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DESIGN & FABRICATION OF ELECTROMAGNETIC ENGINE

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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.

I. INTRODUCTION

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 engineconsists 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 bya battery source of suitable voltage and the polarities of electromagnet are set in such a waythat 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 insidethe cylinder and reciprocate permanent magnet piston on basis of repulsion forces created by winding. The total power supplied by battery will be just to fulfil the copper losses of winding and power required to magnetize the windings. 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. In the recent years, the development of electric vehicles is exploding. Such electric vehicles use an electric drive motor as a power source. Conventional electric drive motors are designed to pick up rotational energy of a rotor as a power by directly rotating the rotor by electromagnetic force. The electric drive motors of such a type, however, lead naturally to an increase in the weight of a rotor in order to pick up greater outputs and, as a consequence, suffer from the disadvantages that the weight of the portion corresponding to a rotary assembly section becomes heavy. Then such electric drive motors require a power transmission mechanism for transmitting the driving power from a power source to the wheels to be designed to be adapted to the features of the electric drive motors. Power transmission mechanisms for internal combustion piston engines, which have been generally used for conventional vehicles, cannot always be applied to electric vehicles as they are. These problems impose greater burdens upon the designing of electric vehicles.

For internal combustion piston engines, there are a variety of resistance that result fromtheir structures. They may include, for example,

1. Air intake resistance of an air cleaner
2. Resistance of a cam shaft
3. Compression resistance in a cylinder

4. Resistance of a piston to an inner wall of a cylinder

5. Resistance of a cooling fan

6. Resistance of a water pump.

7. Resistance of an oil pump.

The loss of energy due to these resistances is the causes of reducing the energy efficiency of the internal combustion piston engines. An overall system assembly of the internal combustion piston engine further has the additional problem with an increase in theentire weight due to the necessity of instalment of a mechanism for cooling the internal combustion piston engine because the internal combustion piston engine cannot avoid the generation of a considerably large amount of heat by the principles of the engine themselves. Given the foregoing problems inherent in conventional internal combustion piston engines, the present invention has the object to provide an electromagnetic piston engine which can offer the effects of eliminating the various resistances inherent in the conventional internal combustion piston engines, reducing the weight corresponding to a rotary assembly section even if greater outputs can be taken, further making ready applications to power transmission mechanisms for use with conventional internal combustion piston engines, and achieving improved efficiency in utilizing energy.

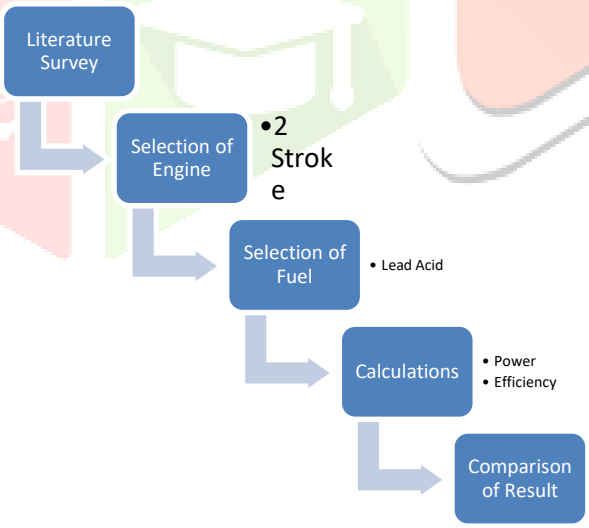
II. OBJECTIVE

- To develop and fabricate an electromagnetic engine.
- To evaluate the engine for its power output and efficiency

III. 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.

IV. METHODOLOGY



V. DESIGN CALCULATIONS

THEROTICAL CALCULATIONS

Input voltage = **12V** Input current = **1 A**

Input Power = Voltage × Current = 12× 1 = **12W Max.**

Force exerted by electromagnet on piston F1 = (N2 I 2KA)/2G2

Where, N = number of turns = 1000

I = Current flowing through coil = 1 A

K = Permeability of free space = 4π×10-7

A = Cross-sectional area of electromagnet (radius r = 0.0175 m)

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

On substitution, we get Max. Force F1 = 24.18 N

Force exerted by permanent magnet Force F2 = (B2A)/2μ0

Where, B = Flux density (T)

A = Cross-sectional area of magnet (radius r = 0.0125 m) μ

0 = Permeability of free space = 4π×10-7

Now flux density B = Br /2 × [(D + z)/(R2 + (D + z)2) 0.5 – z/(R2 + z 2) 0.5]

