Electromagnetic Engine

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Abstract- *What would be the biggest crisis that is being faced right now, definitely it would be the hike in petroleum prices and the adverse effects that it brings on the environment. We here bring the latest technology from the conventional petrol engines to put an end to it.The conventional engine works on the to and fro motion of a piston which is done by spraying the petrol and burning it to generate the power. Here we introduce a new way for the to and fro motion to happen i.e., by providing electro magnets at the top and bottom of the cylinder and placing permanent magnets at the top and bottom of the piston. Therefore by changing the polarity of the electro magnet the piston gets attracted to one end of the cylinder while the other end gives a repulsion force, and when the piston reaches one end the polarity of the electro magnet is again changed (using timing circuits and sensors), repelling the piston from that end of the cylinder and attracting to the other end, and hence the to and fro motion can be obtained. By this way an engine is made without the usage of any petroleum products and the power is generated from the engine by just the magnetic attraction and repulsion from the electromagnets.*

Keywords- Magnetism, Electromagnet

I. INTRODUCTION

With the diminishing fossil fuel resources and unabated increase in energy costs and environmental concerns, engines using 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 limitations. Production of bio-fuel takes enormous resources and they still pollute the environment. They do not meet the ever increasing energy demand as well. Similarly, the solar power is not efficient. Added to all, the initial capital and subsequent maintenance costs for machines that use alternate energy sources are very high. Hence, in the absence of a viable alternative, until now, switching to new technology by changing from traditional Internal Combustion engines has been a challenge.

Magnetism is the basic principle of working for an electromagnetic engine. The general property of magnet i.e. attraction and repulsion forces is converted into mechanical work. A magnet has two poles. A north pole and a south pole. When like poles are brought near each other they repel and attract when like poles are brought together. This principle is being used in the electromagnetic engine.

In this engine, the cylinder head is an electromagnet and a permanent magnet is attached to the piston head. When the electromagnet is charged, it attracts or repels the magnet, thus pushing then piston downwards or upwards thereby rotating the crankshaft. This is how power is generated in the electromagnetic engine. It utilizes only repulsive force that allows the field to dissipate completely, and have no restrictive effects on the rising piston. The electromagnetic engine should ideally perform exactly the same as the internal combustion engine. The power of the engine is controlled by the strength of the field and the strength of the field is controlled by the number of windings and the current that is being passed through it. If the current is increased the power generated by the engine also increases accordingly.

II. DESIGN

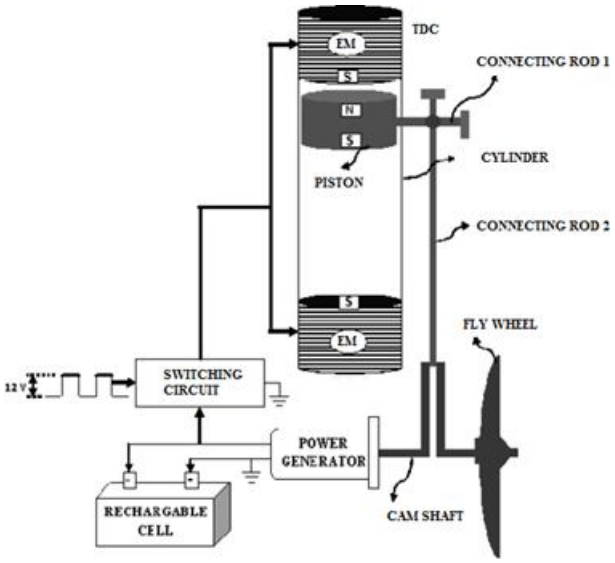

Figure 1: Basic working block

III. BASIC 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 permanentmagnet too. So the idea is to modify the piston head and cylinder head into magnets so that force can be generated between them.

The engine greatly resembles the working of a two-stroke engine. Both the upper and lower coils are connected through the battery, first consider lower coil is energized to produce the magnetic field, so when the electromagnet and the permanent magnet on the piston has the same poles it repels away from each other which creates an upward movement of the piston and, at the same time the electromagnet at the upper side of the cylinder head has to be polarized with the opposite polarity of the approaching permanent magnet head. This creates a pulling effect on the piston and hence the piston has both push and pull effect creating an opportunity for better torque output. With the help of relay and control unit the continuous process through piston can be controlled, also, by the use of sensors we are able to sense the position of the piston and give the required feedback so as to switch the polarities of the electromagnet.

IV. MAIN COMPONENTS

1. CYLINDER

The central working part of an engine, the space which a piston travels. which is typically cast from aluminum or cast iron. A piston is seated inside each cylinder by several piston rings fitted around its outside surface.

