Energy Harvesting from Speed Breaker

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Abstract:

In this harvesting technique, we will use rack and pinion method to generate electricity. In this technique we will convert mechanical energy into electrical energy. The demand for energy has greatly increased. This experiment highlights the notion that power can be produced by speed bumps with certain design. On a regular basis, a significant amount of kinetic energy in various forms is lost on roadways; this energy might be harnessed to generate power, which can then be stored in batteries. This project clearly demonstrates how the rack-pinion system, which essentially converts linear motion into rotational motion and can later be utilized to create electricity, may be used to generate power. The current sources of clean energy are not able to supply enough energy. We have created a device that can harness the power of moving automobiles to produce electricity. It has been shown that a rack system that utilizes both the downward and upward motion to drive a pinion increases the rotation time of a generator by 89.2% when compared to gadgets that only go downward. This study provides helpful data that will aid future research on related devices and clean energy production.

Keywords: *Energy, Shaft, Frame, Gears, Rack & Pinion, Dynamo, Resistor, Led, Power Generation*

I. INTRODUCTION

Energy can only be changed from one form to another; it cannot be created or destroyed. We frequently read about the law of energy conservation. We get our energy from a variety of sources, including nuclear, hydro, and thermal. However, there are certain places where the project is going on, such as the roadways. The amount of traffic on the roads is steadily growing as the motor industry develops. There are now many different kinds of automobiles on the road, and competition will continue as long as the planet does. The government is also putting new infrastructure into place to provide new, quicker transportation routes and connect cities. National and express highways are especially designed to connect densely populated cities; on these routes, automobiles may travel at their top speeds. Since roads are necessary for transportation, the number of vehicles on the road is growing along with the population. With the introduction of the high speed motor, their speed also increased. However, there are some places, such as the market and the school, where driving at a fast pace might be hazardous to human life. In close proximity to these sites, the government road development corporation erected speed breakers. The new technologies of constructing roads and modern materials of the road increase the quality of roads. The present speed breakers are rigid in construction and the abundant energy losses occur when any vehicle passes over it. This loss may be in the form of kinetic energy. This loss of energy can be converted from the kinetic form to another useful form of energy. The cheapest new energy sources are those that involve energy conversion and conservation. This endeavor includes figuring out how to use the energy that is lost when a vehicle crosses a speed limiter. When a car drives over it, a lot of energy is introduced. An employing the speed limiter as a power producing device and inserting a rack and pinion mechanism, we can harness the energy produced and generate electricity. The rack and pinion mechanism will operate as a result of the vertical force of kinetic motion in 2-wheeler and 4-wheeler. The created energy will then be transmitted to the generator by means of a system of gears, and as it rotates, power will be produced. Street lights can be lit at night using the energy we conserve during the day. An arrangement like this might be put in place separately among city lanes and toll booths on highways and other intercity streets, or fuse with speed limiters wherever they are found. Street lights, traffic signals, and other devices can be illuminated using the electricity produced by such a machine. It may also be utilized to store energy, charge car batteries, etc. in busy streets and heavily inhabited places. The notion to convert this energy into an electrical form is the development of this concept.

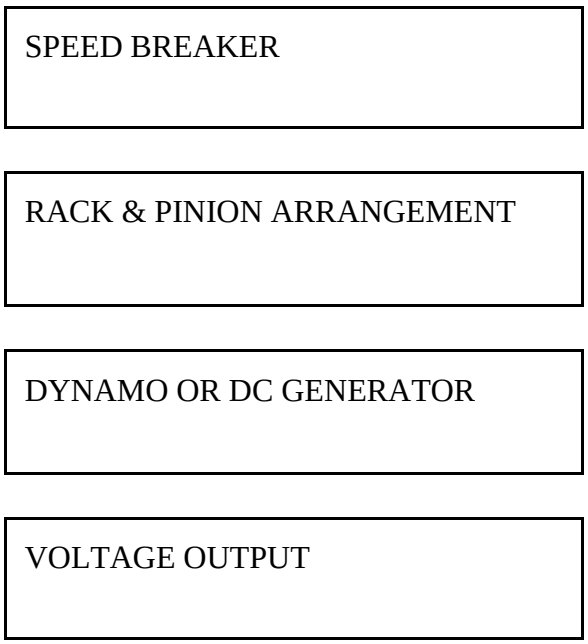
II. LITERATURE REVIEW

The energy crisis is a barrier to an economy's access to energy resources. Studies to find a solution to the energy problem gave rise to the idea of producing power using speed breakers. South Africans were the first to employ it; their power crisis forced them to adopt this technique to light up small settlements along the roadway. The concept of elementary physics was applied in order to transform the kinetic energy into wasted electrical energy when the car runs over the speed limiter. Since then, this field has advanced significantly. Our team at work was intrigued by the concept, so We decided to develop a project that will increase energy production and store it for use at night because it is good for the economy of the country.

