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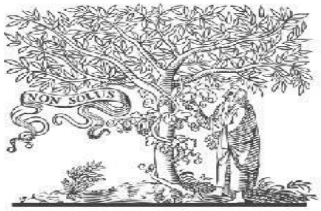

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DESIGN ANDFABRICATION OF SPEED BUMP FOR GENERATION OF ELECTRICITY

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Abstract

The goal of the project is to design and produce a speed breaker power generator. We are attempting to use one such source in this project. By using a straightforward mechanism in place of the conventional speed breakers, electricity is produced. The speed breaker itself is lowered by the weight of the vehicle as it passes over it, which causes a rack gear to be displaced. This rotation of the pinion connected to the generator's shaft produces electricity. Given the growing number of automobiles on the road, this technique provides a reliable way to generate electricity. The model's fabrication also has a modest cost. It can be strategically positioned close to traffic lights, at parking lot entrances, and any other the location where there is a lot of traffic. It begins to move when the car drives over it. Solar power generators can be used to produce electricity. This seeks to use solar energy as efficiently as possible to produce the most amount of electricity. Using solar and speedbreaker technology, this tries to demonstrate several sustainable energy producing ways. Using this technique, electricity may be produced effectively using the sun's energy and the kinetic energy of moving automobiles on roads, highways, parking lots, etc.

In this paper, we go into great detail on the various steps of research, design, and production that went into making different components including springs, generators, rack and pinion mechanisms. We assemble the majority of the components. It also provides the explanation.

this report provides a summary of the design and research efforts made to ensure the project's success.

Introduction

Speed bumps are a type of traffic calming device that uses vertical deflection to reduce motor vehicle traffic and enhance safety conditions. The speed bump, speed cushion, and speed table are all variations.

Vertical deflection devices are widely used across the world, and they are most typically used to enforce low speed limits of 40 km/h (25 mph) or below.

Renewable energy and energy recovery are now regarded as the most effective techniques for mitigating the financial

and environmental consequences of excessive fossil fuel use. The majority of the research has focused on solar energy, wind energy, and wave energy. Yet, the operational mode of many of the used systems is insufficiently optimised. This clearly suggests that large quantities of energy are still being squandered and may be recovered. Energy may be recovered from a variety of existing systems, including combustion systems, where exhaust gas energy can be collected and used in a variety of applications. Additionally, heat rejected from HVAC condensers can be used as a source of heat. Without a doubt, numerous applications may be considered energy sources.

Speed bumps are one of these uses. Speed bumps are kinematic devices that get their kinematics from cars passing over them and convert the produced kinetic and potential energies to electrical energy. The speed bumps systems translate vertically, causing the driving vehicle's mass to experience vertical translation, resulting in potential and kinetic energy.

Why, What, and When

The reactions to these three W's are critical. The first W will address the necessity for the job (why). The second W (what) will address the work's essential notion, and the third W (will) will address the likelihood of its eventual realisation in the actual world.

Starting with the entire earth, it is widely acknowledged that our fossil fuel reserves are decreasing. Demand and supply are rising, whether for petrol for our cars or electricity for our houses, but supply is struggling to keep up. Even if prices rise, no amount of money can halt them.

Experimental Diagram :

Methodology :

A rack is permanently meshing with a pinion beneath to the top of the speed breaker. The rotation of a pinion activates the rotation of a gear increasing the rpm 16 times in it's total.

The collected energy is transformed to direct current after passing via a dc motor. As a result, whenever a car goes over a bump, the motor turns and creates direct current.

BASIC PRINCIPLES:

The Principle is to convert mechanical-to-electrical energy conversion. We can create power from speed breakers utilising three alternative techniques to generate electricity using vehicle kinetic energy as input.

- Roller mechanism
- Rack- Pinion mechanism

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- Crank-shaft mechanism

Normally, rack and pinion gears convert rotational motion to linear motion, however,They are sometimes used to convert linear motion to circular motion. They convert a rotary movement (the pinion's) into a linear movement.

ConstructionDetails :

The various machine elements used in the construction of power hump are

- RACK
- SPUR GEAR
- SHAFT
- SPRINGS
- DYNAMIC ELECTRICITY:

RACK:

Its principal is to transform rotational motion into translatory motion. It must have greater strength, stiffness, and shock load resistance, as well as reduced wear and tear.

SHAFTS:

It is a spinning element that is used to transfer electricity from one location to another. It provides support for rotating devices such as gears and flywheels. It must have a strong torsional and lateral stiffness.

DYNAMIC ELECTRICITY:

It is a machine that transforms mechanical energy into electrical energy. It operates on the basis of "Faraday's laws of electromagnetic induction."

SPRINGS:

It is described as an elastic body that distorts when loaded and returns to its original shape when the load is removed. It absorbs, cushions, or manages energy caused by shocks or vibrations.

SPUR GEAR:

It is described as an elastic body that distorts when loaded and returns to its original shape when the load is removed. It absorbs, cushions, or manages energy caused by shocks or vibrations.

SPUR GEAR :

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HELICAL SPRING :

Alloy Steel Properties

ALLOY STEELS : Properties (Contd.)

