

Solenoid Engine

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Abstract- This paper deals with reduce use of major fossil fuel and use of renewable sources as much as possible to reduce pollution and better energy saving for future using solenoid engine. By using electromagnetic engine pollution of air is overcome and operation can be eco-friendly. The current challenges is make them more efficient and convenient to reduce cost. In this engine the friction of engine parts is less over the IC engine. So life of electromagnetic engine is more.

Keywords- Electromagnetic engine, Spark distributor, Solenoid, Radial engine, Pro E, CATIA V5

I. INTRODUCTION

In automobile engine is as main power source in which by combustion heat is produced and chemical energy is converts into mechanical energy. but due to combustion harmful gasses are produced which causes of air pollution. now a day's electric bikes are developed. but they have less load carrying capacity and not suitable for long run. so that we prefer electromagnetic engine for more power and capacity. Solenoid works as electromagnet when current supplied to it. Engine works without any fuel and no pollution in atmosphere such in case of fuel engine. Coil magnetism is used to attract the plunger. spark distributor is used to actuate electromagnet according to position of piston in cylinder rather than sensors and microcontroller.

II. PRINCIPLE OF SOLENOID. ENGINE

Solenoid engine basically working on the electromagnetic attraction. It is an electromagnetic device which moves the plunger as per the coil magnetism and no pollution into the atmosphere. Whenever electric current is supplied to conductor a surrounding magnetic field is set up at its surface and it works as electromagnet. The electromagnetic force is depend upon the current flowing through coil and number of turns that wound on coil. As the current passes from coil is works as electromagnet and the basic idea is about to run the engine on magnetic attraction and repel principle.

III. STRUCTURE DESIGN

The pentagonal shape keeps the same versatility as the round oven structure, with possibility to be inserted into a corner position, without ever giving up the advantage of having a classic covering on all sides of the corner. For structure designing we use PRO E software to obtain 3D view and dimensions for proper design

The pentagonal shape keeps the same versatility as the round oven structure, with possibility to be inserted into a corner position, without ever giving up the advantage of having a classic covering on all sides of the corner. The main advantage of pentagonal is at 72° and the plunger movement require for movement from one plunger to another is 72° rather than 90° required in case of square size design. This engine follows simple mechanism of attraction, the attraction of coils is in order of first coil- third coil- fifth coil- second coil- fourth coil

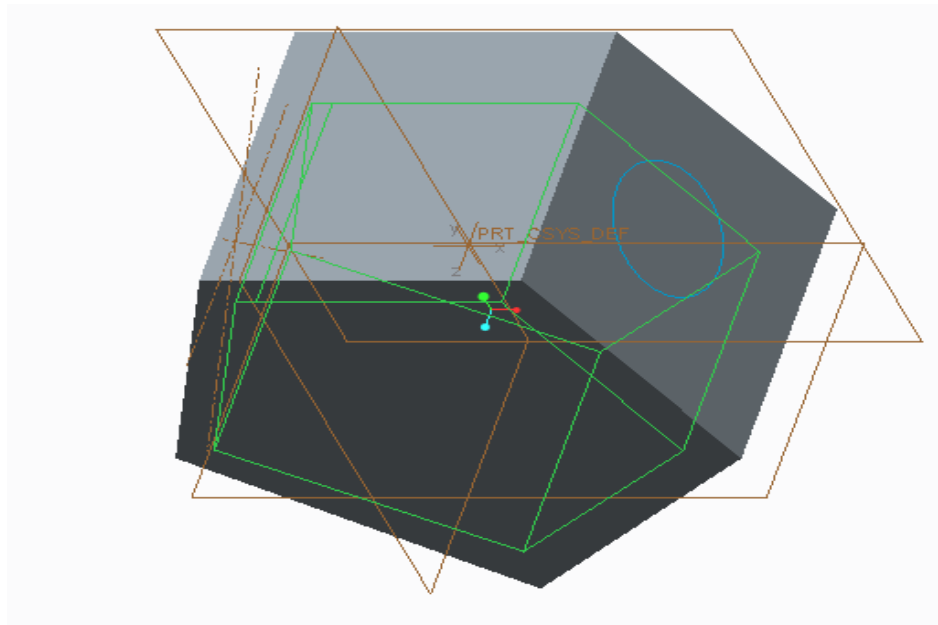


Figure 1 (a) Structure Design PRO E

This structure is used because it can generate lot of power with simple arrangement because of pistons radiates out from a common centre point. For structure design we use Pro E and for Plunger design we use CATIA V5 software.

