



Power Generation Using Speed Breaker With Help Of Rack & Pinion Mechanism

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Abstract: The current project is to fabricate a mechanism that harvests energy from the speed breaker by rack and pinion arrangement. The principle involved in the present work is to convert the potential energy of the speed breaker into electrical power. Large amounts of electricity can be generated, thus saving lot of money and will be very beneficial for the Government. When a vehicle is in motion it produces heat energy due to friction between the vehicle's wheel and the road and also when vehicle strikes the wind at high speeds. There is a system to generate power by converting the potential energy generated by a vehicle going up on a speed breaker into kinetic energy. When the vehicle moves over the inclined plates, it gains height thus resulting in an increase in potential energy, which is wasted in a conventional rumble strip. When the breaker comes down, they crank a lever fitted to a ratchet-wheel type mechanism (an angular motion converter) which in turn rotates a geared shaft that is loaded with recoil springs. The output of this shaft is coupled to a dynamo to convert kinetic energy into electrical energy.

Keywords: Vehicles, speed breaker, Rack and pinion, Gear Shaft, Dc Generator, Power generation

I. INTRODUCTION

India's population was increasing per day by day and suffering for lack of power generation. There is a system to generate power by converting the potential energy generated by a vehicle going up on a speed breaker into kinetic energy. When the vehicle moves over the inclined plates, it gains height resulting in an increase in potential energy, and then converted in to electrical energy. Power can be generated in two ways by using renewable energy sources and non-renewable energy sources. Non- renewable energy sources are oil, coal, nuclear and natural gases, these sources pollute the environment. Renewable energy sources are wind mills, hydro power, solar, geothermal and biomass, as shown in fig:1. these sources are eco-friendly with the environment. This project is also related to renewable energy source which generates power through speed with help of rack and pinion mechanism, here the potential energy is converted to kinetic energy. So if we establish these project near the speed breakers we can generate a lot of power and can be stored in a batteries for future uses.

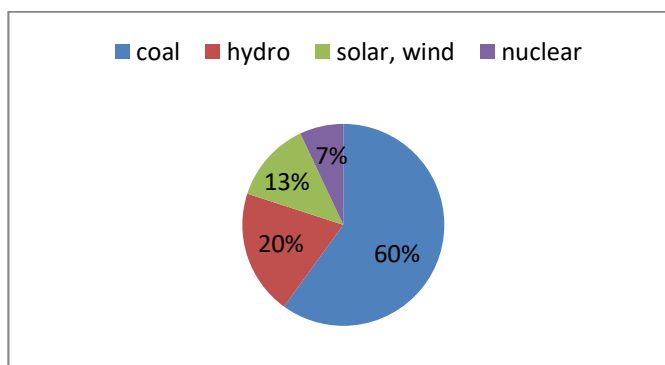


Fig1: Power Generation Capacity of India

These are the mechanisms used to generate power through speed breakers are as follows:

- 1) Using Roller Mechanism
- 2) Using crank shaft Mechanism
- 3) Using Rack and Pinion mechanisms

II. LITERATURE REVIEW

Ali Azam et. al., (1) This is generating many kilowatts of power by using downward as well as the upward motion of rack. With the help of speed breaker mechanism, linear motion of rack is converted into rotary motion of pinion and thus is used to rotate the shaft of DC generator. It generates 273.24 watts with 400kg of load and 14cm of the height of the rack. DC voltages charge the batteries during the passage of moving vehicles. Using inverters, we will be able to use batteries power for other useful applications. Guide slots and lubricating oil sump is required to minimize friction losses. The initial cost of this arrangement is high but after the first cost, it will be a free energy system.

G. Ramakrishna Prabu et. al., (2) Electricity plays a very important role in our life". Due to the population explosion, the current power generation has become insufficient to fulfill our requirements. In this project we discover technology to generate electricity from speed breakers in which the system used is reliable and this technique will help conserve our natural resources. In coming days, this will prove a great boon to the world, since it will save a lot of electricity of power plants that gets wasted in illuminating the streetlights. As the conventional sources are depleting very fast, it's high time to think of alternative resources.