For our Electromagnetic engine uses only magnets for its operation. 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 cylinder of an electromagnetic engine is a simple rectangular 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 manufacturable. Also the cylinder is made of aluminum, a non-magnetic material which limits the magnetic field within the boundaries of cylinder periphery. Usage of aluminum material makes the engine lighter unlike the cast-iron cylinder used in internal combustion engine

Figure 2 :Prototype cylinder

For the prototype purpose we have used the above shown pipe which is non conducting to electricity and not attracted towards the magnet. The cylinder length was measured accordingly by calculating the strength of the magnets. The point at which the repulsive force of a magnet stopped the piston and the point from which the piston can be attracted was noted and the length of the cylinder was then calculate. The cylinder mechanism is connected to a linear to rotary motion mechanism from which the flywheel can be rotated. The cylinder mechanism unlike the cylinder in an IC Engine does not need any cooling as no heat is generated by this cylinder mechanism. The cylinder uses a sliding mechanism from left to right and the up down motion is not used as the gravitational pull can be avoided by this mechanism. The force of gravity was a main concern in previous projects which failed them from continuing the project. Hence this design constrain was changed by us by changing the motion from vertical to horizontal design. By using a non-metallicmaterial, the weight reduction of the cylinder is also made possible. Usage of non-ferrous and non-metallic materials is also done so that the electromagnets or the permanent magnets do not get attracted to the cylinder.

2. PISTON

The cooking time can be controlled with this mechanism thereby preventing over consumption of the LPG.

The hollow piston casing is made up of non-magnetic stainless steel, titanium or similar materials of high resistivity and low electrical conductivity. Alternatively, piston casing can also be made up of non-metallic, thermal resistant

materials as well or 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 (NdFeB), samarium-cobalt (SmCo) 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 flat surface of the piston head may be completely exposed or it may be covered by a thin layer of non-magnetic material of sufficient thickness.

The other end of the piston case connects to the piston rod that connects to the crankshaft. The crankshaft and the piston rod convert the linear reciprocating movement of the piston to the circular movement.

Figure 3: Prototype Piston

The piston is mainly the magnet but for its stability while moving through the cylinder and for allowing any fixtures to be connected to it the magnets are placed inside a non-magnetic material as shown in figure. The magnet is closely placed and gripped firmly inside so that the magnet does not come out of it while attracted to the core of an electromagnet. For our prototype purpose we have used the above shown piston which is a PVC coupling in which the magnet is placed.

3. 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 usually 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. 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. The electromagnets are 23 gauged ,600 turns and they are taped at 400turns.

4. SWITCHING CIRCUIT

A relay-based switching circuit is implemented for the change of polarities in both the electromagnets to happen. It uses two batteries in which the negative of the first battery is grounded and positive of the second battery is grounded. The circuit is implemented in such a way that when the current is passed through the first relay there will be a positive current or a clockwise direction of current passing through the first electromagnet and a negative or anticlockwise current passing through the second electromagnet. From this an attractive force is obtained from the first electromagnet and a repulsive force is obtained from the second electromagnet. The relay switches its working as per the frequency given from the potentiometer and the current flows in each direction at each switching. The circuit diagram for the switching circuit using relays is shown below.

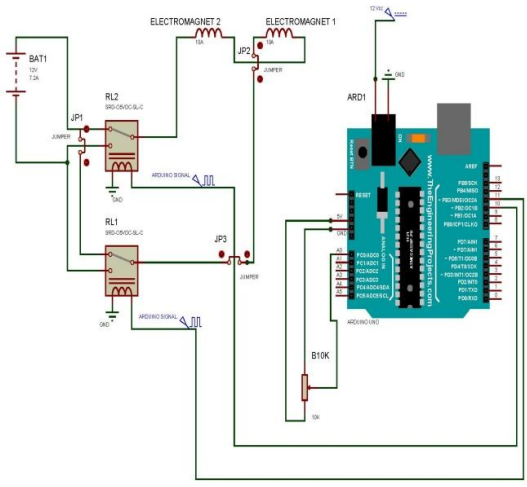

Figure 4:Switching Circuit

V. RESULTS

The prototype is an idea which uses the property of an electromagnet by virtue of which it changes the polarity of its poles whenever the direction of current is changed. This variation in polarity is utilized to attract or repel the permanent magnet attached to the piston. By slight modification in design and by the use of better hands the engine can be modified to generate more power, thereby increasing its efficiency, so that it can be used in commercial vehicles and other applications.

The above figure was the initial concept of our design but the gravitational pull makes this model of engine less in efficiency. Therefore, a new model of this engine was built horizontally leaving away the difficulty of gravitational pull. The most recent model of our engine with the conversion of linear to rotary motion is shown below.

