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ELECTROMAGNETIC OSCILLATING ENGINE

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ABSTRACT

An electromagnetic oscillating engine by using rocker crank mechanism is capable to produce mechanical power from oscillating motion of rocker (arm). The rocker crank mechanisms are mainly used for converting circular motion into reciprocating or oscillating motion of rocker (arm), but here we use rocker crank mechanism for converting oscillating motion of rocker (arm) into rotary motion crank. The present engine runs by using principle of magnetic repulsion between same poles. The present electromagnetic engine in which crank having 360^0 rotation in order to forward and backward motion of rocker from its fix position. This mechanism is entirely different from the IC engine mechanism. It requires less component compared to IC engines or recently developed electromagnetic engines, that's reason it having less weight and high power output. The present engine consist two electromagnets and one permanent magnet (block or disc shape). The engine provided with the cylinder which made up of magnetic shielding materials or ceramic. The present engine by using rocker crank mechanism is design in such way that time taken to complete forward stroke is more than the time taken to complete return stroke. The rocker (arm) allow to swing left dead center to right dead center or right dead center to left dead center with help of bearing support. The permanent magnet is fixed at topmost position of rocker; also electromagnets are screwed to left and right side of cylinder instead of placing at cylinder head. Also rocker pivot is fixed between these two electromagnets. Both electromagnet gets equal power from battery source by suitable voltage with different polarity. The time delay is given to electromagnets for excitation of current in coil by using current controller circuit. The current excites in first electromagnetic coil then permanent magnet reaches to the right dead center due to repelling force between same poles, thus crank completes its half rotation. After some time interval current excites in second electromagnetic coil then permanent magnet reaches to left dead center or initial position due to repelling force between same poles with respect fixed position of rocker, thus crank completes its remaining half rotation. The present engine describes two strokes namely forward and backward strokes, both are power strokes. If we require more power then uses multiple cylinders in which make same arrangement as above mentioned that gives equal motion to crankshaft. The power supply is controlled by microcontroller with the help of power splitter, timer, and relay switch arrangement.

Keywords: - Battery, Crank, Current controller, Electromagnet, Permanent magnet, Repellant force, Rocker.

I. INTRODUCTION

Increasing the efficiency and reducing exhaust gases have been dominant over the research field. Nowadays scientists are searching for alternative fuels due to increasing the demand of fossil fuels. Hence need of switching new technology by changing traditional IC engine has been challenge.

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From last century, the various changes in the IC engines. The IC engine having less efficiency due various resistances occurs in engine, such as resistance offered by cam shaft, oil reservoir, resistance due to piston on inner side of cylinder etc. In daily life demand of fossil fuels goes on increasing, also fossil fuels are non-renewable in nature. The internal combustion engine having other problems like installing cooling arrangement, design heavy and complicated parts etc. So in order to avoid the generation of large amount of heat as well as controlling exhaust gases need to search alternatives.

Recently developed electromagnetic piston engine are heavy in weight. For greater power it requires the multiple cylinder arrangement, each cylinder arrangement having one power stroke. Hence there is a fluctuation in speed, so it requires the flywheel for reducing fluctuations, also it having complicated reciprocating arrangement. But our aim is to reduce components and increasing efficiency of engine need to search alternatives.

Also recently developed electric cars are using the electric motor for generating driving force. The rotor of electric motors gives rotational energy to propeller shaft of vehicle, this lead to vehicle runs. This arrangement makes bulky. It is inefficient in order to greater output power, for avoiding this heavy arrangement we need to search alternatives.

The eliminating the various drawbacks of above mentioned engines, we have to search the alternatives for achieving improved efficiency in order to utilization of energy input.

II. OBJECTIVES

- To reduce the use of fossil fuels.
- To reduce emission of harmful exhaust gases.
- To optimize the mechanism of driving vehicles by introducing new technology.

III. WORKING PRINCIPLE

The working of the electromagnetic oscillating 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 force exerted by magnets on other magnet. By the principle of magnetism, when like poles of magnet are 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 the permanent magnet too. So the idea is to modify electromagnet and rocker head into magnet so that force can be generated between them.

