

Prototype of an Solenoid Actuator Operated Electromagnetic Engine.

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ABSTRACT:

In day to day life the automobile is becoming very important for the human comfort. It is the long lasting technology of this 21th Century. It has made every work easy of human. In this century the Invention of the "Internal Combustion" took place, which was also known as IC Engine. This types of Engine work on the Fuel such as petrol, diesel and other crude oils. But this type of resources may remain for few years, and get declined after a time. So to get an alternative engine we are going to introduce "Solenoid Operated Electromagnetic Engine". This type of an engine works with the help solenoid actuator, which is of pull type. This helps to move piston linearly. This makes the rotation of the flywheel.

INTRODUCTION:

As we know that every automobile works with the help of the Internal Combustion type engine. . This type of Engine work on the Fuel such as petrol, diesel and other crude oils But this type of engine creates an pollution and other ill effects to the Ozone layer of the earth. Such a type of fossil fuel are going to get declined after a few years. With 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. The harmful radiation gives a birth to the green house effect and the Global Warming. The exhaust gases such as Nitrogen oxide, lead oxide and Sulphur dioxide creates an pollution are being harmful to the human life. So to reduce this type of an pollution an alternative type of an Engine is required. So we are introducing Solenoid Operated type Electromagnetic Engine. This type of an engine works with the Solenoid operated actuator. This type of an engine may take place of an Internal Combustion engine. By introducing this type of an engine many vehicles, which may scraped due to IC engines may used again with the help of same components. This type of an engine works with the help of battery. It can give good efficiency and can be used as a clean fuel without making the pollution. As we know the Piston block and the Cylinders are the main components of the engines. So we are using the same components for this type of an Electromagnetic engine. In this type of an engine we do not require the use of fuel. Which is the most advantage of this type of an engine. Many researches have been going with the help of this type of an engine. So by taking an overview of all researches we are introducing "Solenoid Operated Electromagnetic Engine." In this type of an engine the fuel is replaces with an battery. The battery will be the main source of this type of an engine. It does not consist of the valve timings such as IC engine. It only depend on the timer attached to the solenoid actuator. It has no requirement of the component such as silencer, muffler and other equipment of exhaust system, because no gases are created. This type of an engines are different than, that of hybrid engines. There are also other resources but they are not sufficient to fulfill the human comforts. There are other resource such as solar energy which can be also used as power converter. But this energy does not give efficient supply to work the engines. The Solar energy also depend on many factors like Climate, Temperature, etc. So by seeing another alternatives, the Solenoid operated electromagnetic engine is suitable for the future scope. This technology will save the old vehicles from becoming scrap. By just replacing the old engines by the electromagnetic engines will increase the life of vehicles. They do not meet the ever increasing energy demand as well. Similarly, the solar power is not efficient.. The electromagnetic engine should ideally perform exactly the same as the internal combustion engine.

LITERATURE SURVEY

Radhakrishna Togare who had invented 'MAGNETIC PISTON ENGINE' had mentioned about the running an engine with the help of magnetism by using electromagnet and permanent magnet [1].

Sherman S. Blalock has mentioned in his 'ELECTROMAGNETIC RECIPROCATING ENGINE' about converting an IC engine to an electromagnetic reciprocating engine by replacing the cylinder with nonmagnetic material and the piston replaced with permanent magnet pistons. An electromagnet is disposed at the outer end of each cylinder whose magnetic field are used for driving the piston [2].

Benjamin R. Teal who invented 'MAGNETICALLY OPERABLE ENGINE' has mentioned about a combination device for developing a mechanical output from electrical energy which uses at least one electrical magnet solenoid and preferably a plurality of same. For controlling the time and degree of energization of electrical magnets, timing gears are used [3]

Mr. Manoj Gattani has invented 'LINEAR MAGNETIC GENERATOR'. He mentioned about producing mechanical and electrical output at same time hereafter referred to as a GOPI GEN . His objective for inventing this model is to provide a high efficient, zero emission is developed for power production which can lead the path of magnetic piston based alternative power source [4].

Harold .L. Miller is an inventor of 'PERMANENT MAGNET DRIVE APPARATUS AND OPERATIONAL METHOD'. His invention concerns with reciprocating drive system that performs force and torque conversion by way of magnetic field interaction in between permanent magnets [5].

Basic principle of Solenoid Actuator:

The Actuator we are using is of the push type. This actuator will create the linear motion, which will help to reciprocate the piston and connecting rod. The highly repulsive force is created from actuator to the motion of flywheel. The Solenoid actuator has its vast application in many fields of engineering. The actuator has a copper windings inserted inside. This windings creates the Electromotive force. This force makes the plunger move up and down. But in this we are using the push type of the Solenoid actuator. For motion of the plunger we are using the timers. This timer makes the ON and OFF position for the movement of the plunger. In the previous modification permanent magnets were used instead of solenoid actuators. But it requires the high power electromotive force. Due to which it would effect on the efficiency and required large power to overcome the rotational movement. The solenoid actuator is compact in size and can be installed easily. This type of the actuators creates less friction and can be lubricated easily. Actuation for machine and process automation must range from the most basic on-off function to extremely complex sequencing. When the process involves linear or rotary motion, solenoids are among the best actuation devices in terms of size, cost, simplified installation and ease-of-use. On the following pages, we've shown several application examples that demonstrate the wide range of markets and applications to which our solenoid products are apply

Other Components of Prototype:

Piston: The piston for this type of engine is about 25cc. This types of pistons are rarely used for the small engines. The piston is made up of the mild steel material. The piston is another important component after the solenoid actuator. The piston is held with the linear motion of the actuator. The less friction will be created for the movement of the piston, due to no other repulsive forces are taking place.

