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Technical Paper on Electromagnetic Railgun

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ABSTRACT

The paper has the information about the model and working of electromagnetic rail gun. The basic idea of study is Lorentz Principle and applications of this principle. The model can be translated as the simple model of a loop which is made from a current carrying wire and studying the loop properties in an external magnetic field. Although applying this idea on a practical system has its own difficulties and necessities. These necessities and difficulties are discussed in this paper. The concept of launching the projectile using the electromagnetic field under the influence of external magnetic conditions is a new concept. this type of concept is a future development concept but however It has been demonstrated how this concept is effective.

KEYWORDS

EMF-Electro-magnetic field

Railgun

Lorentz Principle

Force

Charges

Voltage

Current

IMAGE TABLE

FIGURE NUMBEER	DESCRIPTION
FIG1.0	Rail Gun Model
FIG2.0	Lorentz Principle

INTRODUCTION

All utilizations of this idea would include a shot of some sort sending off that could be utilized in comparative however differentiable ways: moving a tram vehicle,making a lift framework, fast weapon sending off, Nailers, and so on. While data on curl firearm configuration exists in many divided pieces in writing and on the internet. Railgun is a future weapon for shooting long-range focuses with high precision. Railgun is a prudent weapon as it involves no sort of fuel for shooting a shot. It utilizes high incautious current to produce the important power expected to raise a ruckus around town. The US Navy has been wanting to execute railgun framework on ships as their long-range shooting weapon. Railgun should be energized to a specific voltage level to create the vital power to shoot the shot to accomplish the predefined target area. It is vital that insignificant voltage is expected for shooting the shot to raise a ruckus around town precisely as it limits the misfortunes happening in the railgun framework. This venture centers around addressing this test by limiting

the railgun's underlying voltage expected to shoot a shot for stirring things up around town with high exactness. It likewise centers around limiting the copper misfortunes happening in the framework

The gun basically consists of two parallel rails. One end of the rail is connected to the power supply and a conductive projectile is inserted between the rails to complete the circuit. in this type of circuit the electrons flow from the negative terminal of power supply to the negative rail across the projectile an to the positive rail again back to the power supply. When a current is applied to the coil the coil acts like an electromagnet creating magnetic field around it throughout the length of the rails up to the amateur position. From the right hand rule the magnetic field circulates around each conductor. The current is an opposite direction along each rail therefore connect magnetic field between the rail be is directed at the right angles to the plains formed by the central axis of the rail and the armature. with the help of current flowing through the amateu a Force is produce which accelerates the projectile along the rails of projectile, Always out of loop Irrespective of supply polarity. The force produced is also away from the power supply and it is words the muzzle end of rails The Lawrence force acting on the rails attempts to push rails apart but since the rails are fixed they cannot move.

The electromagnetic gun is an adaptation of railgun in which the projectile is in contact with the connective barrel The projector which is used in railgun rights between 2 polarities of charged rails i,e positive and negative. Advantage of railgun is a massive increase in theoretical launch speed which makes the system to have less flash to bang and higher kinetic energy so the projectile can kill with speed instead of having to carry explosives.electromagnetic gun does not accompany the use of gunpowder therefore a shell cost of electromagnetic gun is cheaper than that of guided bullet. the ammo used for electromagnetic gun does not require a warhead to kill heavily armoured targets because of its extremely high kinetic energy. This eliminates the use of explosives for particular action.

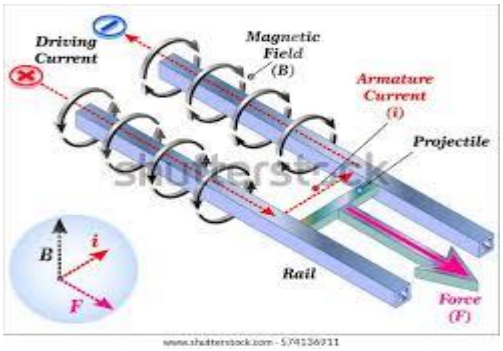

Fig 1.0

HISTORY

The idea of railgun was presented by French designer andre' louis octave Fauchon-Vileplee, who made a model in 1917 with the assistance of Tudor batteries. During World War One the French head of innovations at the service of combat hardware's Commission Fauchon to foster a 30mm 250mm electric cannon on July 25th, 1918.

In 1980, the Ballistic Research Laboratory (later combined to shape the U.S. Armed force Research Laboratory) started a drawn-out program of hypothetical and trial research on railguns. The work was directed transcendently at the Aberdeen Proving Ground, and a significant part of the early examination drew motivation from the railgun tests performed by the Australian National University.

Beginning around 1993 the British and American legislatures have teamed up on a railgun project at the Dundrennan Weapons Testing Centre that finished in the 2010 test where BAE Systems discharged a 3.2 kg (7 pound) shot at 18.4-megajoules [3,390 m/s (7,600 mph; 12,200 km/h; 11,100 ft/s)].In 1994, India's DRDO's

Armament Research and Development Establishment fostered a railgun with a 240 kJ, low inductance capacitor bank working at 5 kV power ready to send off shots of 3-3.5 g weight to a speed of in excess of 2,000 m/s (4,500 mph; 7,200 km/h; 6,600 ft/s). In 1995, the Centre for Electromagnetics at the University of Texas at Austin planned and fostered a fast shoot railgun launcher called the Cannon-Calibre Electromagnetic Gun. The launcher model was subsequently tried at the U.S. Armed force Research Laboratory, where it showed a breech effectiveness north of 50%.