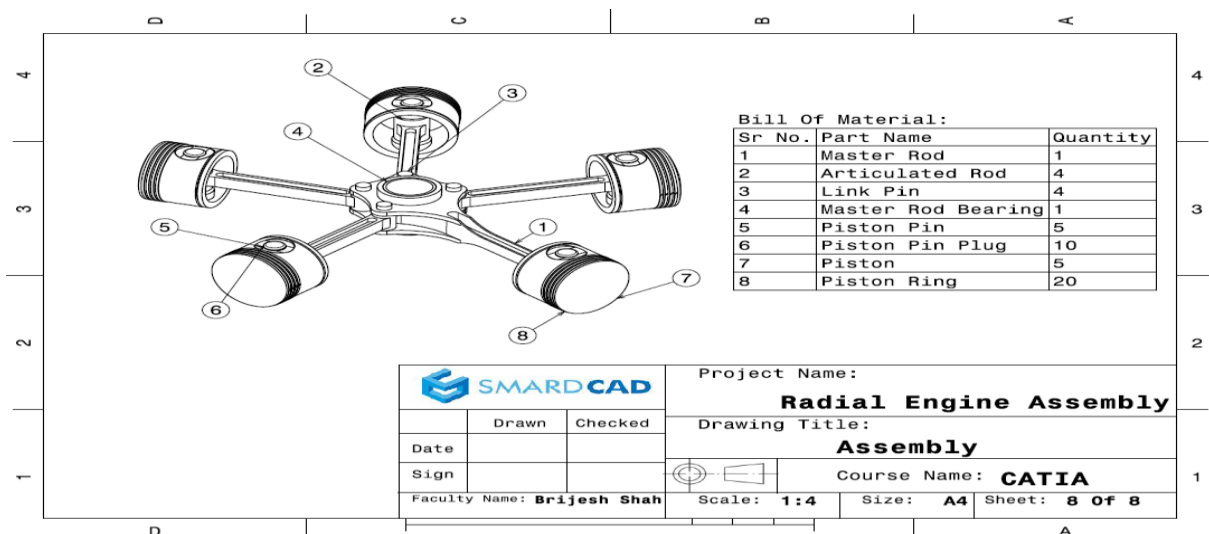


Figure 1(b) Plunger Design In CATIA V5 Software

IV. WORKING PRINCIPLE OF MECHANISM

When supplies current through coil then due to electromagnetism generates magnetic field around hat coil due to that the rod inside get repel or attract based on direction of current. To give movement from one plunger to other plunger attraction can use simple distributor rather than arduino and micro controller. The main movement of plunger attracts is in order of First coil-third coil- third coil – fifth coil – second Coil – fourth Coil and further this 1-3-5-2-4 cycle follows for rotation.

