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Engineering

ELECTROMAGNETIC RECIPROCATING ENGINE

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ABSTRACT An electromagnet based engine where the magnetic flux plays the major role which is used for the complete engine working, and thereby the vehicle. In the older IC engines the movement of the piston is achieved with the help of combustion of fuel. The piston power is then transmitted to the crankshaft. Here the flux is used for the piston movement which is achieved by the magnetic action between two or more electromagnets with a controller unit. Here an electromagnet is mounted on the piston and also on the engine casing thereby which it aids the normal function of piston by the magnetic flux method. The magnetic field interactions between the piston magnet and the camshaft magnet cause the piston to reciprocate within the cylinder thereby which the vehicle movement can be achieved. Here electromagnetic energy is used over the conventionally used IC engine, which make it more eco-friendly an affordable. Another advantage over the existing electrical vehicles is that, by using this electromagnetic engine technology, we can convert the existing IC engine to an electromagnetic engine without much cost compared to the fully electrical motor cars.

KEYWORDS : Electromagnet, Controller Unit, Low Cost, Sustainable

INTRODUCTION

In recent years, the development of electric vehicles is exploding. Such electric vehicles use an electric drive motor as the power source. Conventional electric drive motors are designed so as to generate power by direct rotor rotation by electromagnetic force from batteries or other electrical input. Also power transmission mechanisms for transmitting drive power from a power source to the wheels in a typical internal combustion piston engine cannot generally be applied to electric vehicles.There is a new engine that does not require Fossil Fuels, does not harm the environment and also has low maintenance cost. The technical name is the Electromagnetic Reciprocating Engine[1].Electric drive motors requires a specially designed power transmission mechanism, greater difficulties exists in designing of electric Vehicles. The desired output is the rotating motions which is converted from the reciprocating output and the application is based on electromagnetic engine which varies from different field.It utilizes only repulsive force that allows the field to dissipate completely, and exhibit no other effects on the rising piston.Also, a variety of unwanted resistances often results from the basic structure of conventional internal combustion engines. These resistances could be caused by, for example, air intake of an air cleaner; compression in a cylinder, friction of a piston against an inner wall of a cylinder, and the operation of cooling fans, water pumps and/or oil pumps[2]. The loss of energy through resistances can greatly reduce the energy efficiency of internal combustion piston engines. The efficiency of internal combustion piston engines can be further deducted by increment in the overall weight of the engine from the cooling mechanism which is required to cool the engine down from the large amount of heat generated by the itself. Stated problems are inherent in conventional internal combustion piston engines, it is desirable to design an engine capable of decreasing or eliminating resistances inherent in conventional internal combustion piston engines and conventional electric motors, reducing the weight corresponding to a rotary assembly, and reducing air pollution[3] such as emitted by conventional gas vehicles.

These types of electromagnetic engines have a wide range of applications in the fields like,

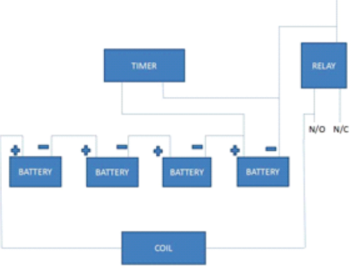
- Automobile applications.
- All light and heavy vehicle,
- All two wheelers.

The asset of this machine is Zero point fuel consumption.which is not possible in the currently available conventional engines. It causes less pollution compared to other IC engines and also it reduces the global warming,correspondingly its maintenance cost is low and harmless when compared to other engine.

The main drawback of this concept is that it is less durable and its Flexibility is low, when compared to other engines.with high initial cost.

Working principle

The electromagnetic engine works on the principle of magnetism. Magnetism refers to the physical phenomenon that refers to the forces magnets exert on each other. A magnet consists of two poles, namely north pole and south pole. Like poles repel and unlike poles attract. This is defined by the principle of magnetism. This phenomenon is applicable in the case of both electromagnets and permanent magnets. Here, the idea is to generate force between the piston head and cylinder head after converting them into magnets. The attractive and repulsive forces of the magnet pave way to the working of the electromagnetic engine. The engine is similar to the functioning of a two-stroke engine. To define its working,consider the piston in the lower position. The coil is connected through the supply battery and the copper coil is energized from the DC supply source to produce the magnetic field. inside the piston there placed the large power Neodymium Iron Boron magnets. The piston moved upper and lower the flywheel connected through the piston link the copper coil energized the piston move upward due to electromagnetic repulsion and when the copper coil is de-energized the piston falls downwards, with the help of relay and control unit. Electromagnetic engine working is based on the principle of interaction between the magnetic fields Permanent magnet is fixed in the piston and iron material is connected to copper coil.



Figue1; Proposed Block Diagram

So that the iron material is transformed into electromagnet when the power supply is given to it. When piston is located in the lower position, the copper coil is connected to the battery. The copper coil is energized and produces the magnetic field. When the copper coil energized the piston move upwards and when the copper coil is de-energized the piston moves downward, with the help of relay and control unit.The processes are continuous, the piston moves up and down which also rotates the fly wheel. The power output is obtained and transferred to the wheels.