A major obstacle in an economy's ability to get energy resources is the current energy crisis. The notion of producing power using speed breakers came from studies to solve the energy issue. Firstly, they had to adopt this technique to light up tiny communities along the roadway due to the energy crisis in South Africa. Basic physics dictates that the wasted kinetic energy created when a car runs over a speed bump should be converted into electrical energy. Since then, this discipline has seen major advancements. Amateur inventor Kanak Gogoi in Guwahati developed a similar contraption that generates power when a car passes over a speed breaker. The idea piqued the interest of IIT-Guwahati, which gave financing for a prototype project to generate electricity from speed bumps. They examined the device and gave the Assam government their recommendation. Their research has made it important to take into account this option to generate electricity on a large scale, as it shows a boost for the nation's economy.

For the Elimination of Remote Power Systems Near Roads, New Electrical Energy Generation Speed-Breaker. Mohsen Parto Dezfoli, Abbas Rezaey, Zahra Baniasad, and Horieh Rezaey are members of the Electrical and Computer Engineering Department at Islamic Azad University, South Tehran Branch, in Tehran, Iran. The kinetic energy of the autos is transformed into electric energy by this gadget. A movable plate that has been set up on the road allows for this; this plate converts the vehicle's stroke motion to the crank mechanism's rotating motion and it generates the electricity

III. Flow chart



IV. DESIGN

Figure 1: Design frame

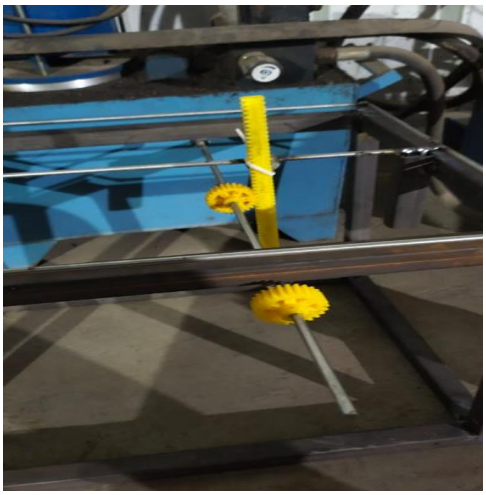


Figure 2: Rack & Pinion

V. METHODOLOGY

Unbrokenly meshing with a pinion is a rack that is located beneath the top of the speed breaker. A gear train begins to rotate when the pinion does, which causes the rpm to increase by roughly 16 times. The mechanism will turn whenever a vehicle glossed over the thump since it is where the recovered energy goes when it is converted to direct current.

5.1 Rack and Pinion mechanism:

The rack and pinion is a small circular gear that meshes with a rectangular bar with teeth on one side. Straight or helical teeth on a pinion can mesh with teeth that are inclined to the pinion-axis shaft's

The rack translates when the pinion rotates on a fixed axis by traveling in a linear line.

Figure 3: Rack & Pinion

5.2 Working principle:

There is a lot of force applied as a car over the bump. An appropriate system that effectively transforms some mechanical energy into electrical energy can be used to tap into this. This component produces energy by using the weight that comes from the motion of motor vehicles as an input. A securely fixed rack that is in perpetual netting with a pinion is located below the bump. To boost the rpm, the pinion is linked to a shaft using additional spur gear that has a large number of teeth. The larger spur gear on the next shaft netting with the mechanism pinion to boost the rpm at the mechanism pinion even more.

5.3 Spur Gear manufacturing:

The most well-known type of gears are spur gears or leisurely pace gears. With parallel and coplanar shafts, they are cylindrical gears. Such gears have straight teeth that run parallel to the pivot of the wheel. The advantages of drive gears are their design, their affordability in both production and carry, the absence of end thrust. They merely spread burden out in the regulation with force. Their research has made it necessary to consider this large-scale power generation alternative, which is beneficial for the nation's economy.

