

## Conceptual Design and Explanation of Magnetically Operated Solar Powered Engine

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### ABSTRACT

In today's world, one of the major problems is pollution. More than 25-50% of the pollution are caused by automobiles. The increasing population and concurrently, the increasing usage of automobiles has resulted in more air pollution. Also the probability of depletion of non-renewable resources is increasing. Many industries including the automobile industries have started moving towards renewable sources of energy. This paper is based mainly on developing green engine MOSPE (Magnetically Operated Solar Powered Engine) that is pollution free and resembles the IC engines. The operation of the engine is based on magnetic theory of repulsion and attraction. The prime concept for the development of this engine has been derived from mechanism of Stirling engine.

**Keywords:** Green engine, magnetic theory, Stirling engine

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### I. INTRODUCTION

Many improvements have been made and are being made in the field of automobiles and they are mostly concentrated in the development of hybrid engines which include electric engines and solar powered engines. The engines are mostly motor operated and they have some drawbacks like speed attainment ranges. The replacement of the existing IC engines with its working principle is one of the most important parameter to reduce some drawbacks. The magnetically operated solar powered engines have been designed based on the working principle of IC engines. The concept of magnetically operated solar powered engine is to replace the existing IC engines and also with a motive to reduce the pollution and contribute to the green environment. The theory behind the design of magnetically operated solar powered engine consists of two principles. The first principle includes the theory of magnetism and the second principle includes the photovoltaic principle. The operation of MOSPE (Magnetically Operated Solar Powered Engine) is explained in detail.

### II. PRINCIPLES USED IN MOSPE:

The Working of MOSPE is based on two important principles which are described below.

#### 2.1. First principle of MOSPE:

The first principle is the most basic principle and it is based on the theory of attraction and repulsion. According to this principle, "Like poles repel and unlike poles attract". The forward and

backward strokes are designed based on this principle and is responsible for the conversion of linear reciprocating motion of the piston into rotary motion of the crankshaft.

#### 2.2. Second principle of MOSPE:

The second principle is the photovoltaic principle responsible for the operation of photovoltaic or solar cell. The movement of electrons due to the effect of solar radiations or in general the conversion of light energy into electrical energy has been utilized to improve the effect of electromagnetism.

### III. DESIGN OF MAGNETICALLY OPERATED SOLAR POWERED ENGINE

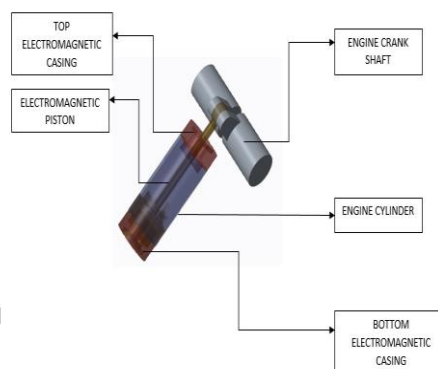


fig.1-Three dimensional diagram of MOSPE

#### IV. CONSTRUCTION OF MAGNETICALLY OPERATED SOLAR POWERED ENGINE

##### 4.1. COMPONENTS OF THE ENGINE:

The various components of the engine include

- A hollow cylinder
- Electromagnetic casings
- Electromagnetic piston
- Solar panel

##### 4.1.1. ELECTROMAGNETIC CASING

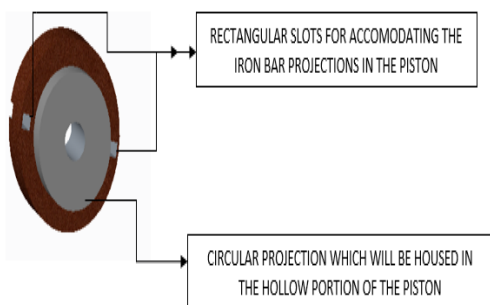


fig.2-Electromagnetic casing

The electromagnetic casing is one of important parts in the engine. It is used to cover both the top and the bottom of the cylinder. It consists of rectangular slots for accomodating the projected bars in the piston. The inner side of the rectangular slot are insulated with suitable material. They have a circular projection which is housed in the hollow portion in the piston.