Abhishek Chaudhari et. al., (3) In the coming days, demand for electricity will be very high as it is increasing every day, speed breaker power generator will prove a great boom to the world in the Future. The Aim of this research is to introduce another innovative method of green power generation in order to contribute toward developing the world by enriching it with utilization of available resources in more useful manner.

K. Arun Kumar et. al., (4) In concluding the words of this paper, since the power generation using footstep gets its energy requirements from the Non-renewable source of energy there is no need of power from the mains and there is less pollution in this source of energy. It is very useful to the places all roads and as well as all kind of footstep which is used to generate the non-conventional energy like electricity. It can extend this project by using the same arrangement and construct in the footsteps so that increase the power production rate by fixing school and colleges, highways etc.

Anup Sharma et. al., (5) Energy conservation and reuse is important to sustain industrial growth and the standard of living of a country. In order to promote sustainable development, it's important to reuse energy as it can significantly reduce the per capita consumption. Now as vehicle traffic is a major issue in most big cities, this can be used to our advantage by installing these speed breakers in heavy traffic roads and toll booths and we can generate electricity almost continuously by using the proposed mechanism with minimum effort and maintenance.

Akash Liladhar Gorle et. al., (6) The existing source of energy such as coal, oil, etc may not be adequate to meet the ever-increasing energy demands. These conventional sources of energy are also depleted and may be exhausted. These are some nonconventional methods of producing energy. This paper is a one step to path of exploring the possibilities of energy from several non- conventional energy sources.

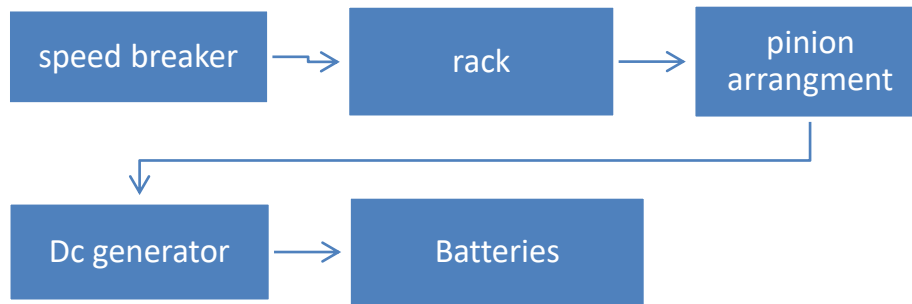
T.V. Gurudath et.al., (7) As the demand increases for electricity the new techniques will be evolved to make effective use of all the available energy. The Rack and pinion method is an innovative method of green power generation in order to contribute toward developing the world by enriching it with utilization of available resources in more useful manner. The emissions from the system are zero, it will be the most eco-friendly reliable one in the scope perception. The mechanism proposed is much simpler and continuously produces electrical power, and the produced electrical energy is renewable energy which is pollution free.

Mr. Pradeep et. al., (8) A crucial part of life is played by electricity. The current methods and processes for generating power are no longer sufficient to meet our needs due to the dramatic growth in population. In this project, we learn about reliable technology that can generate electricity from speed bumps, preserving our natural resources in the process. The overarching objective was to develop the speed breaker System while controlling the engineering. The shaft's inability to withstand heavy weights in earlier variants was fixed in this model by the addition of a universal joint.

Laxmi Gupta et. al., (9) This type of electricity generation helps us in saving our conventional resources as it generates electricity through renewable natural resources which are easily available. By this method electricity can be generated without depending on other factors and can meet high demands of the future. It is also an environmentally friendly process. There is also no obstruction in traffic flows. It is automatic and no need of manpower resource in this. This has application in many areas such as streetlights and traffic lights which stop accidents from happening. "Electricity plays a very important role in our life".

