

“Design And Fabrication Of Magnetic Reciprocating Engine”

Piyush Dhoke¹, Aditya V Hemane², Prajan P Gondole³, Akshay J Dahake⁴, Rakesh B Kadbe⁵, Sagar S.Mande⁶, Prof. N.R. Pathare⁷

^{1,2,3,4,5,6}Students, ⁷ Assistant Professor

Department of Mechanical Engineering, Priyadarshini College of Engineering, Nagpur, India,

Abstract: Business has been looking to end its dependency on Oil. Oil supplies are dwindling, the demand is increasing along with the cost. The Magnetic Reciprocating Engine, can replace the Combustion Engine; it does not use any fossil fuels. The Magnetic Reciprocating Engine can replace the Combustion Engine in any vehicle, eliminating the fuel cost. The Magnetic Reciprocating Engine can replace the Combustion Engine in an engine-generator, creating green renewable electricity. The Magnetic Reciprocating Engine has a low operating cost with 12 year maintenance cycle. The Magnetic Reciprocating Engine can end the need for fossil fuels in transportation and electricity production for homes and businesses.

In the absence of viable alternative, until now, switching to new technology by changing from traditional Internal Combustion engines has been a challenge. So, “Magnetic Reciprocating engine” will fulfill the problem. It can be used to perform various tasks and functions that involve application of force or displacement of objects. This method provides an environmental friendly, very high efficiency engine that can complement or replace any engines that use fossil fuel, biofuel, solar power, wind power, hydro power, electricity, storage energy, or other energy sources.

Keywords: Magnetic

I- INTRODUCTION

Coal, petroleum, natural gas, water and nuclear energy are the five main energy sources that have played important roles and have been widely used by human beings. Magnetic engines are defined as two phases engine which has no exhaust emission, higher efficiency such characters are seen in these kinds of engines.

Global Issues

Everyday radios, newspapers, televisions and the internet warn us of energy exhaustion, atmospheric pollution and hostile climatic conditions. After few hundred years of industrial development, we are facing these global problems while at the same time we maintain The invention of Magnetic reciprocating engine, generally relates to the reciprocating engine based on linear, back-and-forth movement of the pistons and the improvements thereto. The uniqueness of this invention comes from the fact that Magnetic piston engine can be effectively can be effectively integrated with equipments and machines that need engine to perform various tasks functions. It can work as an automobile engine, aircraft engine, locomotive engine, ship engine, lawn mover engine, etc., depending on the requirement. In general, it can complement or replace existing engines that use fossil fuel, bio-fuel, electric power, solar power, wind power or stored power, etc. Further, it can also be used to drive the power generators to produce the electricity. The use of Magnetic piston engine is limitless when the application area is considered use of Magnetic piston engine is limitless when the application area is considered.

OIL DEPENDENCY

The World’s Oil supply is a limited resource. Different organizations have different durations, but they all agree that Oil will end. In 2002 ExxonMobil charted that Oil should end around 2040. New Oil supplies have been found since then but Oil will end. Oil, Fossil Fuel, remains the top global energy source and the fuel of choice for transportation. Demand for Oil is projected to rise by approximately 25 percent through 2040, led by increased commercial transportation activity. A growing

share of this demand will be met by sources such as deep-water, Oil sands and tight Oil, which are increasing as a result of advances in technology. The International Energy Agency's [IEA] World Energy Outlook 2010 projected world Oil production to increase through 2035, with depleting conventional Oil being replaced by fields yet to be found and fields yet to be developed.

To avoid the serious social and economic implications a global decline in Oil production could entail, the 2005 Hirsch report emphasized the need to find alternatives, at least ten to twenty years before the peak, and to phase out the use of petroleum over that time. This was similar to a plan proposed for Sweden that same year. Such mitigation could include energy conservation, fuel substitution, and the use of unconventional Oil. Because mitigation can reduce the use of traditional petroleum sources, it can also affect the timing of peak Oil and the shape of the Hubbert curve. The less we use, the longer it will last.

The US Military has come to the conclusion that the energy supply is vital for security, energy security. The DOD has completed a plan in June 2011, Operational Energy Strategy that outlines three ways to increase energy security: 1) reduces demand for fuel, 2) diversify energy supply and 3) incorporating these considerations into building the future force. The Electromagnetic Reciprocating Engine will end the need of Oil in transportation and power generation.