Cylinder block: The cylinder block we are using is in accordance with the piston size. The cylinder block

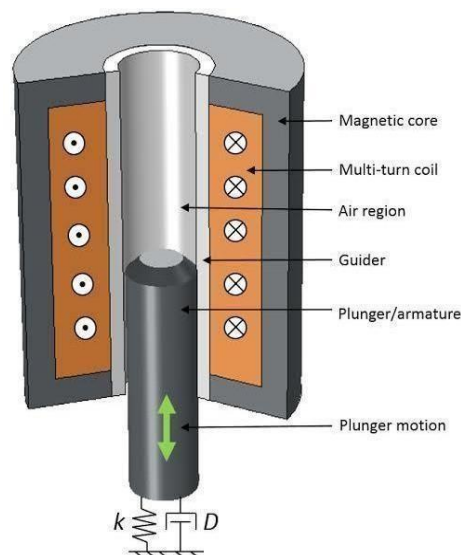


Fig No.1 Solenoid Actuator.

is made up of the Acrylic material. The cylinder block acts like frame or a support for the piston. It is the outer body of the piston frame. It gives the resistivity for the piston movement. In the IC engine the piston and the cylinder block have to go under the process of heat transfer process. But in this type no heat transfer takes place between the cylinder block and piston.

Flywheel: The flywheel is used to convert the linear motion into the rotational motion. The flywheel is made up of the stainless steel. The weight of the flywheel is around 200gm. The flywheel will help to store the energy. The kinematic force is created for its rotation by consisting torque and the moment of Inertia. The bearing attached to the flywheel gives the maximum speed and energy for the rotation.

Connecting rod: The connecting rod is connecting between piston cam and the flywheel bearing. It is made up of the Mild steel. It also takes the linear motion, due to the movement of the piston.

Battery: We are consisting lead acid battery. The battery is to hold 7.5 Amp current and with the output of 12V. It is the rechargeable type of battery. It is also the main component in the Solenoid operated electromagnetic engine. The fuel has been replaced over, the battery as its working component. It is the main source of power supply. The battery is easily available as the working resource for this types of the engines.

IC Timer555: It is the 8 bit type of controller. It used for the ON and OFF of the actuator movement. Solenoid actuator is totally dependent on this timer. It act as a time delay.

Working Principle:

The Electromagnetic engine works with the principle of an linear actuation of electromagnetic solenoid actuator. In this we consist of Lead acid battery of 7.5 Amp. With an Input voltage of 12v. To on off the switch we use the relay and IC 555 timer to operate the actuation of the circuit. When the current is supplied through relay it, makes the push button ON and OFF with the help of a suitable timer. Due to which when the current get ON the magnetic field is created in the solenoid and which makes the Solenoid actuator get actuated. In normal position the plunger is in downward direction. Actuation makes the plunger move up and down. The plunger is connected to the Connecting rod which is made of mild steel. For this type of working are using the piston of 25CC. The piston is taken as per the requirement of load that can be taken by the plunger of the actuator. Due to pavement of the connecting rod the piston is to be followed by the upward and downward motion. The flywheel is connected to the piston which makes the rotational motion of it. In this the reciprocating motion is converted in to the rotational motion of flywheel. Between the flywheel and piston rod the bearings are situated which increases the speed of flywheel rotation. Hence this is the working principle of the Electromagnetic engine.

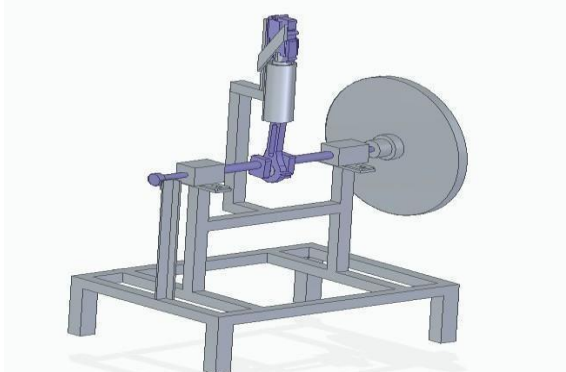


Fig No.2 Catia model

Design:

Input current=4.5 Amp Input Voltage= 12V

Take permeability space $\mu = 4\pi \cdot 10^{-7}$ Input power generated=12*7.5=90W Force generated = $(N^2 \cdot I^2 \cdot K \cdot A) / (2 \cdot G^2)$

But in this, we don't have gap between the actuator and the piston, so we are neglecting the gap 'G' or by taking 1m. $F = (1000^2 \cdot 7.5^2 \cdot 4\pi \cdot 10^{-7} \cdot 4.54) / (2 \cdot 1^2)$

$F = 149.85N$.

Torque = $F \cdot r$

Where, r = crank radius=0.01m. Now $T = 149058 \cdot 0.01$

= 1.49 N-m.

Mass of Flywheel, $E = T \cdot \Theta$

Where, $\Theta = \pi$ $E = 1.49 \cdot \pi$ $E = 4.680J$.

Also $E = 0.5 \cdot I \cdot \omega^2$

$I = 0.073 \text{ Kg-m}^2$

Now to calculate mass, $I = 0.5 \cdot m \cdot r^2$

$M = 1.86 \text{ kg}$.

Take $N = 108 \text{ rpm}$.

Therefore now output power is,

$P = (2\pi \cdot 108 \cdot 1.49) / 60$ $P = 16.625 \text{ W}$.

Efficiency= (output power/Input power)

= (16.62/90)

$\eta = 18.72\%$.

CONCLUSION:

We have successfully demonstrated the concept of using Solenoid operated Electromagnetic engine. The efficiency was about the engines working with IC engines. Hence we have studied the working of prototype successfully.

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