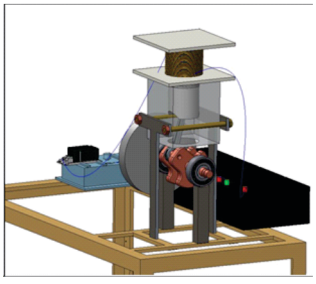


Figure 2:-Electromagnetic Piston Setup

Engineering Drawing

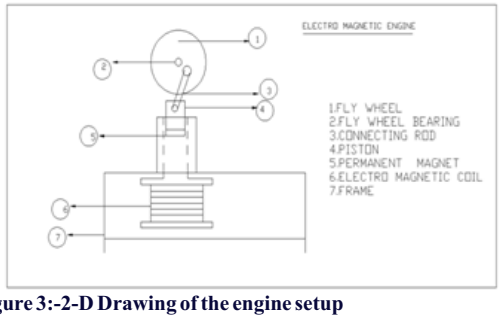


Figure 3:-2-D Drawing of the engine setup

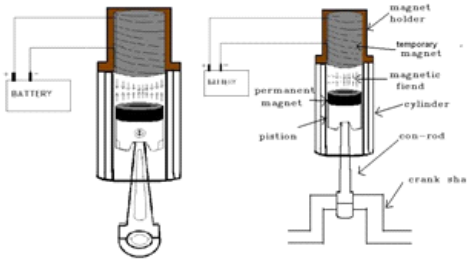


Figure 4:Cross-sectional view

COMPONENTS

The major components involved in the design and the fabrication of the electromagnetic engine are as follows.

Cylinder

- Piston
- FlyWheel
- Permanent magnet
- Relay
- Timer IC
- Battery
- Temperature Control System

Temperature within operational range – The Hot Electric Valve is closed, sending coolant to the Radiator Bypass. The Radiator Bypass will send the coolant through the Electric Heating Coil, which is off, then to the Cool Electric Valve. The Cool Electric Valve is closed, sending coolant to the Electric Coolant Pump. The Electric Coolant Pump will send coolant to the electromagnets.

DESIGN CALCULATION

Input Voltage=36V
Input Current=21A
Input Power= Voltage × Current= 36×21= 756W

Force exerted by electromagnet on piston :

F_1=(N^2×I^2×K×A)/(2×G^2)

Where, N= number of turns=1200
I= Current flowing through coil= 21A
K= Permeability of free space=4π× 〖10〗 ^(-7)
A= Cross-sectional area of electromagnet(radius r=0.0325m)
G=Least distance between electromagnet and permanent magnet= 0.01m
D= diameter of electromagnet=0.065m
On substitution we get
Max Force F1 =1253.52 N
Force exerted by permanent magnet;
F_1=(B^2×A)/(2×μ_0)
B=B/2[(D+Z)/(R^2+(D+Z)^0.5)-Z/(R^2+Z^2)^0.5]
On substituting the value of flux density we get
F2=11.1N
F=F1+F2
=1264.62N
Torque
T=F×r
Where F= total force on piston=1264.62N
R= crank radius=0.01m
T= 1264.62×0.01
Torque T= 12.64N-m
Power=(2*3.14*N*T)/60
=(2*3.14*125*12.64)/60
=165.37 W or 0.22 HP
Efficiency= Output/Input *100
=165.37/756 *100
=21.87%

RESULTS AND DISCUSSION

The electromagnetic engine prototype which works on the principle of magnetism was successfully designed and fabricated. Experimental inspection was successfully performed on the prototype. The results obtained from the experiment set up are as follows. The preliminary model of an engine which works on the principle of magnetism was successfully manufactured. It uses electricity as its input. The primary goal was complete elimination of fuel usage. The prototype produces no pollution and is eco friendly. The prime model is a two stroke engine. Only the repugnant force between the magnet and electromagnet is used for power generation. Acceleration can be controlled by changing the timer which controls the relay

The efficiency and power output of the machine was quite less than expected. The reason for less power and efficiency are due to the imperfect windings of the electromagnet. The windings are not machine wound. It was wound with hands on a lathe. So the windings are not tight and there is small air gap. The field initiated will not be much strong as expected. The windings are not laminated which leads to copper and hysteresis losses. The use of relay restricts the passage of current as it provides a resistance. So with lacking current flow, the field induced by the electromagnet will be less and results in less force. The fabrication work and the design are not perfect. There would be some misalignments and it could lead to a drop in output.

CONCLUSIONS

The template is an idea which uses the attribute of an electromagnet by virtue of which it changes the opposition of its poles whenever the direction of current is changed. This variation in polarity is utilised to attract or repel the permanent magnet attached to the piston. The usage of relay and timer will limit the output of the engine. By employing an ECU in the engine instead, power can be obtained on each stroke which will result in an increased output. Also, by placing more permanent magnets in succession on the piston will enhance the output of the engine. By minute alteration in design and by the use of better hands the engine can be reshaped to spawn more power, thereby increasing its efficiency, so that it can be used in commercial vehicles and other applications.

In this paper, we have represented a revolutionary engine which need not be separately manufactured, but existing engines can be easily modified and developed to work this way. The proposed electromagnetic engine is a simple and improvised technique to run the electric vehicle in a highly efficient and effective manner.

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