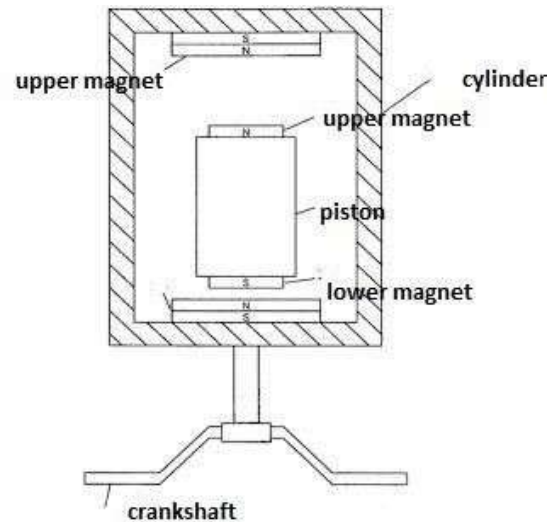
1.2 OIL EXPENSES

The cost of fuel changes over time and affects the operating cost of any organization. The Electromagnetic Reciprocating Engine will end fuel cost. FedEx is an example of a company that would have saved \$12 billion in three years of operations.

Principle

The Magnetic reciprocating engine works in the principle of "like poles repel and unlike poles attract" of magnetism

. "Magnetic reciprocating engine". Due to the principle of its operation, this engine uses very low power (small force) to generate very high power (large force). Hence, this engine works at very high efficiency with the possibility of reaching unity-over operation mode. Some of the important parts used in Magnetic reciprocating engine are as follows:



1.Cylinder

Magnetic engine uses only magnets for its operation. The cylinder prevents unwanted magnetic field and other losses. Further cylinder material itself should not have the properties of attraction and repulsion hence it should not disturb the movement of the piston. As a solution to the above issues, the cylinder must be only made up of nonmagnetic materials such as stainless steel, fiber, titanium or similar materials of high resistivity and low electrical conductivity. The cylinder of an electromagnetic engine is a simple cylindrical 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 a product to manufacture. 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.]

2.Piston

The hollow piston casing is made up of non-magnetic stainless steel, titanium or similar materials which are of high resistivity and low electrical conductivity.

Alternatively, piston casing can also be made up of

non-metallic, thermal resistant materials 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 which in turn connects to the crankshaft. The crankshaft and the piston rod convert the linear reciprocating movement of the piston to the circular movement.

When rotated one-half revolution the stress in the fibres originally above the neutral axis of the specimen are reversed from compression to tension for equal intensity. Upon completing the revolution, the stresses are again reversed, so that during one complete revolution the test specimen passes through a complete cycle flexural stress.

3.Connecting rod

In a reciprocating engine, the connecting rod is used to connect the piston to the crankshaft. It converts the linear motion or reciprocating motion of the piston to the circular motion of the crankshaft. Connecting rod used in this engine is M10 bolt.



The material of the connecting rod is cast iron. As the magnetic fields are contained inside the cylinder, the connecting rod will not be affected much. The connecting rod is same as that of an Internal Combustion engine.

4.ELECTROMAGNET

The design of electromagnet was about using the right gauge of wire and with the right number of turns. But 1st the armature core had to be designed and manufactured. Two coils could have been designed, but this would consume more energy. Hence to minimize the power losses, we calculated to use both the power of attraction and repulsion, instead of only repulsion. This would bring about using only one coil, and more torque can be obtained directly because the power output would be the summation of both attraction and repulsion. This indicated that overall there would be power generation in every moment of the piston. Hence the core design became a curved beam like structure with two flat faces facing the pistons, on each face. This also had an added advantage that the magnetic circuit would now be a closed one, which had fewer losses in the functioning. The core was made with Mild Steel (Bright), as it acts as a soft iron core. The diameter of the core is 50mm throughout except at the end faces. At the end faces the diameter is 55mm with a thickness of 10mm. There were 5 layers of windings done, with total number of turns being 1300. The material used for winding is annealed copper

5.PERMANENT MAGNET

Permanent magnets These are the most common type of magnets that we know and interact with in our daily lives. E.g.; The magnets on our refrigerators. These magnets are permanent in the sense that once they have been magnetized they retain a certain degree of magnetism. Permanent magnets are generally made of ferromagnetic material. Such material consists of atoms and molecules that each have a magnetic field and Neodymium Iron Boron (NdFeB or NIB)

- Samarium Cobalt (SmCo)
- Alnico
- Ceramic or Ferrite

Classification

Permanent Magnets can be classified into four types based on their composition:

1. Neodymium Iron Boron (NdFeB or NIB)
2. Samarium Cobalt (SmCo)
3. Alnico
4. Ceramic or Ferrite NIB and SmCo

are the strongest types of magnets and are very difficult to demagnetize. They are also known as rare earth magnets since their compounds come from the rare earth or Lanthanoid series of elements in the periodic table. The 1970s and 80s saw the development of these magnets. Alnico is a compound made of Aluminium, Nickel and Cobalt. Alnico magnets are commonly used magnets and first became popular around the 1940s. Alnico magnets are not as strong as NIB and SmCo and can be easily demagnetized. This magnet is however, least affected by temperature. This is also the reason why bar magnets and horseshoes have to be taken care of to prevent them from losing their magnetic properties. Ceramic or Ferrite magnets are the most popular today. They were first developed in the 1960's. These are fairly strong magnets but their magnetic strength varies greatly with variations in temperature. Permanent Magnets can also be classified into Injection Molded and Flexible magnets. Injection molded magnets are a composite of various types of resin and magnetic powders, allowing parts of complex shapes to be manufactured by injection molding. The physical and magnetic properties of the product depend on the raw materials, but are generally lower in magnetic strength and resemble plastics in their physical properties. Flexible magnets are similar to injection molded magnets, using a flexible resin or binder such as vinyl, and produced in flat strips or sheets. These magnets are lower in magnetic strength but can be very flexible, depending on the binder used.