PRINCIPLE

The electromagnetic gun uses Lorentz force

According to Lawrence law the charges under magnetic field experiences force The magnetic field which is produced by the electrons travelling in the rails launches the projectile.

The conducting project tile experience is the Lorentz force when placed under magnetic field

- Magnetic field strength{B}
- Armature current{I}
- Armature length{l}
- Force{f}

The relation between magnetic field armature current armature length and forces given by:

$F=B*I*l\sin(\theta)$

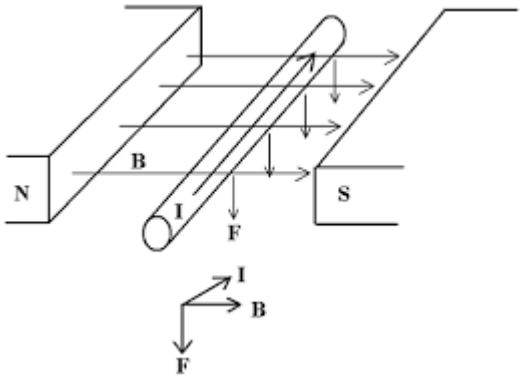

Fig 2.0

Lorentz force is defined as the combination of the magnetic and electric force on a point charge due to electromagnetic fields. It is used in electromagnetism and is also known as the electromagnetic force. In the year 1895, Hendrik Lorentz derived the modern formula of Lorentz force.

ADVANTAGES

1. Where missiles can be more easily detected an intercepted by damaging any number of sensitive components or causing an explosion railgun can
2. Electromagnetic gun ammo can be reused Whereas a conventional gun's ammo cannot be reused once after it is fired
3. Projectiles are faster and are more harder to defend
4. Projectiles are smaller and takes less space so that there is more magazine space
5. Since gunpowder is not used there is no need to store any types of explosives therefore there is no need to take any necessity precautions to store the ammo.
6. Launch speed is high compared to the conventional guns
7. electromagnetic guns are silent compared to the conventional guns

DISADVANTAGES

1. Electromagnetic gun requires careful design off electrical circuits used
2. The technology required to create an electromagnetic gun is yet to be found.
3. The amount of charge and discharge must be carefully monitored.
4. If higher speeds are to be achieved, then high amount of power supply must be used.

FUTURE SCOPE

Electromagnetic launchers, for example, railguns and curl firearms utilize electrical energy to move a mass at an objective. These launchers include utilization of solid attractive fields to push against projectiles.EMP generators incorporate electromagnetic bombs, atomic electromagnetic generators, and non-atomic electromagnetic generators. High electrical power and enormous measure of energy is expected for these weapons.

Advancements for putting away and controlling electric power are required, which are called beat power innovations.

Reception of electromagnetic weapons has expanded in the tactical area to hoodwink and upset adversary powers. EMP is utilized by militaries across the globe as a non-truly disastrous weapon against different targets. EMP has the capacity to handicap correspondence organizations, harm radar organizations, jam tanks, and block maritime boats

Militaries across the globe are using microwave and millimetre-wave innovations for improvement of cutting-edge weapons. Headways in advancements is bringing about better functional utility of electromagnetic weapons with upgraded convey ability, more prominent power thickness, higher reach, and predominant power yield.

The market is driven by development being used of electromagnetic weapons in battle tasks, modernization of weapons in militaries, and improvement of minimized electromagnetic weapons for automated elevated vehicles. Innovative headways and expanding improvement of cutting-edge weapons by state run administrations across the world further enhancement development of this market.

Be that as it may, factors, for example, impediments related with people killing powerful microwaves and hazard of high blow-back by utilization of electromagnetic weapons hamper development of the electromagnetic weapons market. Expansion in ventures by government and guard associations and ascend sought after from arising economies are supposed to give worthwhile open doors to development of the electromagnetic weapons market.

REFERENCES

[1] Raghav Sharma. Jitendrasingh Chaudhary, “New and alternative approach for launching satellite into Low Earth Orbit (LEO) using the Railgun coupled levitation and gap system”, National Institute of Technology, Jalandhar, Punjab.

[2] Volodymyr T. Chemerys, “Key Problems of Railgun: New Concept for their Resolution National Aviation University of Ukraine, Build.1, Cosmonaut Komarov Ave., Kyiv 03680, Ukraine

[3] Yu-tao LOU, Hai-yuan LI, Bao-ming LI, “Research on proximity effect in railgun” National Key Laboratory of Transient Physics, Nanjing University of Science and Technology, Nanjing 210094, Jiangsu, China

[4] Bao-ming LI, "Analysis and discussion on launching mechanism and tactical electromagnetic railgun technology "National Key Laboratory of Transient Physics, Nanjing University of Science and Technology, Nanjing 210094, Jiangsu, China

[5] Ian R. McNab, "Launch to space with EM railgun" Senior Member, IEEE.

[6] Lizhong Xu, Yanbo Geng, "Forces of rails for Electromagnetic railgun", Mechanical Engineering Institute, Yanshan University,

[7] Qing-hua LIN, Bao-ming LI, "Numerical simulation of interior ballistic process of railgun based on the multifield coupled model", National Key Laboratory of Transient Physics, Nanjing University of Science & Technology, Nanjing 210094, China

[8] Jin-guo WU,Bo TANG,Qing-hua LIN, Hai-yuan LI,Bao-ming LI, "3D numerical simulation and analysis of railgun gouging mechanism" National Key Laboratory of Transient Physics, Nanjing University of Science and Technology, Nanjing 210094, Jiangsu, China.