ELECTROMAGNETIC MACHINE

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Abstract - *In the recent years there is an increase in use of fossil fuels. Our engine is totally different from ordinary IC Engine, because of the inventory advancement in operating principles. We have changed the operating principle of IC Engine by using electromagnetic effect instead of combustion of fossil fuels. This engine works on the principle of magnetic repulsion between two magnets. This electromagnetic engine consists of two magnets, one of them is an Electromagnet and other one is a Permanent Magnet. Permanent Magnet acts as piston and Electromagnet is located at the top of the cylinder instead of spark plug and valve arrangement in IC Engines. In this way this engine does not contain any spark plug and fuel injection system. The Electromagnet is energized by a battery source of suitable voltage and the polarities of electromagnet are set in such a way that it will repel the permanent magnet i.e. piston from TDC to BDC, which will result in the rotary motion of crank shaft. When the piston is at BDC the supply of Electromagnet is discontinued, the permanent magnet which was repelled to BDC will come back to its initial position i.e. TDC. This procedure completes one revolution of crank shaft i.e. our output work. A copper winding is also wound to the cylinder block to get additional power to the piston to reciprocate. This winding is connected to a battery to create a magnetic field inside the cylinder and reciprocate permanent magnet piston on basis of repulsion forces created by winding. The present project relates to an electromagnetic piston engine adapted to produce driving power by the electromagnetic force created by a reciprocal movement of a piston in a cylinder.*

*Key Words***:** Electromagnet, Permanent Magnet, Repulsion, Copper Winding

1. INTRODUCTION

Today there is need of alternate fuel for day to day life. Fuel prices are increasing rapidly and environment get polluted from the emission of hazardous gases from fuel sources. Shortage of the fuel is expected from consumption. Hence there is need to reduce the emission of gases like CO, SO2, NOx, which are hazardous to nature.

With reduced fossil fuel resources and increase in energy costs and environmental concerns, engines use alternate energy sources such as bio-fuel, solar power; wind power, electric power, stored power, etc. are being developed around the world. However, such engines have many disadvantages. Production of bio-fuel takes vast resources and they still pollute the environment. Similarly, the solar power is not efficient. Added to all, the initial capital and subsequent maintenance costs for machines that use alternative energy sources are very high. Hence, in the absence of a viable alternative, as of now, switching to new technology by changing from traditional Internal Combustion engines has been a great challenge. Magnetism is the basic principle of working for an electromagnetic engine. The general property of magnet i.e. repulsion and attraction forces is converted into mechanical work. A magnet has two poles, a north pole and a south pole. When two like poles are brought together they repel each other and when unlike poles are brought together they attract. This principle is being used in the electromagnetic engine.

2. PROBLEM STATEMENT

Today fossil fuels are widely used as a source of energy in various different fields like power plants, internal & external combustion engines, as heat source in manufacturing industries, etc. But its stock is very limited and due to this tremendous use, fossil fuels are depleting at faster rate. So, in this world of energy crisis, it is inevitable to develop alternative technologies to use renewable energy sources, so that fossil fuels can be conserved. One of the major fields in which fossil fuels are used is Internal Combustion Engine. An alternative of IC Engine is "Electromagnetic Engine". It is an engine which will use magnetic flux density to run the engine

3. WORKING PRINCIPLE

The working of the electromagnetic engine is based on the principle of magnetism. A magnet has two poles a north pole and a south pole. Magnetism is a class of physical phenomenon that includes forces exerted by magnets on other magnets. By principle of magnetism, when like poles of a magnet is brought together they repel away from each other. When unlike poles are brought near each other they attract. This is same for the case of an electromagnet and a permanent magnet too. So the idea is to modify the piston head and cylinder head into magnets so that force can be generated between them. This working of the electromagnetic engine is based on attraction & repulsive force of the magnet.

The engine greatly resembles the working of a two-stroke engine. To start, let us begin from the situation, when piston is located in the lower position. The coil is connected through the battery, the copper coil is energized to produce the magnetic field the piston in side of the large power Neodymium Iron Boron magnets, the piston moved upper and lower the fly wheel connected through the piston link the copper coil energized the piston move upward and copper coil is de-energized the piston move to downward. With the help of relay and control unit. The continuous process through piston is move to (up and down) with also rotated the fly wheel
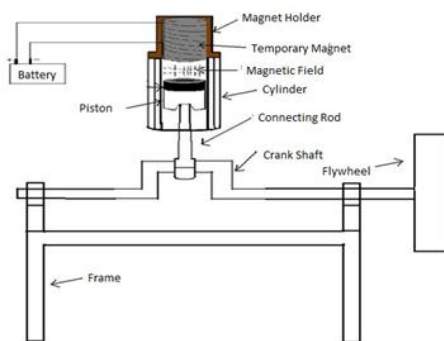
4. COMPONENTS OF SYSTEM

4.1 Cylinder

Electromagnetic engine uses only magnets for its operation. The cylinder prevents unwanted magnetic field and other losses. Further cylinder material itself should not have the properties of attraction and repulsion hence it should not disturb the movement of the piston. As a solution to the above issues, the cylinder must be only made up of nonmagnetic materials such as stainless steel, fiber, titanium or similar materials of high resistivity and low electrical conductivity. The cylinder of an electromagnetic engine is a simple cylindrical block with a blind hole in it. The temperature within the electromagnetic engine cylinder is very low and so no fins are needed for heat transfer. This makes the cylinder easily a product to manufacture.