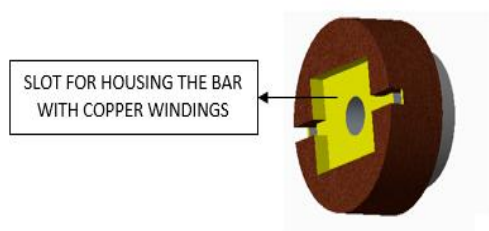


fig.3-Part indication in the casing

It consists of a slot to accommodate the bar with copper windings. The bar makes contact with the casing thus being responsible for making the casing electromagnet.

##### 4.1.2. CRANKSHAFT

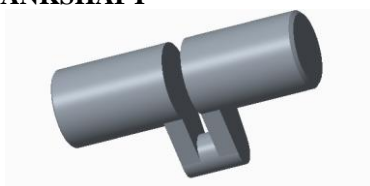


Fig.4-Crankshaft

As in normal IC engines the function of the crankshaft in MOSPE is to convert linear motion of the electromagnetic piston into rotary motion.

##### 4.1.3. ELECTROMAGNETIC PISTON

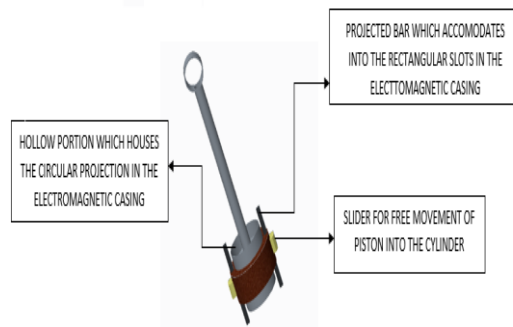


Fig.5-Electromagnetic piston

The piston is connected to the crankshaft. It is provided with a copper coil wounded bar which is embedded in the solid portion of the piston. It consists of two projected iron bars on either side. The projections move into the rectangular slots in the electromagnetic casing. When these projections are completely inside the casing (top or bottom electromagnetic casing) they make contact with the bar wounded with copper coil which is attached to the casing.

These bars (which are in the top and the bottom electromagnetic casing) are connected to the solar panel and are responsible for conducting electricity. When the projections make contact with coil wounded bar in the casing, they conduct electricity and transfer the electricity to the copper coils in them through the projected bars and make the piston act as an electromagnet. The top and the bottom of the piston are hollow on one side so that they fix into the circular projection in the electromagnetic casing. When the hollow seating in the piston accommodates the circular projection in the casing, both being electromagnet result in the repulsion thus causing the linear movement of the piston. The piston consists of sliders on both sides. When it is repelled it moves freely in the cylinder with the help of sliders.

##### 4.1.4. BAR WOUNDED WITH COPPER COIL

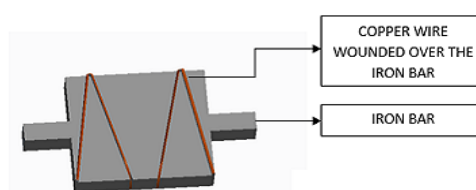


Fig.6-Bar wounded with copper coil

The bar wound with copper coil is placed or attached in the slot provided for it in the electromagnetic casing (both top and bottom electromagnetic casing). They are present both in the top and bottom of the electromagnetic casing. They conduct electricity and are responsible for transforming the casing into an electromagnet.

#### 4.1.5. ENGINE CYLINDER

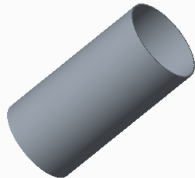


Fig.7-Engine cylinder

The engine cylinder is a hollow portion which accommodates the electromagnetic piston.

It is made up of aluminium so that it does not make any attractive or repulsive contact with the piston. The cylinder is provided with minimum allowance for the reciprocating movement of the piston. It has small holes so that the movement of the piston becomes easier and it does not need to overcome any pressure. The inner surface of the cylinder is provided with a slider so that when a piston is repelled by the casing it moves quicker to the other end for the next repulsive stroke.

