

Power generation using electromagnetic suspension system

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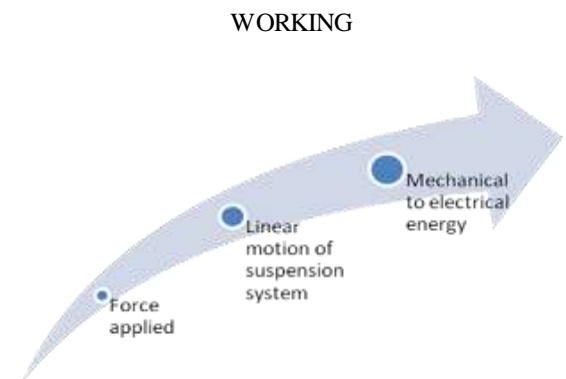
Abstract- The aim of this project was to find out alternative source of energy whose setup will be cheaper as compared to other system. The power generator electromagnetic suspension system is a system that converts force applied on system into electric power. The main focus was on the force applied by foot step which can be converted from one form to another i.e.; electricity. To achieve this, principle of electromagnetism is used in order to generate electricity from this motion in the most simplified setup. The systems consist of copper wire along with standard dimension spring which is easily available in the market which offered desired output. Thus the system is having most simplified structure which can be easily manufactured at low cost.

INTRODUCTION

The power generator electromagnetic suspension system is a system that converts bump, force, linear motion & vibration into electricity. This electricity can be further used in glowing LED, low watt bulb, etc. Our system can be used in places where there are generation of vibrations, linear motion or bumps such as treadmill, dance floor, staircase, etc. Our system uses capacitor to simply absorb this energy without converting it to electricity. So here we put forth a way to use this free energy and store it for further needs. To achieve this we here use the principles of electromagnetism in order to generate electricity from this motion.

Our system is made up of a metal shaft, spring, magnet, coils, base with screws and joints. It uses a coil wound around in particular turning arrangement over the inner beam of the part. We use cylindrical supports in order to minimize friction and ensure smooth generation. The head of the system consists

of magnets attached to outer core of PVC pipe which are aligned with inner core to ensure smooth motion while ensuring efficient generation. This arrangement is fitted with springs in a precise manner so as to achieve the desired motion and magnet coil overlapping which allows for generation of electricity through electromagnetism principle.



Process of power generation

When force is applied on the system the permanent magnets performs the motion between coil winding. This results in generation of magnetic flux due to which electric energy is obtained. This linear motion of the system uses a dense permanent magnet stack embedded on the small diameter PVC pipe and coil wound on pipe having larger diameter. The springs are used for damping load. The electricity generated by each system can then be combined with electricity from other power generation systems and stored in the batteries. Since the coil produce alternating current it can be directly used with respect to certain condition.

SPECIFICATION

Inner Cylinder

Type: Hollow circular cross section
 Material: PVC
 Diameter: 20 mm
 Length: 140 mm
 Thickness: 1 mm

Outer Cylinder

Type: Hollow circular cross section
 Material: PVC
 Diameter: 60 mm
 Length: 200 mm
 Thickness: 1mm

Metal Plates

Type: Rectangular cross section
 Material: Mild steel
 Length: 385mm
 Breadth: 190 mm

Copper Windings

Type: Winding
 Material: Copper
 Gauge: 36
 Turns: around 400

Neodymium Magnets

Type: Permanent magnet with circular cross section
 Material: Neodymium
 Outer diameter: 59.41 mm
 Inner diameter: 22.79 mm
 Thickness: 13.02 mm
 Nos. Of magnets: 7 units

Spring

Type: Helical compression spring
 Material: Structural steel
 Diameter: 40mm
 Thickness: 3mm
 Length: 140mm