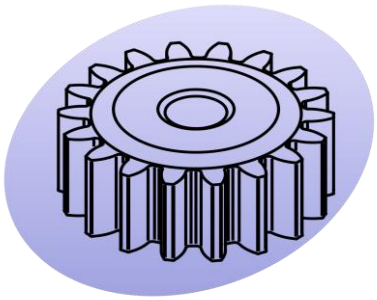


Figure 4: Spur Gear

5.4 DC Motor:

An apparatus that converts electrical energy into mechanical energy and back again is a direct current (DC) motor. Brushes and commutator segments connect the supply end of a DC motor to the current-carrying armature. Its north and south poles are separated by a magnetic armature. The electromagnetic effect of the magnets generates mechanical force when current is applied to the armature. According to Fleming's left-hand rule, a DC motor operates. The Left-hand law conveys that if a current-carrying conductor is positioned perpendicular to a magnetic field, force will be applied to the conductor in a direction that is also perpendicular to the field's and the conductor's directions. According to Fleming's rule, the direction of the mechanical force generated would be indicated if the thumb, second finger, and index finger of our left hand were extended perpendicular to one another, with the middle finger pointing

in the direction of the current carried by the conductor and the index finger pointing along of the magnetic field generated, or north to south by the thumb.

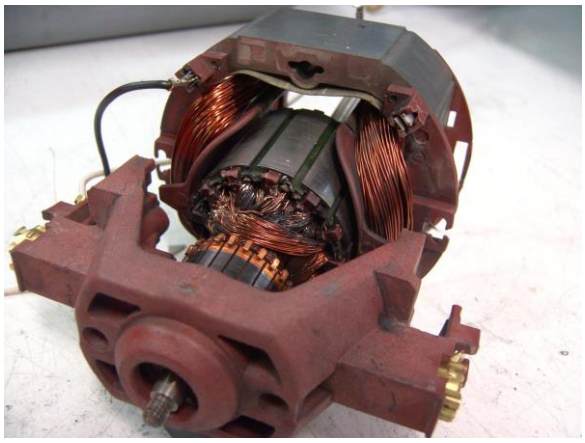


Figure 5: DC Motor

5.5 Spring:

The spring will extend back to its normal length after the load on the car has been released because it is made to work with that load. The other end of the frame's pivot point is attached to one spring. It uses a single helical compression spring.

5.6 Dynamo:

It's an apparatus that changes mechanical energy into electrical energy. The dynamo consists of a stationary magnet (stator) that generates a strong magnetic field and a revolving magnet (rotor) that bends and slashes through the stator's magnetic lines of flux. Electricity is produced when the rotor passes through a magnetic flux line.

5.7 Shaft:

It is a revolving component that transfers power from one location to another. It supports the rotating components, such as flywheels and gears. High lateral and torsional rigidity are required.

5.8 Power calculations:

5.8.1 Nomenclature

Hr.	Hour
m	Minute
wt.	Weight
Wd	Work done

h	Height
Ts	Time Spent
P	Power
W	Watt
TE	Total energy
F	force
Ft	Tangential Force
Fr	Radial Force
Nm	Newton meter
Pr	Pinion radius
T	Torque
rpm	Revolution per minute
OP	Output power
M	Mass
g	Gravitational Force

Five motorcycles will often pass in a minute, understating the findings assuming that the full operation period was 5 hours, of our sum up on the expressway because of the speed breaker, then:

Vehicles passed through the breaker in total:

5 Hr *60 m *5 motorcycles = 1500

• Vehicle mass as estimated (Bike): 200kg

• The speed breaker is 7 cm tall.

• Work completed: *Wd*g*h*

*= 200*9.81*.07*

= 137.34 J

Now,

Wd x Ts = P

= 137.34/4 = 34.335W

So, for 1500 vehicles,

*P = 34.335*1500*

= 51502.5W

Therefore,

*TE = (4*51502.5)/3600*
= 57.225 W-Hr

Now,

F = m*g F represents the vertical force of the vehicle operating on the rack.
*= 200*9.81*
= 1962 N

This force will have a tangential component as well as a radial component on the pinion.