The working of electromagnetic oscillating engines are based on attraction and repulsive force of magnet. The engine greatly resembles the working of two stroke engine. The cooper coil wounded on MS rod connected through the battery. The copper coil is energized to produce the magnetic field in large power neodymium iron boron type permanent magnet where two electromagnets are used for oscillatory motion of rocker. The rocker moves from left dead Centre to right dead Centre when copper coil is energized (repulsion between like poles) thus crank completes its half rotation and rocker moves right dead Centre to left dead Centre when copper coil is energized(repulsion between like poles) thus crank completes its remaining half rotation.

With help of relay and control unit, the continuous process (LDC to RDC) also rotate the flywheel. The electromagnetic oscillating engine working is based on principle of interaction between the magnetic field of magnets.

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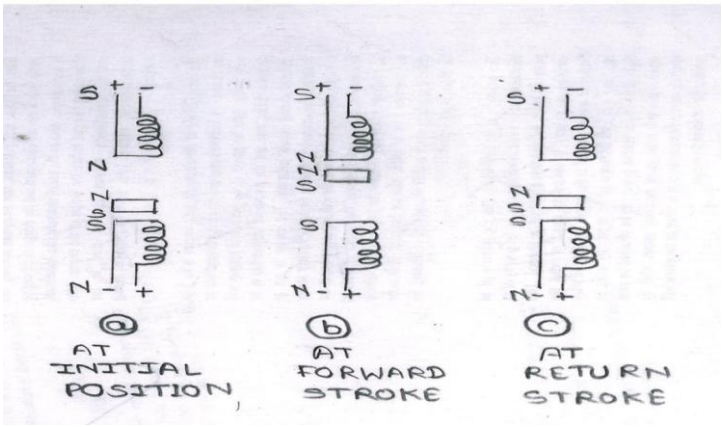

Figure 3.1

View describes the directions of excitations of current in coil gives repellent force on embodiments (permanent magnet)

IV. COMPONENTS OF ENGINE

4.1. Electromagnet

It is the temporary magnet made by insulated copper wire wound around a core. When electricity passed through coil, it generates magnetic field and coil consist number of turns. It gets power supply from battery source.

4.2. Cylinder

The cylinder must take care of unwanted magnetic field and other losses further cylinder material itself should not get attracted to the magnet and resist the movement of the piston. To take care of above issues, the cylinder must be only made up of non-magnetic materials such as stainless steel, titanium or similar materials of high resistivity and low electrical conductivity. the temperature within the electromagnetic engine cylinder is very low and so no fins are needed for heat transfer.

4.3 Rocker

It is cylindrical part. It generally made up of cast iron, cast steel aluminum alloy. Permanent magnet mounted on topmost position of rocker.

4.4 Connecting rod

The Connecting rod is used to connect the rocker to crank. it converts linear motion of rocker into circular motion of crank. The material of connecting rod is cast iron. As the magnetic fields are contained inside the cylinder, the connecting rod will not affected much.

4.5 flywheels

Flywheel is made up of mild steel and it is use to convert reciprocating energy into rotary energy. It regulates the engines rotation, making it operates at steady speed. The amount of energy stored in a flywheel is proportional to the square of its rotational speed. Energy is transfer to the flywheel by applying torque to it. It is used to store the rotational kinetic energy.

4.6 Relay

A relay is an electrically operated switch. Current flowing through the coil of the relay creates the magnetic fields which attract a lever and changes switch contacts. It controls power supply of electromagnet.

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4.7 Timer

The 555 timer IC is an integrated circuit used in variety of timer, pulse generation and oscillator applications. It is specialized type of clock for measuring the time interval. It is an automatic mechanism control by micro controller for activating device at present time.

4.8 Microcontroller

A micro controller is a compact computer designed to govern the operation of embedded system in motor vehicles, robots. It controls the power splitter, timer and relay switch.

4.9 Battery

Where high values of load current are necessary, the lead-acid cell is the type of most commonly used. The electrolyte is a dilute solution of sulfuric acid. In the application of battery power to start the engine in automobile

V. DESIGN OF ROCKER CRANK MECHANISM

The design of rocker crank mechanism is by using the grashof criterion.

$S + L \leq P+Q$

Where,

S = Shortest link

L = Longest link

P and Q are remaining two links

The quick return crank rocker mechanism in which crank is input link and rocker is output link but compared to quick return rocker crank mechanism crank is output link and rocker is input link.

