

MODIFICATION AND FABRICATION OF ELECTROMAGNETIC ENGINE

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Abstract: In 21st Century due to increasing populations and technologies, peoples are going more towards automobile for their comforts and due to increasing demands of automobile the fuel which is the like water for human beings and fuel for automobiles running on IC Engine. Means there will be no life for human being without water and same for automobile without fuel. So due to increasing vehicles the requirement of fuel is also increasing which will led to extinction of fuel, so it is necessary to find alternate source for running the engine and maintaining the comforts of human lives, so the purpose of the project is to produce energy which can run the engine by means of magnets known as Electromagnetic Engine. The review paper has given the attention to increase power output and efficiency of the engine by increasing number of coils turn and precisely wounding the coils on the electromagnet.

Keywords: Fossil Fuel, Permanent magnet, Electromagnet, Magnetic Engine, magnetic force, attractive force, repulsive force, coil.

1. Introduction:

In this engine there are two magnet, one is permanent magnet and temporary magnet. In this engine permanent magnet is to be made piston and temporary magnet is at the top of the cylinder. This engine works on principle of attraction and repulsion between the electromagnet and the permanent magnet. The electromagnet is made by wounding the copper coil around metal rod and is connected to electric power source. So by supply of the electricity, magnetic flux will be produced to magnetize the rod. As there is no combustion within the cylinder so design of piston and cylinder arrangement is simpler as compared to IC Engine. Although this engine can't produces any flue gases which are harmful to the environment, because there is no combustion of fossil fuels in this engine. As there is no use of the fuel no combustion takes place and no liberation of the harmful gases in the environment. So the electromagnetic engine is eco- friendly to the environment.

2. Literature Survey:

(N.G.Lokhande et al, 2017) showed basic information about magnets, laws of magnet and its property also with the working of the electromagnetic engine with repulsive force action by suspending magnet in like pole direction inside the cylinder which is used to move the piston from TDC to BDC, while the energy which is stored in the flywheel help the piston to move from BDC to TDC. (Adarsha. H et al, 2017) have taken different types of material for electromagnet like ceramic, iron, steel and the maximum power obtained is from the ceramic material. In this engine Iron cylinder is been replaced by aluminium cylinder and piston is made of cast aluminium because of high transfer rate. In this engine Neodymium magnets is taken as permanent magnet and the number of turn wounded is 160 turn due to which efficiency is very low. So the efficiency can be increased by increasing the number of turns of coil and by increasing the radius of the crank we can increase the power of the engine. The problem with this engine is that it produce lots of heat when the current is about 1.4A around due to that coolant is required. (Ganesh Bairavan.P et al, 2017) modify the I.C engine by providing the precise wounding of the coil on the iron core which can reduce the void between the coil resulting higher magnetic field which increase the efficiency of the engine. (Piyush Hota et al, 2015) implement for producing higher torque which can affect the efficiency of the engine by attaching permanent magnet to the piston and electromagnet which pulls the piston during attraction. The engine can also work on other system rather than I.C engine too. (Prof.A.V Gaikwad et al, 2015) conclude that the magnetic engine does not generate high power. So the idea of generating more power with the method of multi cylinder engine is implemented can be viewed in fig 1. (Sumit Dhangaret et al, 2015) This paper describe the construction and design of a V-type magnetic piston engine, which operate with the help of electromagnetic force. In this paper the number of the turn of the coil is taken 1000 turn and power input is 36W and the power output get is about 7.718 which is very low. The thermal efficiency is around is 21.44. So to increase the efficiency the magnetic engine is to be modified by taking different material can be viewed from fig 2. (Nitin Karandeet et al, 2015) In this paper the attempt is to reduce the amount of HC, CO, NOx in the exhaust, and to increased the combustion efficiency of the internal combustion engines by ionizing the fuel with the help of magnet by producing the magnetic field due to which the fuel will get ionized and there will be proper combustion of the fuel due to which the efficiency of the engine increases and there will be reduction of the exhaust gas in the atmosphere can be viewed from fig 3.