Y. Siva Malleesh et. al., (10) All the types of power generation using speed breaker are listed and studied carefully. Many authors conducted various experiments on each type of mechanism and the results are noted here. All the advantages and disadvantages of all types of mechanisms are described here, the Non-renewable source of energy there is no need of power from the mains and there is less pollution in this source of energy.

III. METHODOLOGY



Speed breaker:-

Speed breakers or speed bumps are safety devices that keep a check on the speed of the fast-moving traffic. These devices use vertical deflection to slow down the speed of automobile traffic to improve safety conditions.

Rack & Pinion:-

A rack and pinion is a type of linear actuator that comprises a circular gear engaging a linear gear. Together, they convert rotational motion into linear motion. Rotating the pinion causes the rack to be driven in a line. Conversely, moving the rack linearly will cause the pinion to rotate.

DC generator:-

A direct-current (DC) generator is a rotating machine that supplies an electrical output with unidirectional voltage and current. The basic principles of operation are the same as those for synchronous generators.

Battery:-

The main role of generator batteries is to provide power to the generator engine starter with power when a facility power outage occurs. Depending on the configuration of the generator system setup, batteries can also provide: Power to the digital control panel.

3.1 WORKING PRINCIPLE:-

While moving, the vehicles possess some kinetic energy and it is being wasted. This kinetic energy can be utilized to produce power by using a special arrangement called speed breaker. It is an Electro-Mechanical unit. It utilizes both mechanical technologies and electrical techniques for the power generation and its storage. Speed breaker is a dome like device likely to be speed breaker. Whenever the vehicle is allowed to pass over the dome it gets pressed downwards then the springs are attached to the dome is compressed and the rack which is attached to the bottom of the dome moves downward in reciprocating motion. Since the rack has teeth connected to gears, there exists conversion of reciprocating motion of rack into rotary motion of gears but the two gears rotate in opposite direction. So that the shafts will rotate with certain R.P.M. as shown in figure 2 these shafts are connected through a belt drive to the dynamos, which converts the mechanical energy into electrical energy.

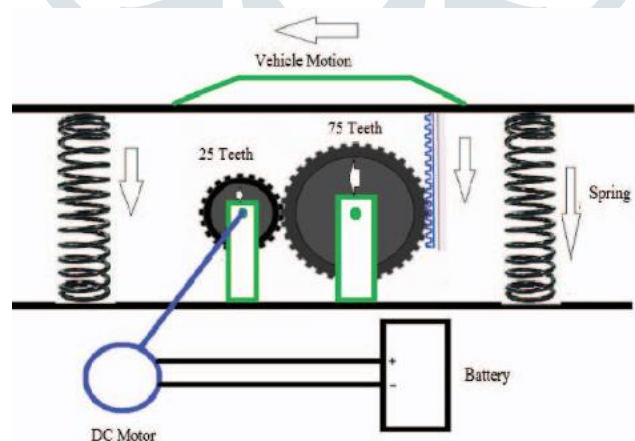


Fig:2 Power Generation through speed breaker

IV. FABRICATION SET UP:-

The system makes use of the speed breaker press and then uses a rack and pinion arrangement to press down and run generator motor thus generating energy. The spring mechanism is used to drive the speed breaker back into its original position as shown in fig:3.

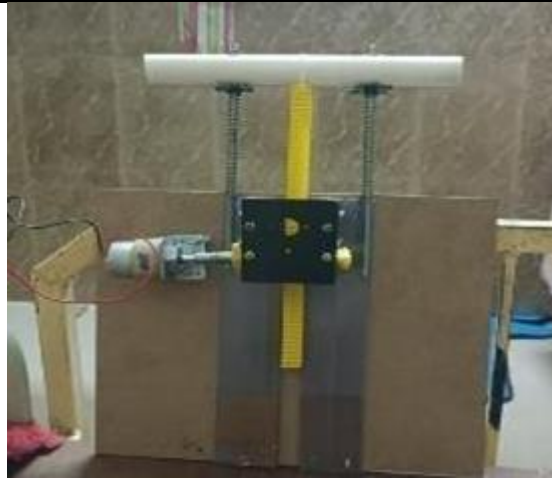


Fig:3 Fabrication of speed breaker with Rack & Pinion Mechanism

4.1 RACK AND PINION:

The rack which is attached to the bottom of the dome moves downward in reciprocating motion. Since the rack has teeth connected to gears, there exists conversion of reciprocating motion of rack into rotary motion of gears but the two gears rotate in opposite direction shown in figure 4. So the gear shaft which is connected to the Dc generator converts the mechanical energy into electrical energy.