Time ratio = time taken to complete forward stroke / time taken to complete return stroke

$$= (180 - \alpha)/(180 + \alpha)$$

The graphical procedure is synthesizing the crank and rocker mechanism is as follows

1. Take an arbitrary point D_1 called rocker pivot and draw D_1C_1 and D_2C_2 i.e. two extreme position of rocker at known length and angle between them is Θ_{12} as shown in figure

2. Draw any line 1 from C_1, draw another line 2 from C_2 such that the angle between line 1 and line 2 is α. The intersection of these two lines will locate point A_1 i.e. location of crank pivot. Since we are drawing line 1 arbitrarily therefore infinite number of solution is possible to this problem.

3. Draw an arc of a radius equal to A_1C_1 with A_1 as a centre.

4. Extend line 2 up to arc drawn through point A_1 having a radius A_1C_1. This will intersect at point E.

5. Measure distance C_2E which is 2 R_2 i.e. twice the crank length, therefore half of the distance C_2E will give the value of crank radius i.e. A_1B_1.

6. Length of coupler link is obtained by,

$$R_3=A_1C_1-R_2$$

$$B_1C_1=A_1C_1-A_1B_1$$

7. The linkage $A_1B_1C_1D_1$ is shown in fig. is the first position of crank and rocker mechanism and $A_1B_2C_2D_2$ is shown in second position of crank and rocker mechanism.

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VI. NOMENCLATURE

1- Cylinder
2- Rocker pivot
3- Connecting rod
4- Crank
5- Permanent magnet
6- Electromagnets
7- Copper coil
8- Electrode terminal
9- Bearing Support
10- Screw

VII. CONSTRUCTION

Drawing shows the embodiments of invention. The **figure 7.5 and figure 7.6** shows electromagnetic engine by using quick return rocker crank mechanism. The present electromagnetic engine runs on the principle of magnetic repulsion between same poles. The cylinder **1** is does not take part in magnetization process as compared to other electromagnetic engines. The cylinder **1** is provides only support to other embodiments, also it made up of non-magnetic or shielding materials.

The figure shows the reference numeral **2** for rocker (arm) and **4** for crank which are the output and input link in present mechanism respectively. The reference numeral **3** used for connecting rod is shown in **figure 7.5 and figure 7.6**.The construction of engine shows one permanent magnet **5** (block or disc shape) fixed at topmost position of rocker pivot **2**. The strength of permanent magnet **5** is taken in order to output requirement.

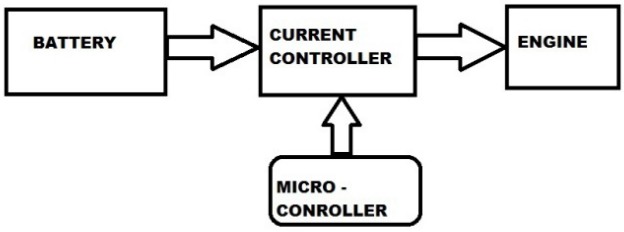

Figure 7.1
Shows the block diagram of electromagnetic engine

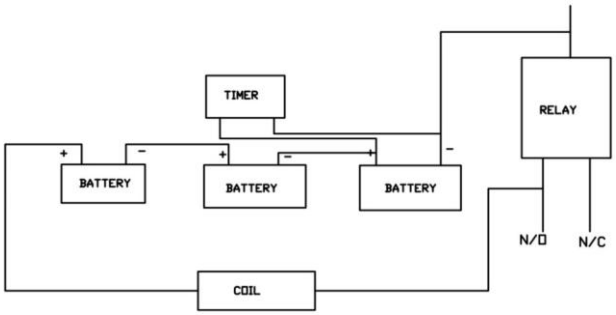

Figure 7.2

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Shows the block diagram of current controller with circuit connection

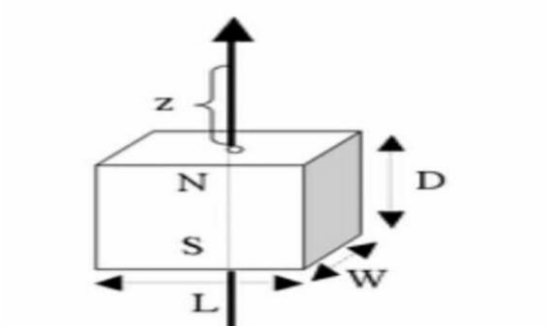

Figure 7.3

Shows the permanent magnet with its dimension parameters

The **figure 7.3** shows the permanent magnet **5** with dimension parameters. Also the reference numeral **6A** and **6B** powerful electromagnets according to power output requirement. Both electromagnets are screwed **10** to the cylinder **1.** Electromagnets are screwed **10** to cylinder opposite of each other with required output distance at LDC and RDC. The reference numeral **7** shows excitation coil and **8** shows electrode terminals. The electrodes **8** are getting electricity supply from battery source. In present electromagnetic engine output is varied with supply of current or voltage and it is controlled by using current controlled system.

