



GLOBAL JOURNAL OF ENGINEERING SCIENCE AND RESEARCHES

SIMPLIFIED ELECTROMAGNETIC RECIPROCATING-PISTON ENGINE

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ABSTRACT

In this contemporary world, the squandering of fossil fuels is intensifying inchmeal. Hitherto the scientists have promulgated the scarcity of these fossil fuels. Moreover these fossil fuels engender the Greenhouse Gases, which is one of the grounds for the increasing Global Warming. The “Electromagnetic Reciprocating Piston Engine (ERPE)” can be a boon to this world. It is a step towards eradication of these sinister gases that are being released by many of the Automobiles of this current world. This innocuous engine works on a Renewable Power, all it need is, Attractive and Repulsive power of a Magnet. The attraction and repulsion of magnet will cause the reciprocation of Piston in the cylinder, it will upshot the crankshaft to rotate, producing Mechanical Power at the output of the shaft.

Keywords: Electromagnet, Permanent Magnet, Piston, Camshaft, Crankshaft, Top Dead Centre, Bottom Dead Centre.

I. INTRODUCTION

With the curtailment of these fossil fuels in the world, new technologies are being introduced in the market. These new technologies are use of bio-fuel, wind-power, tidal-power, etc. but, there are many curbs on these technologies. The production of these bio-fuels clasps colossal amount of resources and still befoul the environment. Also these proxy technologies are not so efficient and they entail a huge amount of initial capital. Nonetheless, they don't meet the rising demands in the market too.

On the other hand, the SERPE works on the Principle of Magnetism. It simply clasps Attractive and Repulsive forces of a magnet. A magnet consists of two pole, scilicet “North Pole” and “South Pole”. As we know, LIKE poles repel each other and UNLIKE poles attract each other. Same principle is applied in this engine. The incessant attractive and repulsive forces offered by the magnets will be an agency for the reciprocating movement of piston.

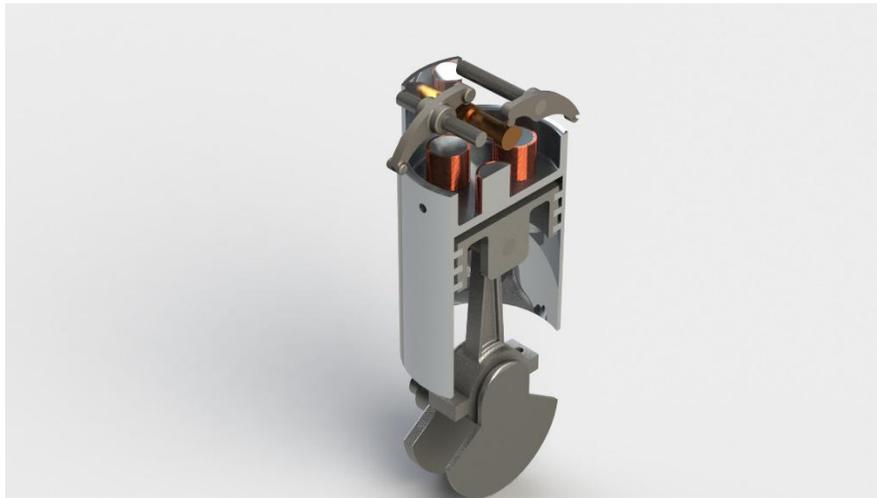
II. METHOD & MATERIAL:

Working Principle

The ERPE works on a simple Principle of Magnetism. As we know, a magnet has two poles i.e. North Pole and South Pole. Physics states that, two magnets either entice or fend off each other. When the like poles of two magnets are made to face each other, they fend off each other. Analogously, when the unlike poles of two magnets are made to face each other, they entice each other.

These two phenomenon are the radix of reciprocating piston inside the cylinder. The electromagnet in cylinder head stead and the piston head will be installed by a permanent magnet. When the engine starts, the piston will be at its TDC and the same polarity to that of the permanent magnet will be acquired by the electromagnet, this will hold off the piston and will thrust the piston away towards the BDC. And when the piston reaches the BDC and will start to move towards the TDC, the electromagnet will entice the piston towards it by acquiring the opposite polarity to that of the permanent magnet. This incessant shifting of polarities by electromagnet will be the radix of the incessant reciprocating movement of the piston.

Figure:



Section View of Whole Assembly

Materials

Material to be used to make these parts should not be effected by magnet. These material have to be non-magnetic for smooth working of this device.

- **Electromagnet:**

An electromagnet is a device which emits magnetic field when current is passed through it. It encompasses a copper coils, a soft metal core and a shell. Electromagnet used in this device is a single shell encompassing three cores and three copper coils, each with 300 number of turns. This electromagnet will be an agency for the incessant reciprocation of the piston in the cylinder.



- **Bronze-acrylic cam shaft:**

A cam is a projected geometry on a cam shaft which is accountable for opening and closing of inlet and outlet valves in an Internal Combustion Engine. The cam functions the valves according to the position of piston in the cylinder. The cam shaft used in this invention will consist of a cam with an acrylic band on half of its parameter. As a cam in this invention will be accountable for incessant change of poles of electromagnet by distributing positive or negative current to the coils of electromagnet. As acrylic is a bad conductor of electricity, it will cut off the current supply when not needed. Acrylic will be coated with a strip of carbon fiber to avoid wear tear on larger extent.