The inner diameter of Cylinder is 0.038m. External diameter is 0.070m and the material used is Aluminum

4.2 Piston

The hollow piston casing is made up of non-magnetic stainless steel, titanium or similar materials which are of high resistivity and low electrical conductivity. Alternatively, piston casing can also be made up of non-metallic, thermal resistant materials can be made by integrating both non-magnetic and non-metallic materials. One end of the hollow case is fitted with a powerful permanent magnet made of neodymium iron-boron, samarium-cobalt or similar high field strength magnetic materials. The permanent magnet acts as the core of the piston. The flat surface (which is also the pole of the magnet) of the piston that is nearer to the pole of the electromagnet is called the magnetic head of the piston or piston head. The diameter of piston is 0.037m. Height of the piston is 0.020m

Fig. Cylinder and piston base

4.3 Connecting Rod

In a reciprocating engine, the connecting rod is used to connect the piston to the crankshaft. It converts the linear motion or reciprocating motion of the piston to the circular motion of the crankshaft. The connecting rod used in this engine is M10 bolt. The material of the connecting rod is cast iron. As the magnetic fields are contained inside the cylinder, the connecting rod will not be affected much. The connecting rod is same as that of an Internal combustion engine.

4.4 Flywheel

Flywheel is made up of mild steel and it is used to convert reciprocating energy into rotational energy. It regulates the engine's rotation, making it to operate at a steady speed. Flywheels have a significant moment of inertia and which resist changes it rotational speed. The amount of energy stored in a flywheel is proportional to the square of its rotational speed. Energy is transferred to the flywheel by applying torque to it. It is used to store the rotational kinetic energy.

4.5 Electromagnet

An electromagnetic coil is formed when an insulated solid copper wire is wound around a core or form to create an inductor or electromagnet. When electricity is passed through a coil, it generates a magnetic field. One loop of wire is referred to as a turn or a winding, and a coil consists of one or more turns. For use in an electronic circuit, electrical connection terminals called taps are often connected to a coil. These coils are often coated with varnish or wrapped with insulating tape to provide additional insulation and secure them in place. A completed coil assembly with one or more set of coils and taps is often called the windings

5. CATIA DESIGN
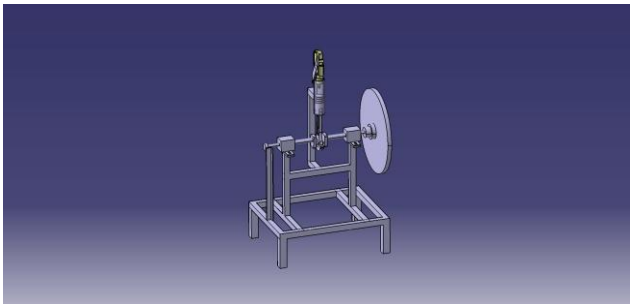
6. DESIGN FORMULA

1) Force exerted by electromagnet on piston
 Max. Force exerted by electromagnet on piston
F1 = $(NI^2\,\mu 0\,A)/2G^2$
Where, N = number of turns
       I = Current flowing through coil
       $\mu 0$ = Permeability of free space = $4\pi\times 10^{-7}$ henry/m
       A = Cross-sectional area of electromagnet
        G = Least distance

2) Force exerted by permanent magnet
 F2 = $(B^2 A)/2\mu 0$
 Now flux density
 B = $Br/2 \times [(D + z)/(R^2 + (D + z)^2)^{0.5} - z/(R2 + z^2)0^{.5}]$
 Where, B = Flux density (T)
        A = Cross-sectional area of magnet
        $\mu 0$= 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
 Total force F = F1 + F2
 Torque T = F × r
 Power Output = $(2\pi nT)/60$
 Where, F = total force on piston
 r = crank radius = 0.01m
 n = rpm of shaf

7. ADVANTAGES

The Electromagnetic Engine can be used as a viable, clean alternative, which will all but eliminate the production of CO_2 resulting from the burning of fossil fuels (i.e., oil and coal). The Electromagnetic Engine will not require any fuel, thereby creating no need for oil, Coal or any other burning of Fossil fuels, hence, no CO_2 production. Several market applications have been identified for the new technology, including vehicle propulsion, renewable electricity, and air travel. The primary market is renewable electricity that will clean water anywhere.

1. Does not require fossil fuel or produce any CO_2 gas.
2. Produce 88% more Horse power than the Combustion Engine and 87% less energy.
3. Produces the electricity for electromagnets and others systems

The Electromagnetic Engine is efficient in converting energy from Electromagnetic Energy to Mechanical Energy by using Crank shaft. The Combustion Engine uses crankshaft, but very inefficiently. The Electromagnetic Engine turns the crankshaft more efficiently than the Combustion Engine, requires less strokes and energy to produce more horse power than the Combustion Engine.

The Electromagnetic engine turns the crankshaft half a stroke or turn before power is provided. This small Distance decreases the amount of Force that is required to turn the crank. This decrease will increase that the engine will produce

8. CONCLUSION

The Electromagnetic engine developed is an attempt to curb the pollution generated by present Internal Combustion Engines. We have successfully demonstrated the concept of using electromagnetics to produce crank shaft rotation in an Internal Combustion Engine model. The research conducted is an example that the present internal combustion engines can be modified and made eco-friendly by using the suggested concept. Though the research conducted in this report in not adequate to be commercially applied but we believe that with adequate funding and further research we would be able to develop the first ever commercially usable electromagnetic engine. The electromagnetic engine designed is totally different from motor, because the working principle of both are different as well as the power consumption is also very less in electromagnetic engine. The only power consumed is the power consumed by electromagnet. Electromagnet used here is to repel the permanent magnet. There are no other power consuming components. Movement of magnet doesn't induce back electromotive force in windings of electromagnet and hence nothing happens similar to electric motor here. Power to be produced at shaft of the engine is much more than the power to be consumed by electromagnet to repel permanent magnet.

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