked by its physical structure, nor annulled by opposing symmetrical forces. Accordingly, these forces are unbalanced, and as a result, during this pulse and subsequent there will be electromagnetic propulsion of the ring along its axis as shown in figure 23.

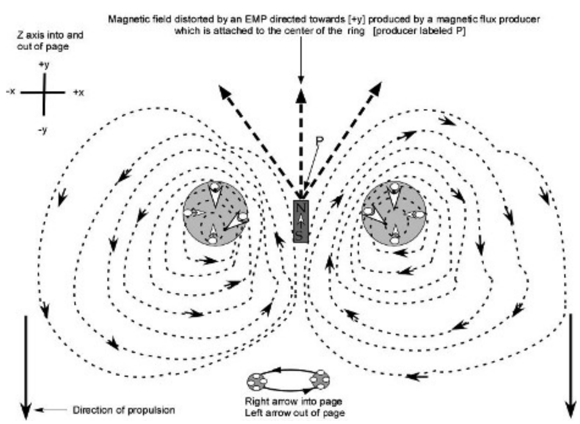


Fig. 23 Notice the direction of the net Lorentz force within the ring = overall propulsion in direction -y

Figure 23 depicts a single circular [loop] conductor [ring] with a current, along with its induced magnetic field. The latter of which is distorted on both sides, relative to the plane of the ring, by a directed magnetic pulse towards [+y] emitted from an attached magnetic flux producer. As a result there is electromagnetic propulsion. Figure 23 is a cross sectional image of the ring with its distorted magnetic field. Relative to the plane of the ring [X and Z axes], the net Lorentz forces are directed towards the outer side of the ring. Relative to the plane of the ring versus the Y axis the net Lorentz force direction is towards [-y]. Therefore during each EMP there exists within the ring an overall net Lorentz force directed towards the [-y] direction [bottom of the page]. So assuming a series of rapid EMP's there will be continuous propulsion of the ring towards [- y] without a propellant.

5. Conclusion

Newton's 3rd Law is a fundamental construct of science considered by the vast majority of physicists to be valid in all circumstances. Therefore, all observed exceptions are considered unfounded or else simply ignored. In essence, Newton's 3rd Law is so engrained within the minds of the scientific community that other alternative ideas are never even considered. Regardless, this paper demonstrates a hypothetical exception to that theory, as well as an actual physical device (homo-polar motor) that violates this law.

If a theory or a physical law is correct then it should accordingly be applicable in all circumstances. Yet, such is not the case with respect to Newton's 3rd Law as revealed by this paper. Once again, in certain instances when a current within a conductor interacts with its own induced magnetic field, there is propulsion of that conductor without corresponding ejection of matter in the opposite direction. Consequently, $F = ma$ in one direction does not equal $F = ma$ in the other direction. In summary, and assuming this hypothesis is correct, one can propel matter in outer space without a propellant in violation of Newton's 3rd Law.

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