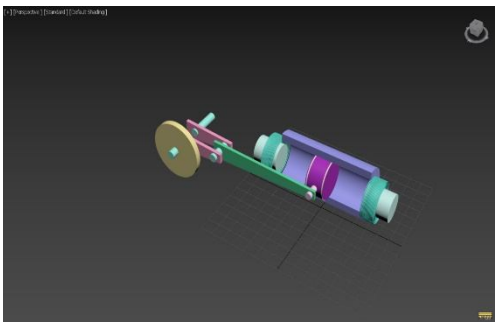

Figure 5:Modified 3D view of engine

The below image shows the working prototype of our model. The components used are for just working process and as the prototype was a success it is assured that it can be done in a large scale with heavier components and using better quality products such as alloys and other non-metallic materials

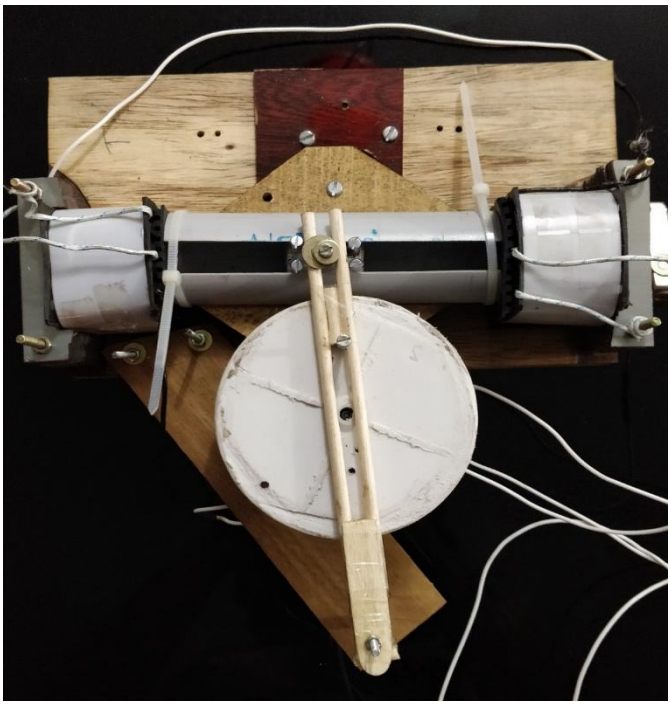

Figure 6:Working prototype

A set of programming was used for switching the direction of current passing through the electromagnet by the help of relays. The programming was done in such a way that when one relay is in open condition the current direction is in positive condition in one electromagnet and in reverse direction in the other electromagnet giving an attraction force from one electromagnet and a repulsive force from the other.

VI. CONCLUSION

The electromagnetic engine has various advantages over the internal combustion engines. The main advantage is, no fuel is being used in the engine. This results in no pollution which is very desirable in the present day situation. As there is no combustion taking place inside the cylinder there is only very little heat generation. This eliminates the need for a cooling system. As magnetic energy is being used the need for air filter, fuel tank, supply system, fuel filter, fuel injector, fuel pump, valves etc. are eliminated and the design of the engine is made simple. Also by the use of materials like Aluminum, titanium etc. we can reduce the weight of the engine. Also existing transmission systems can be used in the electromagnetic engine. Less noise is produce during working. The disadvantage of the electromagnetic engine is its high initial cost. The electromagnets and permanent magnet can be very costly. Also the power of the permanent magnet will decrease during time and the permanent magnet has to be replaced during regular intervals. The engine is not as flexible as the internal combustion engine. The power source is battery. The number of batteries will vary according to the requirement. In high power engines, the number of batteries will increase which may increase the total weight of vehicle and consume a lot of space. Also the batteries needs to be charged regularly which is difficult and time consuming.

In the upcoming future this type of engines can be a mandatory one in countries or states that causes pollution above the minimal level. Therefore these engines will be introduced in automobiles, generators etc. and can create a huge difference in bringing out highly efficient systems with absolutely zero emissions.

VII. FUTURE WORKS

The first step that can be taken for the advancement of the engine can be making it hybrid. As we know that the electromagnetic engine is not as efficient as that of an IC engine, for initial torque and during the requirement of high torque such as moving through an uphill the IC engine can be used and whenever a stable and continuous torque is required the electromagnetic engine can be used.

By using both a conventional engine and electric motor, the best hybrids achieve significantly better fuel efficiency than their non-hybrid counterparts. They also pollute less and save drivers money through fuel savings.The most advanced hybrids have larger batteries and can recharge

their batteries from an outlet, allowing them to drive extended distances on electricity before switching to gasoline or diesel. Known as "plug-in hybrids," these cars can offer much-improved environmental performance and increased fuel savings by substituting grid electricity for gasoline.

VIII. ACKNOWLEDGEMENT

It is a pleasure to acknowledge the help and encouragement of Mr.Ranjith P N, Assistant Professor of Department of Mechatronics Engineering, Nehru College of Engineering and Research Centre Thrissur, Kerala for her endless support with reviewing and for her valuable advice and guidance. Also, we are indebted to our colleagues from Nehru College of Engineering and Research Centre for their inspiration and assistance in completion of this research.

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