Capacitor

Type: Super Capacitor
 Capacitance: 5.5 V/1.0F

Led's

Type: Through Hole Led's
 Material: Gallium Arsenide
 Dimension: 8mm

CALCULATIONS

Calculation of spring

Where k = spring stiffness
 D=diameter of spring=40mm
 d=diameter of spring wire=3mm
 N= number of turns= 9
 G= shear modulus of elasticity
 For carbon steel SAE 1050
 From design data book T V111-9
 G=79Gpa
 Maximum deflection of spring= 3 inches=76.2 mm

$$K = \frac{Gd^4}{8D^3N}$$

$$= 1388.6718$$

Maximum force= spring stiffness × maximum deflection
 =1388.6718×0.0762
 =1058.16
 ~1000 N

Weight=force/acceleration due to gravity
 Let acceleration due to gravity =10 m/s²
 Therefore maximum weight =1000/10=100 Kg

Minimum deflection for which voltage is produced

$$X_{min} = 0.003m$$

$$F_{min} = 13123 \times 0.003810$$

$$= 49.9986$$

$$\sim 50 N$$

Therefore minimum weight to obtain deflection

$$W_{min} = 50/10$$

$$= 5 kg$$

Spring Index (C) =D/d

$$= 13.33mm$$

Shear stress factor (K_s) =1+1/2C

$$= 1.0375$$

Wahl's Correction Factor (K_w)

$$= \frac{4C-1}{4C-4} + \frac{0.615}{C}$$

$$= 1.10$$

Pitch = free length/(n-1)

$$= 17.5 mm$$

Energy Calculation

For 1 stroke
 Current= 24 mA
 Voltage = 2.1 V

For a Led

Current required = 20 mA

Voltage required = 1.8 V

Considering 180 foot steps on a unit

For 180 stroke, current = 180×20

Current = 4320 mA

Considering, 2 units = 2×4320

Current produce by 2 units = 8640 mA

For 180 stroke, voltage = 180×1.8

Voltage = 324 V

Considering, 2 units = 2×324

Voltage produce by 2 units = 648 V

The power generated is enough to enlighten any of the following and many more.

Syska Smart light 7W = 220 V ac

Panasonic RGB Round Base B22 7 Watt = 220 V ac

Wipro garnet 9 w led bulb = 240 V ac

The systems are efficient, low cost systems that meet the environmental requirements.

Current produce is 2.4 mA

Voltage produce is 2.1V

SCOPE

The system can be used as floor under treadmill at gym or as a dance floor at party hall.

It can also used as speed breaker on a road or at tollbooth with some modification to the system.

If system is used as side walk and pavements then it can put human society one step closer towards smart city.

System setup can be placed at densely populated area such as at entry and exit of shopping mall, railway station, airport, metro station etc.

ADVANTAGE

The system consists of simplified construction which is easy to understand and repair in case of any failure. All the components of system are of standard dimension and are easily available at market which makes it cheaper.

Since there is no mechanical contact of main components it avoids chance of wear and tear. Therefore less maintenance is required to the system. The elimination of fossil fuel leads system towards environment friendly source of energy.

DISADVANTAGE

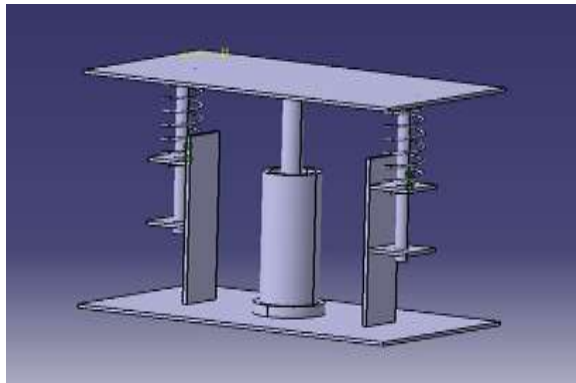
Single unit is not able to produce high amount of energy.

Protection to copper winding is required as precaution to avoid any accidental damage.

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CAD MODEL



PROJECT MODEL



College Ponmar, Chennai ISSN No. 2349-6002
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