#### V. WORKING OF MOSPE

Magnetically Operated Solar powered engine consists of a two repulsive stages. The engine is connected to a solar panel. Initially before the start of the engine, the piston is in contact with the bottom electromagnetic casing. When the power is supplied to the engine through the bar and the copper coil of the casing, a magnetic field is created and hence the bottom casings behave as electromagnets. The projected bar in the piston passing through the rectangular slot in the casing touches the ends of the copper coil wound bar. Thus the current passes through the projected bar and makes the piston electromagnetic. According to the principle of magnetism, the contact between the two electromagnets (piston and the casing) of same polarity makes them repel. The repulsion causes the linear movement of the piston. When the piston moves upwards the projected bar in the piston comes out of the rectangular slot and thus the contact between the projected bar in the piston and the coil wound bar is broken. The piston no longer behaves as an electromagnet.

Now, the piston moves upwards and makes contact with the upper electromagnetic casing. The upper electromagnetic casing working in the same manner as the bottom electromagnetic casing again

repels the piston downwards and the process of successive repulsion continues as long as the power is supplied to them. This successive repulsion causes the linear movement of the piston. This linear motion is converted into the rotary motion of the crankshaft and thus causes the movement of the vehicle.

#### VI. DESIGN DIMENSIONS AND CALCULATION OF TORQUE OF MOSPE:

##### 6.1. DIMENSIONS OF THE CYLINDER:

Height of the cylinder = 500mm

Diameter of the cylinder =  $250\text{mm} \pm 0.25\text{mm}$  (allowance)

##### 6.2. DIMENSIONS OF THE TOP AND BOTTOM CASING:

Diameter of the casing = 250mm

Diameter of the cylindrical projection = 180mm

Height of the casing = 100mm (upto the bottom of the cylindrical projection)

Height of the projection = 50mm

Total height of the casing = 150mm

Dimensions of the slot for the bar wound with coil =  $(150\text{mm} * 125\text{mm}) \pm 0.25\text{mm}$  (allowance)

Dimensions provided for extensions in the bar =  $(50\text{mm} * 25\text{mm} * 20\text{mm}) \pm 0.25\text{mm}$  (allowance)

##### 6.3. DIMENSIONS OF THE BAR WITH COPPER WINDINGS:

Dimensions of the bar =  $150\text{mm} * 125\text{mm}$

Dimensions of the extensions in the bar =  $50\text{mm} * 25\text{mm} * 20\text{mm}$

##### 6.4. DIMENSIONS OF THE PISTON:

Diameter of the solid portion of the cylinder = 250mm

Height of the solid portion = 100mm

(The solid portion is embedded with the bar wound with copper coil)

Diameter the hollow portion of the piston (top and bottom) = 185mm

Height of the hollow portion = 50mm

Height of the iron bar projected from the piston in contact with the embedded bar wound with coil = 130mm

##### 6.5. CALCULATION OF NUMBER OF REVOLUTIONS OF THE CRANKSHAFT:

Calculation of the number of revolution depends upon three factors. The three factors include:

- The force of repulsion
- Distance between the two casings
- Distance moved by the piston

The distance between the top and the bottom casings are fixed. The general formula for torque produced per revolution is given by  
Torque produced per revolutions = Force of repulsion \* Distance moved by piston per revolution  
Force of repulsion is the force with which the piston is moved upwards or downwards and the distance moved by the piston is the distance travelled by the piston inside the cylinder for one repulsion.  
Distance that can be moved by the piston  
= Height of cylinder – Solid portion of the piston – Height of the projection  
= 500 – 100 – 50  
= 350mm

#### 6.6. Assumptions made:

Force of the piston = 1Newton

Distance moved by the piston = 325mm  
= 0.325m

Torque produced per revolution per newton of force  
= 1 \* 0.325 = 0.325Nm

Since the design is a conceptual design detailed calculations were not made.

#### VII. ADVANTAGES:

- Pollution free
- Compact design
- No combustion takes place and no heat loss
- The cylinder is provided with holes so that the piston need not overcome any pressure during upward or downward stroke.

#### VIII. DISADVANTAGES

- Torque is low
- The engine has to be covered with an insulating material, so that it does not attract any magnetic particles like iron when it acts as an electromagnet.
- Maintenance is required.

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