Where, Br = Remanence field = 1.21 T z = distance from a pole face = 0.005 m

D = thickness of magnet = **0.012 m**

R = semi-diameter of the magnet = **0.0125 m**

On substitution we get flux density, **B = 0.2547 T**

Now substituting B in the equation of force, **F 2 = 12.67 N**

Since, force F 1 and F 2 are repulsive,

Total force F = F 1 + F 2 F = **36.85 N** Torque T = F × r

Where F = total force on piston r = crank radius = 0.01m Torque T = 0.3685 N-m

Mass of Fly wheel ω = (2πN)/60, where N = speed = 200rpm

Therefore, **ω = 20.94 rad/s**

Energy stored on flywheel E = T × θ

Where T = torque θ = Angle of rotation = 180o = π radians

On substitution we get energy stored **E = 1.157 J**

Also E = 0.5 × I × ω 2 Where, I = moment of inertia of flywheel ω = angular velocity

On substitution we get moment of inertia**, I = 5.277 × 10-7 Kg-m 2**

Moment of inertia, I = 0.5 × m × r 2

Where, m = mass of fly wheel r = radius of fly wheel = 0.07 m On substitution,

We get **m = 2.154 Kg**

P = (2πNT)/60 Where, N = speed = 200 rpm T = Torque = 0.3685 N-m

On substitution, we get Output Power P = 7.718 W

Efficiency = (Output/Input) × 100 = (7.718/36) × 100 Therefore,

Efficiency = 21.44 %

EXPERIMENTAL CALCULATIONS

Input voltage **= 12 V** Input current = **1 A** Input power = Voltage × Current = 12 × 1 = 12W Max.

Force exerted by electromagnet on piston F1 = (N2 I 2 KA)/2G2

Where, N = number of turns = 904

I = Current flowing through coil = 1 A

K = Permeability of free space = 4π×10-7

A = Cross-sectional area of electromagnet (radius r = 0.0078 m) G = Least distance between electromagnet and permanent magnet = 0.01 m On substitution, we get Max.

Force, F1= (9042 ×12 ×4π×10-7 ×0.0078)/2× (0.01)2 = (817216×1×12.5664×10-7 ×0.0078)/2×0.0001 = (80101.8125×10-7)/0.0002 = 400509062.5×10-7 =**40.05 N**

Force exerted by permanent magnet Force F2 = (B2 A)/2μ0

Where, Max. Force, F1= 40.05 N 25 B = Flux density (T)

A = Cross-sectional area of magnet (radius r = 0.015 m) A=π×r 2 A =π× (0.015)2 A = π× 0.000225 A =0.0007 m2 μ0 = Permeability of free space = 4π×10-7

Now flux density B = Br/2 × [(D + z)/ (R2 + (D + z)2) 0.5] – z/ (R2 + z2) 0.5

Where, Br = Remanence field = 1.21

T z = distance from a pole face = 0.01 m

D = thickness of magnet = 0.01 m **R = semi-diameter of the magnet = 0.015 m**

On substitution we get flux density, B = 1.21/2 × [(0.01 + 0.01)/ (0.0152 + (0.01 + 0.01)2) 0.5] – 0.01/ (0.0152 + 0.012) 0.5 =0.605 × [0.02/ (0.000225 + 0.0004)0.5] – 0.01/ (0.000225 + 0.0001)0.5 B =0.148 T

Now substituting B in the equation of force,

F2= [(0.148)2 × 0.0007]/2× 4π× 10-7 =[0.0219× 0.0007]/25.1327× 10-7 =(1.533× 10-5)/(25.1327× 10-7) =0.06099×102 = **6.1 N**

Force Exerted by the Permanent Magnet**, F2= 6.1 N**

Since, force F1 and F2 are repulsive, Total force F = F1+ F2 F = 40.05+ 6.1 = 46.1 N… (Torque T = F × r)

Where, F = total force on piston r = crank radius **= 0.012 m**

On substituting F and r, T= 46.1× 0.012 = 0.5532 N-m

Output Power P = (2πNT)/60

Where, **N = speed = 125 rpm T = Torque = 0.5532 N-m**

On substitution, P = (2π × 125 × 0.5532)/ 60 = (434.4822)/ 60 = 7.2414 W

Total Force, **F= 46.1 N**

Torque, **T= 0.5532 N-m**

Output Power**, P= 7.2414 W**

Efficiency, E = (Output/Input) × 100 = (7.2414/ 48) × 100 = 0.1508 × 100 = **15.08%**