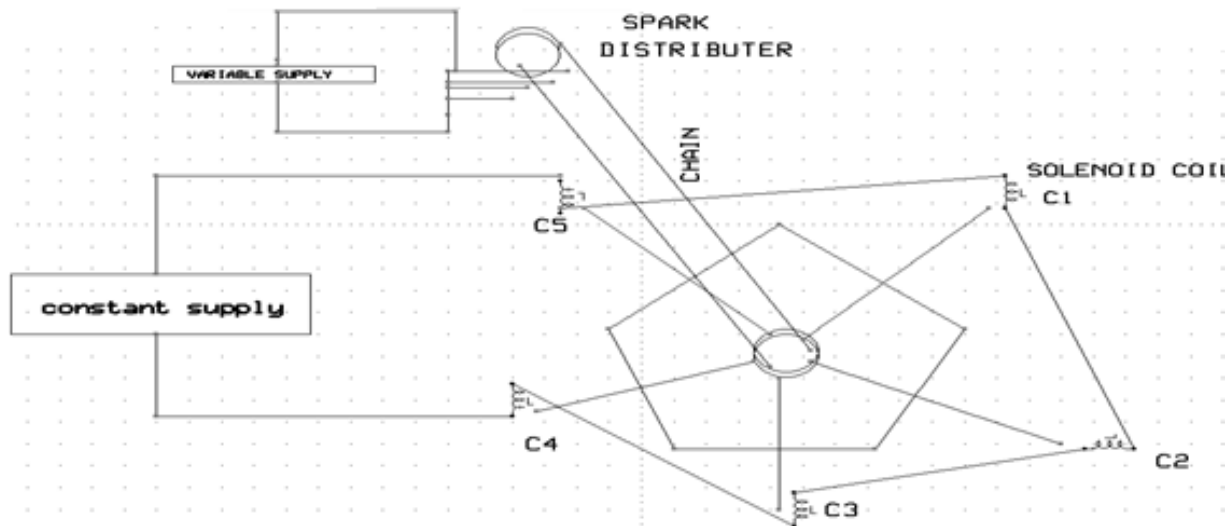


Figure 2.Circuit Connection

This works in the same way a spark distributor on a combustion engine would have worked, except it's actually providing the power to actuate the solenoids instead of providing just an ignition spark. By applying variable supply to the distributor we can vary the speed of attraction of each plunger meanwhile the speed of rotation varies. the spark distributor provides jerk to move attraction of coil from first coil to third coil and vice versa so that it rotates in circular motion.

The efficiency of engine is decided by timing of spark into spark distributor. The arrangement completely depends upon the configuration used in designing the electromagnetic engine.

V. COMPONENT AND MATERIAL USED

5.1 BATTERY :

Battery is used to give electrical supply to induction coil and as main power source. Also to get variable by supplying spark distributor. Battery can charge with a Dynamo/ Alternator like automobiles.



Figure 3.Battery Source

5.2 SOLENOID COIL :

Solenoid coil is consist of number of turns of copper wire wound on iron or former piece. Coil works as electromagnet when the current is flowing through it. The turns ratio depends on applied voltage. the more current coil becomes more strong electromagnet.

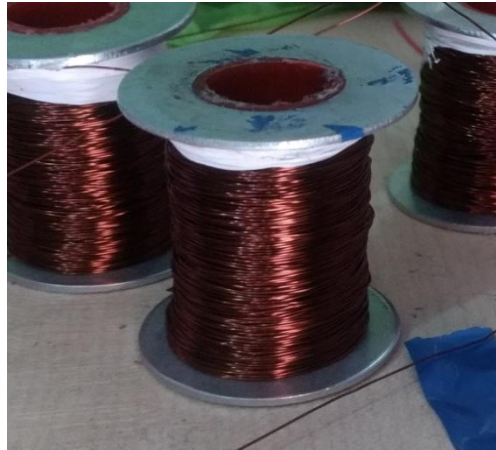


Figure 4. Coil Structure

5.3 SWITCH :

There is a switch between solenoid coil and battery supply for connecting and disconnecting supply and for control constant current supply to coil.

5.4 RHEOSTAT :

It is placed between the distributor with number of studs. This will work as an accelerator. With the decreasing value of resistance the more amount of current is flowing through distributor and speed of movement is increases.

5.5 SPARK DISTRIBUTOR :

The main function of distributor is to provide speed variation. The distributor is also used in automobile, but its function is somewhat different in this engine. As the spark is increased at the spark distributor the value of movement is increases.



Figure 5. Spark distributor

5.6 STRUCTURE ASSEMBLY:

For pentagonal structure design we use high density fibre wood material and assemble the sections of part as per the design structure in PRO E .