*Ft = F*Cos (20)*
= 1843.67 N

*Fr = F*Sin (20)*
= 671.043 N

As a result, the (rack) pinion's torque will be calculated as
*= Ft * Pr*
= 1843.67.015*
= 27.655 Nm

The formula for power is torque times omega, or 34.335 = T* 2*3.14*(rpm)/60.

Therefore, rpm equals 11.8 12

Calculation of actual perform

h between spring: 6.5cm
M applied on model: 6 kg
*W: M*g*
*:6*9.8*
:58.8
*Wd: h*M*w*
*: 58.8*6.5*
: 382.2
:3.822 W

5.8.2 Nomenclature

V	Voltage
I	Current

V measure through millimeter is 1.22*10(-6)
I measure through millimeter is 30*10(-6)

Power: I*V
: 00.122*000.30*10(-6)
:36.6*10(-6) W

The OP from our project is 36.6*10(-6) W

5.9 Advantages:

1. Improved power transfer efficiency.
2. Due to its small size, it is simple to set up.
3. Offers a constant velocity ratio.
4. Highly reliable.

This device is designed to capture kinetic energy and waste from any moving items. The kinetic energy of the autos is transformed into electric energy by this gadget. Moving plates that are mounted on the road are used to do this. These plates collect very minute movements from the road surfaces and transfer them to rack and pinion systems. In this case, the speed-reciprocating breaker's motion is converted into rotational motion using a rack and pinion configuration. The flywheel is attached to a shaft that the pinion's axis is coupled to. The rotating motion obtained at the pinion results in a slower speed. The dynamo can be rotated at this speed.

The magnetic flux surrounding a static magnetic stator is reduced by the rotating dynamo, creating the

electric propulsion (emf). The created emf is then transmitted to an inverter, where it is controlled. This controlled electromagnetic field is now transmitted to the storage battery, where it is kept overnight. Then, at night, this current is used for lighting purposes on both sides of the road for a long distance.

VI. RESULTS & DISCUSSION

The working model created by Power Bump's design and construction is displayed. The entire fabrication is shown in this figure, which may be mounted to cars to generate electricity.

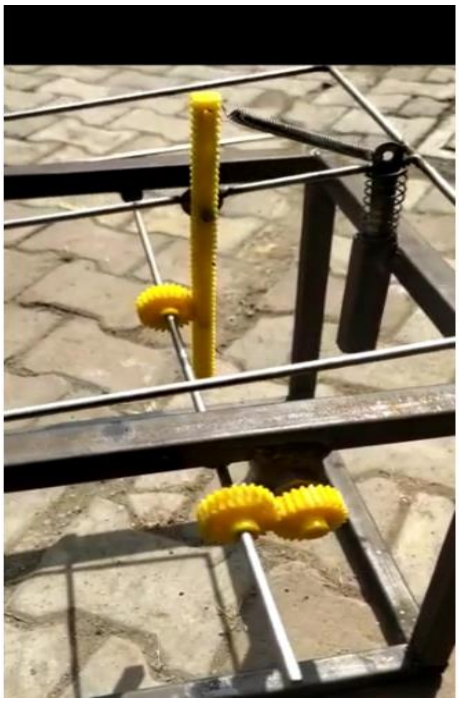


Figure 6: Frame

VII. CONCLUSION

The approach employed in this project to generate electricity from speed breakers is dependable, and the method will help preserve our natural resources. In light of India's current electricity problem, the government is concentrating on using non-conventional energy sources to generate electricity and lowering the country's contribution to global warming. Therefore, the methods mentioned above will also aid in the production of energy. It will provide electricity to villages without any extra effort throughout the year.

This will be a huge help to the world in the coming days since it will prevent a lot of electricity from power plants from being spent on lighting the street lights. This will be a huge help to the planet in the coming days as it would prevent a lot of electricity from power plants from being spent on lighting the street lights. It's imperative to consider alternative resources because the available conventional sources are rapidly running out. For effective utilization, we must conserve the energy produced by conventional sources. As a result, this idea not only provides options but also strengthens the economy of the country.

VIII. FUTURE SCOPE

This technology is still under development. Appropriate for parking at multiplexes, shopping centers, toll booths, signals, etc. Street lights, etc., are lit up using batteries that have been used for charging. To increase input torque and ultimately generator output, speed breakers can be made for large trucks. The lack of light might be somewhat decreased.

IX. ACKNOWLEDGEMENT

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