5.4 3D MODEL IN CATIA

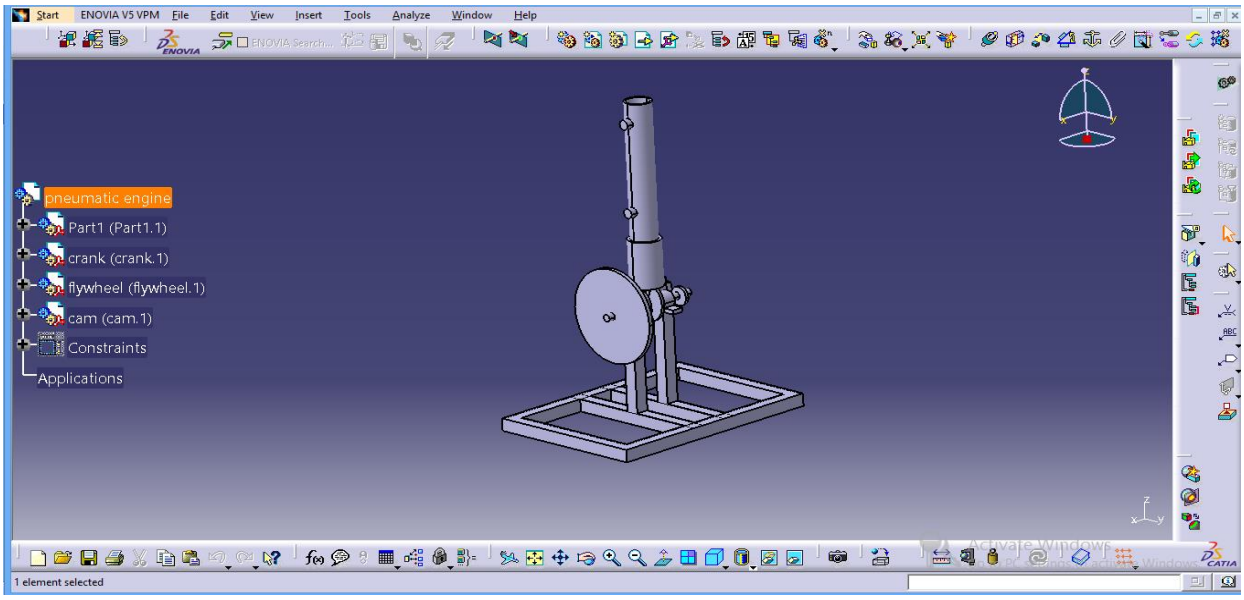


Fig5.4.1 Catia Design Of Electromagnetic Engine

VI. RESULT

- Total Force Exerted, F= 46.1 N
- Torque, T= 0.5532 N-m
- Output Power, P= 7.2414 W= 0.00971 bhp
- Efficiency, E= 15.08%

6.1 COMPARISON OF THEORETICAL AND EXPERIMENTAL VALUES

PARAMETERS	THEORETICAL VALUES	EXPERIMENTAL VALUES
Maximum force exerted on the piston by the electromagnet	24.18 N	40.05 N
Force exerted by the permanent magnet	12.67 N	6.1 N
Total force	36.85 N	46.1 N
Flux Density	0.2547 T	0.148 T
Torque	0.3685 N-m	0.5532 N-m
Output Power	7.718 W	7.2414 W
Efficiency	21.44%	15.08%

VII. CONCLUSION

The Electromagnetic engine developed is an attempt to curb the pollution generatedby 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 researchconducted in this report in not adequate to be commercially applied but we believe thatwith 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.

VIII. REFERENCES

1) Electromagnetic Engine by Vishal Abasaheb Misal1, Umesh Dattatray Hajare & ArshadAshak Atar

2) http://www.electromagnetic.org.uk/reciprocating.htm (Website on EM engines)

3) Electromagnetic Mechanism by Shirsendu Das (TIT Agartala)

4) Reciprocating Electromagnetic Engine, Leland W.Gifford

5) IJDR journal (Studies on Electromagnetic Engine)

6) Basic concept of electromagnet & electromagnetism from textbook of Physics by C.R.Dasgupta

7) Basic concept of Engine from the book 'Automotive Engine' by Srinivasan

8) Simple Electromagnetic Engine using piston and flywheel by Jestin_Cubetech

9) Teal Benjiman R - Magnetically operable engine

10) Oliver Thurston Davis - Electromagnetic motor and generator

11) William John Hill - Electromagnetic engine

12) Studies on electromagnetic engine - Amarnath Jayaprakash, Balaji, G., Bala Subramanian,