- **Rocker arm:**

A rocker arm links a cam to a valve and support the opening and closing of the valve as per cam position. In this invention rocker arm will act as a link between a battery terminal and camshaft. Rocker arm will complete the circuit and will stream the positive or negative to cam as and when needed.

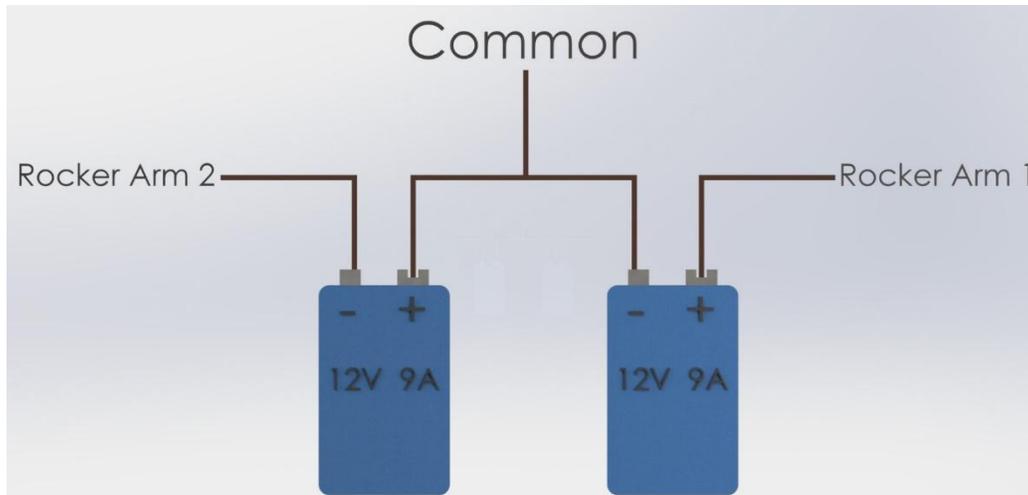


- **Piston with magnet on head:**

In a normal Internal Combustion Engine, piston is a device which reciprocates in the cylinder and in turn it rotates the crankshaft. In this invention, a magnet will be affixed to the head of the piston. This magnet will be attracted or repelled by the electromagnet and will source the piston to reciprocate in the cylinder.



- **Circuit connections:**



This is how the connections are to be made.

III. BACKGROUND OF INVENTION

This “Simplified Electromagnetic Reciprocating-Piston Engine” is an equipment designed to streamline the equipment mentioned in the reference. As per reference, the equipment mentioned within were practically difficult to manufacture and fetch into being for use in conventional life. This made me advance a device simpler in geometry and more practical to manufacture and to use in conventional life. In case of cessation of devices mentioned in prior art, it will be strenuous to repair or replace the devices by any normal mechanic or technician, which ultimately leads to termination of device for usage. This device invented by me can be repaired or replaced effortlessly by any normal mechanic or technician in case of a cessation in conventional life.

IV. RESULT & DISCUSSION

The results are compared to the I.C. Engine of Royal Enfield Classic500cc as the dimensions (Stroke & Bore) of this invention is very much similar to Classic 500cc engine head.

Below mentioned are the equations and calculations referred.

Calculations:

Number of turns in electromagnet (N) = 3000

Input Voltage (V) = 12 V

Input Current (I) = 35 A

Cross-Section Area of Magnet (A_1) = $7.8539 \times 10^{-5} \text{m}^2$

Permeability of Free Space (K) = $4\pi \times 10^{-7}$

Permanent Magnet Grade = Neodymium N52

Radius (R) = 1.5 inch = 0.0381 m

Thickness (D) = 0.5 inch = 0.0127 m

Distance from Pole Face = 5 mm = 0.005 m

Remanence Field (Br) = 1.48 T

- Force Exerted by Electromagnet (F_1) = $(N^2 I^2 K A_1) / 2G$

On substituting the values we get,

$$F_1 = 108.8112 \text{ N}$$

ii. Force Exerted by Permanent Magnet (F_2) = $(B^2 A_2)/2K$
Where, $B = Br/2 \times [(D + z)/(R^2 + (D + z)^2)^{0.5} - z/(R^2 + z^2)^{0.5}]$
On substituting values we get,

$$F_2 = 153.8558 \text{ N}$$

iii. Total Force (F) = $F_1 + F_2$
On substituting values we get,

$$F = 262.6681 \text{ N}$$

iv. Torque (T) = $F \times \text{Crank Radius}$
Where, Crank Radius = 0.045 m
On substituting values we get,

$$T = 11.82 \text{ N-m}$$

v. Power (P) @8000rpm = $(2\pi NT)/60$
On substituting values we get,

$$P = 9902.354 \text{ W i.e. } 13.2792 \text{ bhp @8000rpm}$$

V. OBJECTIVES OF INVENTION

- Universalization of the pre-existing devices mentioned in Reference.
- This engine is advanced to shrink the use of fossil fuels.
- This engine will run on electric power.
- The discharge of greenhouse gases will be abridged by this invention.

VI. CONCLUSION

Hence, this equipment can replace the Combustion Engines that emits the Greenhouse Gases which are responsible for Global Warming. This equipment is harmless as it can be made to work on renewable solar energy. Only improvements of the current technology can help it progress within reasonable time and financial limits. The Simplified Electromagnetic Reciprocating-Piston Engine fits perfectly into this view. Its adoption by the automobile industry would have a tremendous impact on the environment and world economy. By further research and development it can prove to be a boon to the middle class Indian citizen.

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