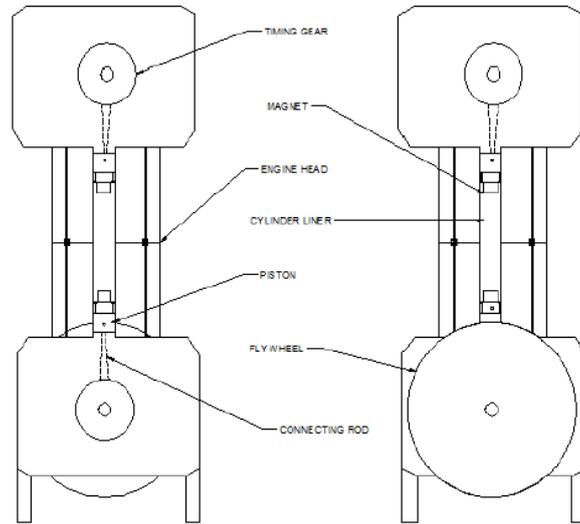


Figure 1. Design of magnetic engine [Prof A V Gaikwad et al, 2015]

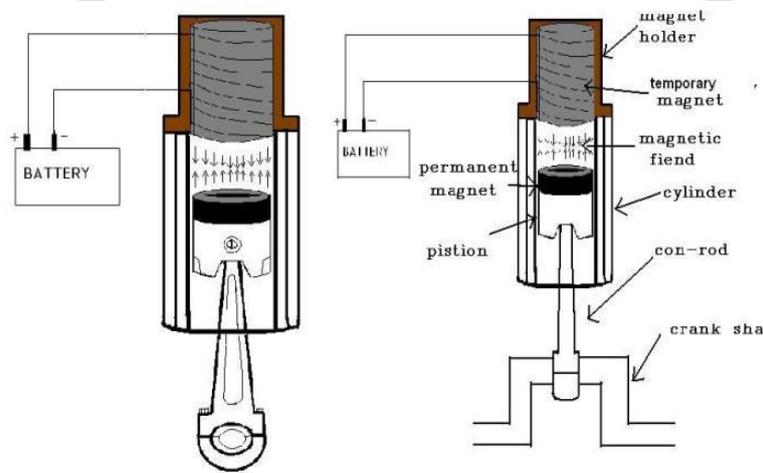


Figure 2. Diagram of Magnetic Piston Operated Engine [Sumit Dhange et al, 2015]

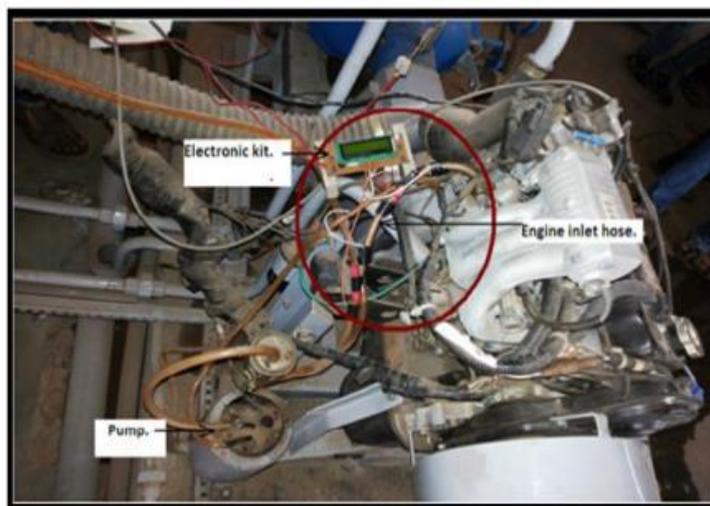


Figure 3. Experimental setup of electromagnetic kit [Nitin Karande et al, 2015]