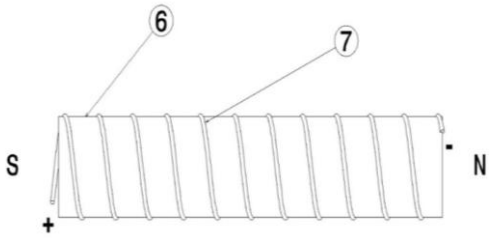

Figure 7.4

View shows the electromagnet excitation coil.

The system includes the relay, timer, and power splitter shown in **figure 7.2.** The above mentioned equipment's are operated by using microcontroller. The **figure 7.1** shows the block diagram of electromagnetic engine. The present electromagnetic engine in which rocker (arm) **2** means input link is supporting with bearing **9.** The bearing is capable to provide better performance for swinging movement of rocker (arm) **2** at forward and return stroke. The crank **4** is connected to crankshaft for delivering rotary motion shown in **figure 7.5 and figure 7.6.**

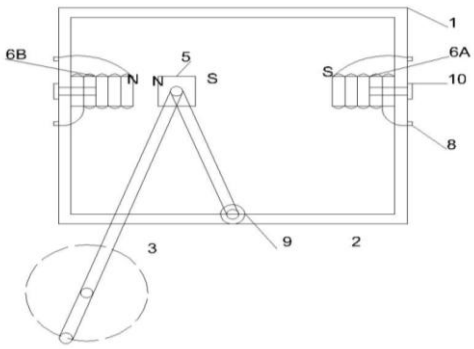

Figure 7.5

View shows the single cylinder electromagnetic oscillating engine in which rocker (arm) at position after forward stroke.

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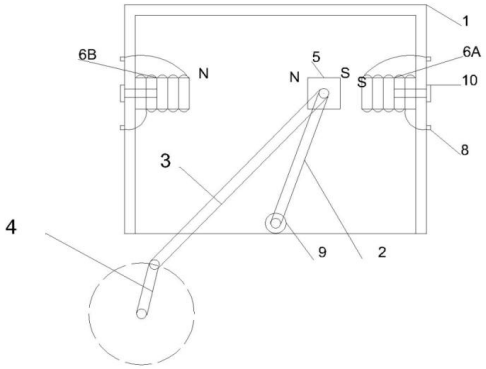

Figure 7.6

View shows the single cylinder electromagnetic oscillating engine in which rocker (arm) at position of return stroke

VII. WORKING

The present electromagnetic engine is specially design for return stroke faster than forward stroke. The present engine working in two strokes namely forward and return stroke. The time ratio is ratio of time taken to complete forward stroke and time taken to complete return stroke. The distance between two electromagnets is maintained as the distances travelled by permanent magnet at forward and return stroke in order crank **4** complete its full rotation.

Both electromagnets **6A 6B** having different excitation force which managed by using timer circuit and relay unit. The current excites in first electromagnetic coil of electromagnet **6B** then permanent magnet **5** reaches to the right dead center due to repelling force between same poles and after some time interval current excites in second electromagnetic coil of electromagnet **6A** then permanent magnet **5** reaches to left dead center or initial position due to repelling force between same poles with respect fixed position of rocker (arm) **2**. Hence given electromagnetic engine having two power strokes compared with other electromagnetic engines for single cylinder arrangement. The fluctuations in speed are reduced by using the flywheel. The **figure 7.5** shows the initial position of rocker (arm) **2** in present electromagnetic engine. The current is supplied through the battery source the magnetic field is generated in electromagnet **6B** the permanent magnet **5** reaches to RDC due to repelling force between same poles thus crank **4** completes its half rotation are shown in **figure 7.5. Figure 7.5** shows the single cylinder electromagnetic oscillating engine in which rocker (arm) at position after forward stroke. The magnetic field is generated in electromagnet **6A** after electricity is supplied after definite time interval, due repelling force between same poles permanent magnet **5** is repelled by electromagnet thus it reaches to LDC is shown in **figure 7.6.**Thus oscillating motion of rocker (arm) is converted into rotary motion of crank **4**.The present electromagnetic oscillating engine by using rocker crank mechanism having following design and methodology for calculating efficiency of engine.