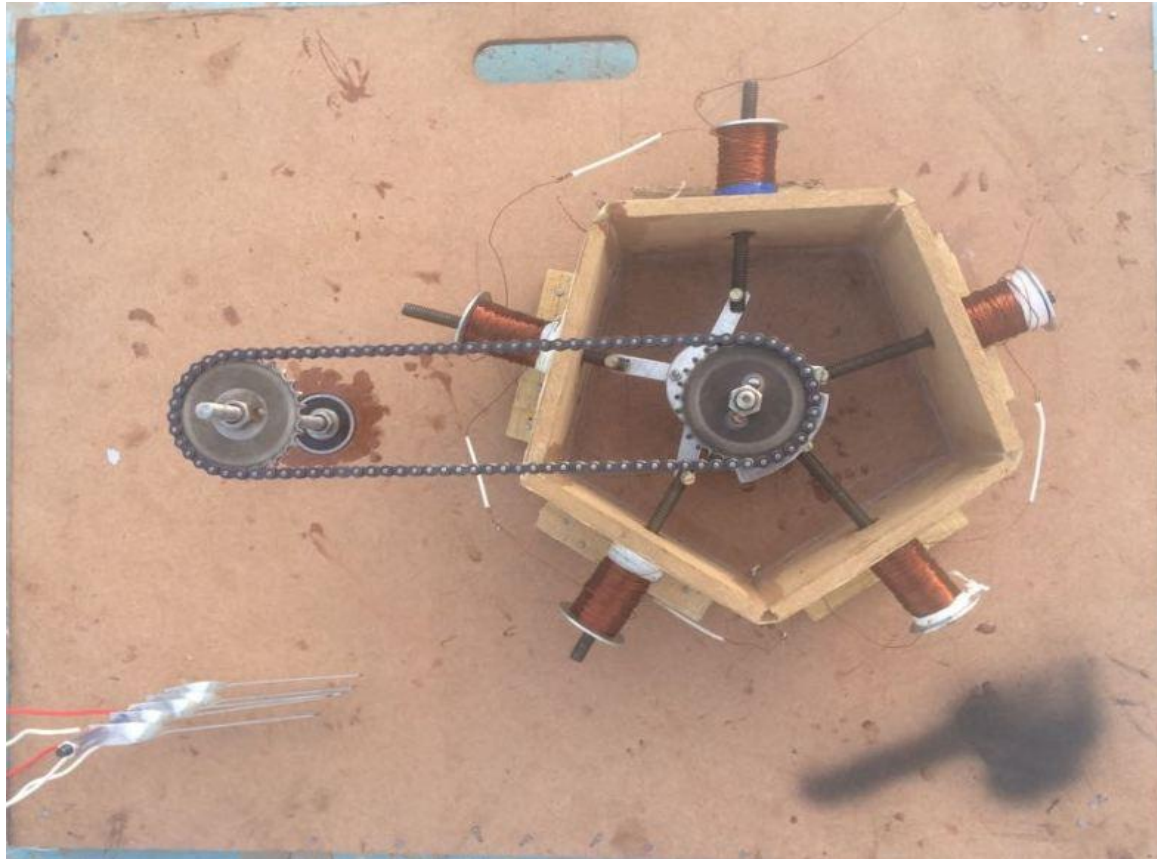


Figure 6.Design Structure

VI. COIL CALCULATIONS

- For 28 gauge copper wire
- from American standard wire gauge Diameter for 28 gauge Is 0.0126
-

➤ $A = \pi r^2$

$$= \pi * (0.0063)^2$$

$$= 3.1415 * 0.00039$$

$$= 0.0124 \text{ mm}$$

$$= 1.24 * 10^{-4} \text{ m}$$

➤ Specific Resistance $R = \rho l / A$

$$[\text{Where } \rho = 1.678 * 10^{-6} \text{ for copper}]$$

$$= (1.678 * 10^{-6} * 396.30) / (1.24 * 10^{-4})$$

$$= 591.3662 * 10^{-2}$$

$$= 5.91362 \, \Omega$$

➤ $V = IR$

$$I = V / R$$

$$= 12 / 5.9136$$

$$= 2.0292 \text{ A}$$

➤ Flux Density $B = \mu_0 I / 2\pi d$ [Where ; $\mu_0 = 4 \pi * 10^{-7}$]