(Menta Sudheer et al, 2014) This paper has given the concept of magnetic engine in which the ferromagnetic plate is placed inside the cylinder and that is the reason of the attraction and repulsion of magnet piston inside the cylinder. The moment of the plate is connected with the gear mechanism. (Abil Joseph Eapen et al, 2014) In the proposed engine the strength of field controls the power of engine and the strength of field is controlled by the number of windings and amount of current passed through it. In the proposed engine lead acid battery can be implemented for electromagnetic charging. There are losses in the coil as

its not coated so there will be copper losses and hysteresis losses which results in less generation of field ,which affects the piston movement and with less piston movement it affects the overall efficiency of the engine. (Amarnath Jayaprakashet et al, 2014) The paper discuss that using permanent magnets the advantages is that the energy availability is constant and has capability to increase the operating life of the magnet. In the engine reciprocating can also be used but with increase in moving components the efficiency is affected. So the efficiency of the engine also depends on motor and the material for the engine cylinder should be nonferrous as ferrous material have tendency to attract with magnetic material. (Ramanan.M et al, 2013) In this paper Neodymium magnet is used as permanent magnet. In this paper magnetic field is been analysed by taking two magnet keeping at different distance like 0.5mm and 1mm. When the distance decreases magnetic strength decreases. The magnetic field strength produced at 0.5 mm distance is 7558 gauss and magnetic field strength produced at 1 mm distance at 7598 gauss. The force produced at 0.5 mm distance is 56.49 lb and at 1 mm distance is 50.63 lb. So to increase the efficiency the force produced should be more which can be increased by increasing the magnetic strength and the magnetic strength can be increased by maintaining about 1mm distance between the magnets. (C. Sudhakar et al, 2013) This paper has designed V-type engine which produced more power compared to other magnetic engine, it uses the repulsive force as there is two cylinder with common crankshaft. The motion of piston in both cylinder is vice versa with the help of relay, power splitter and timer which is controlled by micro-controller to move the piston vice versa in cylinder can be viewed from fig 4. (J. Rithula et al, 2013)In this paper, spark plugs are replaced by conductors and valves by electromagnetic material in a existing engine. So the advantages is that this mechanism of electromagnetic engine can be proposed in the existing engine which results in less costing. The grade for the magnet is n32 and material is Samarium and Neodymium and preferable battery for polarity changing is lithium ion battery. (Shirsendu Das et al, 2013) In this paper design conditions are mentioned like the distributor arm must rotate at same rpm with crank shaft. The parts of cylinder, connecting rod, crank shaft etc. should be made of nonmagnetic materials such as aluminium alloys or forged steel except piston because piston is made up of magnetic material. Piston ring is not used for free piston movement so lubrication used is dry. For multi cylinder engine it is not applicable. (Atul Kumar Singh et al, 2011) In this paper, by using 400 number of turns of coil results in more output compared to conventional internal combustion engine so it can be predicted that with increasing number of turns of coil there will be an increase in power output and also there will be less cost compared to conventional internal combustion engines. In this paper comparison of proposed engine is done with 70cc conventional internal combustion engine.

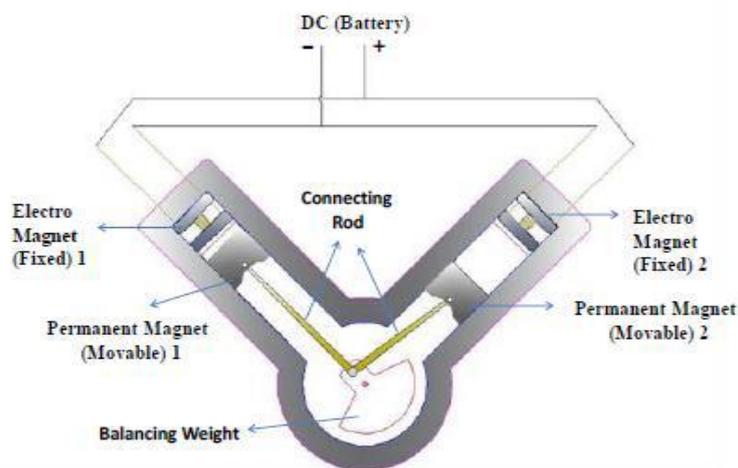


Figure 4. Schematic diagram of V Engine [C Sudhakar et al, 2013]

3. Experimental Setup:

The experimental arrangement as shown in the below figure. 5. The two relay is used to change the polarity of the coil. The relays is connected with the arduino, arduino is used to program the relay, so that at specific interval it will change the polarity. The arduino is connected with the laptop which is used to input the program in the arduino circuit. The full arduino and relay circuit is attached with the coil and the battery.