Designation	Condition	tensile strength N/mm²	yield strength N/mm²	Izod Impact Nm	BHN
40 Cr 1	Tube, hardened & tempered	1100 / 720	900 / 600		
40 Cr 1 Mo 28	Tube, " or cold drawn & tempered				
40 Cr 1 Mo 60	Creep resisting, bars & forgings, oil hardened & tempered	900—1150	700—800	48—55 / 21	
40 Cr Ni 14W 3 Si 2	Valve Steel, softened				255—
45 Cr 9 Si 4	Valve steel, hard & tempered				
47 Mn 2	Sheet & strip, cold rolled & tempered	900—1100	750		
	" hardened & "	1150—1350	1000		
55 Cr 70	Wear resisting, hardened and tempered	900 to 1050	660	35	255—
80 Cr 20 Si 2 Ni 1	Valve steel, hardened & tempered.				269—

Calculation :

MATERIAL SELECTION FOR SPRING (HELICAL SPRING) :-

For 50cr70 (Alloy steel, hardened temperd.)

Properties for given materials:-

Sut:- 1050 N/mm^2

BHN:- 255-311

1.Weight of vehicle = 200×9.81=1962 N ≅2000 N

∴ P = 1.962 KN

2.Permissible shear stress is taken as 0.5 of sut

τ = 0.5×sut=0.5×1050=525 N/mm2

∴ Spring index : 8

3. Calculate wahl factor by equation (Spring stiffness)

K =(4C-1/4C-4) + (0.615/C)

= (4×8-1/4×8-4) + (0.615/8)

∴ K = 1.184

4. Find out the wire diameter (d) Using

= K(8PC/πd2)

525 = 1.184(8×2000×8/πd2)

d = 9.50 mm

≅ 10 mm

5. Obtain mean coil diameter (D) by following relationship,

D = Cd

= 8×10 = 8×9.58

D = 80 mm D = 76.64 mm

6. Using the ewuation , Determine the number of active coils (N) by equation.

δ = 8PD3/Gd4

The modulus of rigiditiy (G) for steel wires is 81370 N/mm2

(Assume 8cm deflection in V.B.B Page 400)

80 = 8×2000×803×N/81370×104

N = 7.94 ≅ 8 coil

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7. The number of in active coils for the square and grounded ends is 2.

Nt = N+2 = 8+2 = 10

8. Determine the spring's solid length.

Solid length = Nt×d

= 10×10

= 100 mm

9. Determine the spring's actual deflection.

δ = 8PD3N/Gd3

= 8×2000×803×8/81370×104

δ = 80.54 mm

10. Determine the total gap:-

(Assumed gap 0.5 to 2mm between adjucent coil)

Total gap = (Nt-1)×gap between two adjusting

= (10-1)×1

= 9mm

11. Determine the spring's free length by following relationship.

Free length = solid length+total gap+ δ

= 100+9+80.54

Free length = 189.54 mm ≅ 190 mm

12. Determine the pitch of the coil by using relationship.

p = free length/Nt-1

p = 189.54/10-1

p = 21.06 mm

13. Determine the rate of spring by,

k = Gd4/8D3N

= 81370×104/8×803×8

k = 24.83 N/mm

RACK AND PINION CALCULATION :-

1.Module :- Pitch circle diameter/Number of teeth= 36/18 = 2 mm

2.Radius of pitch circle (r) = 36/2 = 18 mm

3.Addendum (a) = module = 2 mm

4.Addendum circle radius (ra)

= r+addendum = 18+2 = 20 mm

5.pinion pressure angle (Ø) = 14.5° involute

6.Length of arc of contact = length of path of contact/sinØ = 13.75 mm

7.Length of path of contact = (asinØ)+{rd2-(rsinØ)2}0.5-rsinØ = 13.29 mm

8.Minimum number of teeth in contact = length of arc of contact/πm = 2

9.Angle turned by the pinion = length of arc of contact×360/2πra = 39.39°

10. Minimum length of the rack = 2πra = 125.66 mm

Fabrication process

ARC WELDING

Arc welding is a method of joining two metals that are either comparable or different. This approach generates enough heat to dissolve metals using electrical power. The metals fuse together as they cool. To liquefy the metals at the site of welding, the welding power supply is employed to form a circular segment between the cathode and the base material.Slag is being formed around the welding area.

Advantages:

- Low budget electricity production
- Less floor area
- No obstruction to traffic
- Easy maintenance
- Suitable at parking of multiplexes, malls, toll booths, signals, etc.
- Uses: Charging batteries and using them to light up the streets, etc

APPLICATIONS

• It is suitable for commercial use.
• It may be used to power streetlights.
• It may also be used to send signals.
• We may utilise electricity to power safety devices such as CCTV cameras.

Uses:

Charging batteries and utilising them to illuminate the streets, for example. Such speed breakers can be developed for heavier vehicles, boosting input torque and, as a result, generator output.
More appropriate and compact procedures to improve efficiency.

Conclusion :

Energy is generated by installing a rack and pinion mechanism and using the speed breaker as a power producing device. The energy we save during the day may be utilised to power streetlights at night. A comparable configuration may be deployed individually across city lanes, beside toll booths on motorways and other intercity routes, or in combination with speed bumps anywhere in the globe. The final prototype model, which was built, produced a maximum output of 3.87 volts.

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