$$= [(4 \pi * 10^{-7}) * 2.0292 / [2\pi * .03785 * 10^{-3}]$$

$$= 4.0584 * 10^{-4}$$

$$= 10.7224 * 10^{-4} \text{ W b/ m}^2$$

$$= 1.0722 \text{ mWb/m}^2$$

➤ Magnetic Flux $\Phi = BA$

$$= (1.0722 * 10^{-3}) * (1.1245 * 10^{-4})$$

$$= 12.0568 \text{ } \mu\text{W b}$$

for 50 mm height,

➤ Magnetic Force $F = BIL$

$$= (1.0722 * 10^{-3}) (2.0292) (10.04 * 10^{-3})$$

$$= 21.844 * 10^{-6} \text{ N}$$

➤ Magnetic Field Strength $H = NI/L$ [; $HL=NI$]

$$= 200 * 2.0292 / 10.043$$

$$= 405.8 / 10.043$$

$$= 40.406 \text{ A/m}$$

➤ Magnetic reluctance $r = 1/R$

$$= 1/5.9136$$

$$= 0.1691 \text{ AT/Wb}$$

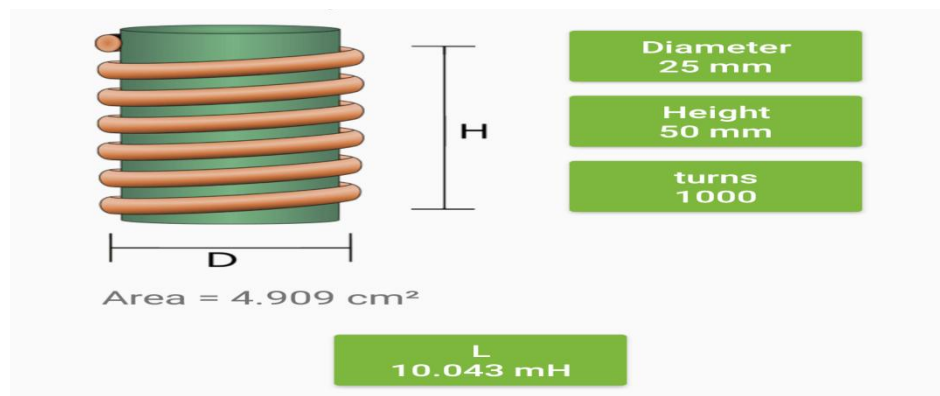


Figure 7. Inductance calculation

For Coil Testing Of Coil we Take 28 Gauge Copper conductor with 200 turns wound on former plastic PVC pipe. Supplying coil with variable supply for testing plunger attraction force. We connect variable rheostat in

series with the coil. By slowly varying resistance value we observe the magnetic force produced by coil. so that we can conclude the value of current supplied to coil at which the plunger smoothly attracts towards the coil.

Sr. No.	Current	Resistance	Plunger movement
1	2.5 Amp	92 Ω	Less Attraction
2	3.5 Amp	48 Ω	Attracts
3	7.6 Amp	30 Ω	Rapidly Attracts
4	8.2 Amp	28 Ω	Strongly Attracts

Table 1. Coil Testing Observation for 200 turns Coil

VII. MERITS OF ELECTROMAGNETIC ENGINE

- There is no effect on atmosphere because electromagnetic engine cause no atmospheric pollution.
- It required less maintenance compared to IC engine.
- It provide alternative to the fossil fuels.
- It is Lighter in weight than an internal combustion engine.
- It provide more efficiency with lesser torque.

VIII. CONCLUSION AND FUTURE SCOPE

This work presents the pentagonal engine structure . In future ,for more power and torque output we can design the structure with more sectional design like V8 or V 12 engine with more efficient power outage.due to use of this and this type of system use of non renewable resources is somewhat reduced and energy for future can be conserve.

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