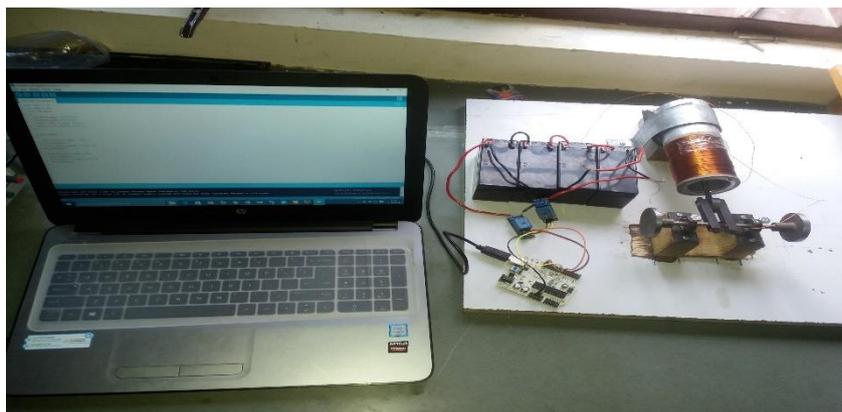


Figure.5. Experimental Setup of Electromagnetic Engine

The circuit is programmed for 3 second for each stroke i.e. forward stroke and backward stroke. The battery is connected in the series connection. When the power is supplied to the battery, the piston starts to moves in the forward direction which completes the forward strokes mean while the A relay is on. After the forward stroke is completed, instantly B relay gets active and A relay becomes deactivate, then the backward stroke gets completed. This will be continuous process and the piston moment will be there and the power will be stored in the flywheel. Then the torque is calculated on the given power and rpm is measured with the help of tachometer. Then the variation is done with the help of change in current and rpm or voltage and rpm.

4. Design Calculation:

1) Force exerted by electromagnet on piston

$$\text{Max. Force exerted by electromagnet on piston } F_1 = (N^2 I^2 \mu_0 A) / 2G^2$$

Where, N = number of turns

I = Current flowing through coil

μ_0 = Permeability of free space = $4\pi \times 10^{-7}$ henry/m

A = Cross-sectional area of electromagnet

G = Least distance between electromagnet and permanent magnet = 0.005 m

2) Force exerted by permanent magnet

$$F_2 = (B^2 A) / 2\mu_0$$

Now flux density

$$B = Br/2 \times [(D+z)/(R^2+(D+z)^2)^{0.5} - z/(R^2+z^2)^{0.5}]$$

Where, B = Flux density (T)

A = Cross-sectional area of magnet

μ_0 = Permeability of free space = $4\pi \times 10^{-7}$ henry/m

Br = Remanence field = 1.21 T

z = distance from a pole face = 0.005 m

D = thickness of magnet

R = Radius of the magnet

3) Total Force and Power output produced by the Engine

$$\text{Total force } F = F_1 + F_2$$

$$\text{Torque } T = F \times r$$

$$\text{Power Output} = (2\pi n T) / 60$$

Where, F = total force on piston

r = crank radius = 0.01m

n = rpm of shaft

5. Conclusion:

The engine which uses electricity to run the engine by means of electromagnet has given alternate ways to run the IC engine which runs the automobiles. So as in electromagnetic engine there is no burning of fuel so no exhaust gas like CO₂, HC, CO, NO_x which is harmful to environment will be produced. So the electromagnetic engine will be eco-friendly to environment and as it does not uses fuel for running the engine so the running cost will be reduced. So by precisely fabrication of the electromagnetic engine it can replace the IC engine in the automobile.

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