IX. METHODOLOGY

Input voltage = …. V

Input Current = …. A

Input power = voltage * current

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= ……. W

Maximum force exerted by electromagnet on permanent magnet at forward stroke F_1

$$F_1 = N^2I^2A\mu_0/ 2g^2$$

F_1 is force in Newton's

$\mu_0 = 4\pi*10^{-7}$

I = current flowing through coil in Ampere

N = number of turns

g = least clearance between electromagnet and permanent magnet in m

A = cross sectional area of magnet in m^2

Maximum force exerted by electromagnet on permanent magnet at return stroke F_2

$$F_2 = N^2I^2A\mu_0/ 2g^2$$

F_2 is force in Newton's

$\mu_0 = 4\pi*10^{-7}$

I = current flowing through coil in Ampere

N = number of turns

g = least clearance between electromagnet and permanent magnet in m

A = cross sectional area of magnet in m^2

Force exerted by permanent magnet F_3

$$F_3 = (B^2A) / 2\mu_0$$

Where, **B** is flux density in tesla

A = cross sectional area of magnet in m^2

$\mu_0 = 4\pi*10^{-7}$

Now, flux density

$$B = Br/ \pi [\arctan (LW/2z (4z^2+L^2+W^2)^{0.5}) – \arctan (LW/2(D + z)(4(D + z)^2+L^2+W^2)^{0.5})]$$

Br = Remanence field in tesla

Z = Distance from a pole face on the symmetry axis in m

L = Length of block in m

W = Width of block in m

D = Thickness or height of magnet in m

Where F_1, F_2, F_3 are repelling forces.

Total repelling force at forward stroke = $F_1 + F_3$

Total repelling force at return stroke = $F_3 + F_2$

The total force required to complete one revolution of crank $F = F_1 + F_2 + 2F_3$

Torque $T = F * r$

= …….. Nm

F = total force on rocker in Newton = total force required to complete one revolution of crank in Newton

r = crank radius mm

Output power = $2 \pi N T / 60$

N is speed in rpm

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Then,

Output power = …… W

Efficiency = output power 100 / input power

X. ADVANTAGES

1) Light in weight.
2) The fossil fuels are not required for run the engine.
3) It reduces the pollution.
4) It reduces global warming
5) Totally green engine
6) Less noise
7) The present electromagnetic engine is easy to design due it have no complicated parts.

XI. LIMITATIONS

1) Comparing with IC engines less power is produced.
2) The produced torque is not uniform.
3) The large electricity source required as a input

XII. APPLICATIONS

1) It will be using in automobile application
2) It will use as alternative to IC engine.

XIII. CONCLUSION

The present invention relates to an advance method for converting oscillating motion of rocker (arm) into a rotary motion of crank. Nowadays automobiles are manufactured growing equally to meet demands. The emission of toxic pollutants from automobiles causes hazard to health of human beings. Therefore we need to develop the green technology for vehicles. The electromagnetic cars are better alternatives for fossil fuel in automobiles. The electromagnetic engine having major advantages over IC engines such as the engine is light in weight, less running cost, totally green engine, it reduces global warming etc. The present electromagnetic engine is easy to design due it have no complicated parts. The electromagnetic engine requires less parts compared to other engines that causes cost of engine is minimized. The quick return crank rocker mechanism is designed for converting oscillating motion of rocker (arm) into rotary motion crank. The e present electromagnetic engine having two strokes namely forward and return stroke, both are power stroke. The quick return rocker crank assembly designed in such way that forward stroke is faster than return stroke. Whenever we require more power then uses multiple cylinder arrangement. That's reason an electromagnetic oscillating engine by using quick return rocker crank mechanism is efficient method to driving the vehicles.

XIV. ACKNOWLEDGEMENT

It gives us a great pleasure to present the project entitled "**Electromagnetic Oscillating Engine".** Apart from our efforts, the success of project work depends largely on the encouragement and the guidelines of many

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