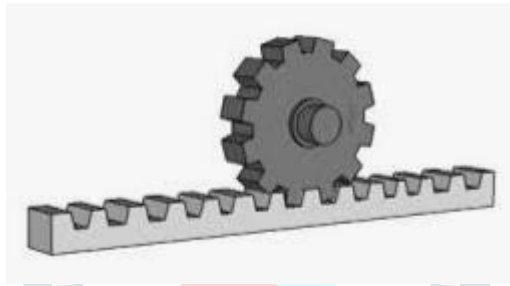


FIG:4 Rack and Pinion

4.2 SHAFT

The term shaft usually refers to a component of circular cross section that rotates and transmits power from a driving device, such as a motor or engine, through a machine. Shafts can carry gears, pulleys and sprockets to transmit rotary motion and power via mating gears, belts and chains as shown in figure 5.

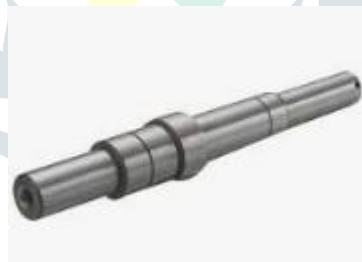


Fig:5 Shaft

4.3 BEARING:

Nowadays, bearings are one of the most commonly used machine parts because their rolling motion makes almost all movements easier, and they help reduce friction as shown in figure 6. Bearings have two key functions: They transfer motion, i.e., they support and guide components which turn relative to one another. They transmit forces.



Fig:6 Ball Bearing

4.4 SPRING:

The spring mechanism is the used to drive the speed breaker back into original position. It converts rotary motion into linear motion, but sometimes we use them to change linear motion into rotary motion. This mechanism is very economical and easy to install as shown in figure 7.



Fig:7 Helical Spring

4.5 DC GENERATOR:

A DC generator is an electrical machine whose main function is to convert mechanical energy into electricity. When the conductor slashes magnetic flux, emf will be generated based on the electromagnetic induction principle of Faraday's Laws.



Fig:8 Dc Generator

V. RESULTS:-**5.1 POWER CALCULATION**

Mass = 2 Kg

Height of the rack = 30 cm

Work done = Force x Distance

Where,

Force = Weight of the Body x gravity

= 2 x 9.81

= 19.62 N

Distance travelled by the rack = 3cm = 0.03 m

Output power = work done / time

= 2 x 9.81 x 0.03 / 1.15

= 0.511 watts

5.2 TABLE1: SHOWS THE OUTPUT POWER THAT GOT FROM THE PROJECT

s.no	Weight applied on speed breaker (kg)	Output power (watts)
1	5kg	1.279
2	10kg	2.559
3	15kg	3.838
4	20kg	5.118

VI. CONCLUSION:-

This paper introduces another innovative method of green power generation in order to contribute towards the development of the country by enriching it with utilization of available resources in a more useful manner. Due to the population explosion, the current power generation has become insufficient to full fill our requirements. In the upcoming days, as demand of electricity is increasing rapidly, it will prove a great boon to the country and also to the world, since it will save a lot of electricity of power plants

which is wasted in illuminating the streetlight. This research can be used to develop our country by enhancing more and more utilization of its sources in a more appropriate and proficient manner. The development of a country is directly proportional to the way in which it uses power supply sufficiently and efficiently. Now is the need of an hour when these types of inventive ideas should be brought into practice.

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