WORKING

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 permanent magnet too. Here the main intention is to modify the piston head and cylinder head into magnets so that force can be generated between them.

This working of the electromagnetic engine is based on

attraction & repulsive force of the magnet. The engine greatly resembles the working of a two-stroke engine. To start, let us begin from the situation, when piston is located in the lower position that is the BDC, the coil is connected through the battery, the copper coil is energized to produce the magnetic field. The piston of the large power Neodymium Iron Boron magnets gets attracted by the electromagnet hence moving the piston from BDC to TDC and hence rotate the fly wheel connected to crankshaft link. While one piston move from BDC to TDC the electromagnet gets de-energized and other electromagnet gets energized and hence resulting the flywheel in completion of full stroke.

As the name suggest, the MAGNETIC RECIPROCATING ENGINE will work on the principle of magnetism. When the piston at the BDC is provided with initial cranking effort ,it will move from BDC to TDC causing 180o rotation of crank shaft. As the magnet placed at the top of the piston and magnet fix at cylinder head are facing each other with like poles ,the repulsion force will start acting on both the magnets . Minimum the distance between the magnets will cause higher repulsion force . Therefore when piston reaches at TDC ,the repulsion force will repel the magnets and thus the magnetic piston will move downward from TDC to BDC causing further 180o rotation of crank shaft and thus one complete rotation of crank shaft is obtained . After piston reaches BDC the flywheel will pull the piston back towards TDC and thus cycle repeats. The engine will work on two stroke i.e compression and power stroke. In this system, a permanent neodymium iron-boron magnet was adhered to the top surface of the piston. Hence the magnet travelled along with the piston with reciprocating motion. So there were two magnets stuck to each piston which reciprocated within the cylinder. The magnets were fixed in such a way that the pole orientation was in the same direction. For e.g. if the south poles of both the magnets were fixed to piston surface, then the north poles were exposed to the atmosphere.

FUTURE SCOPE

As in present condition humans are heading toward the use of sources of energy which are pollution free and eco-friendly. Thus the magnetic piston engine can be used as a better alternatives. It can be used to perform various tasks and function that involve application of force or displacement of objects. This engine is highly efficient as it does not uses any input source and it works on its own power. It has the possibility of reaching unity-over operation mode. It has the capability to replace the electric motors and any engine which requires fuel

burning to operate. As these prototype model consists of only one piston and only one pole of magnet is used for running the engine, in future modification can be made to it by using two magnetic piston on both side of the fixed magnet to make use of both the poles of magnet and to achieve high power and more effective use of magnets.

CONCLUSION

Design and working of magnetic piston engine is different from other engine. The Principle of Operation of Electromagnetic Engine is Different than 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 it is more economic and free from air pollution. Magnet is one of the prime power source used for many application. By the demand of fossil fuels expecting that electromagnet is main alternative fuel and it is very much useful for coming generation. Power to be produced at shaft of the engine is much more than the power to be consumed by electromagnet to repel permanent magnet. Thus electromagnetic engine gives Green energy, as no harmful by-product is emitted in Surrounding Atmosphere. Thus is the future of Automobile Industries.

REFERENCES

- [1] Radhakrishna Sheshalyengar Togare, "Magnetic piston engine", 2010; US 7,667,356 B2
- [2] Sherman S. Blalock, "Electromagnetic reciprocating engine" US4317058
- [3] Abil Joseph Eapen, AbyEshowVarughese, Arun T.P, and Athul T.N; "Electromagnetic Engine", IJRET, 2014
- [4] C. Sudhakar, K. Premkumar, K.Vijith, S.Balaji; "Emission less Engine by using ElectroMagnet", IJRAET, 2013
- [5] IJRET- "International journal of research in engineering and technology". Vol 3 , issue 6 june 2014
- [6] V. Ganeshan, "Internal combustion engine" tataMcgraw hill,
- [7] S.S. Rattan , "Theory of machines" ,tataMcgrawhill
- [8] Kirpal Singh (2011), Automobile Engineering, 12th Edition, Vol. 1.
- [9] Kirpal Singh (2011), Automobile Engineering, 12t