Industrial Engineering Journal
ISSN: 0970-2555
Volume : 53, Issue 5, No.13, May : 2024

INNOVATIVE POWER GENERATION METHODS USING SPEEDBREAKER SYSTEMS FOR SUSTAINABLE ENERGY SOLUTIONS

Dr. D. Sangupandy, Associate Professor, Department of Mechanical Engineering, Sri Shakthi Institute of Engineering and Technology, Coimbatore, Tamil Nadu, India
Gugan B UG Student Department of Mechanical Engineering, Sri Shakthi Institute of Engineering and Technology, Coimbatore, Tamil Nadu, India
Kousik S UG Student Department of Mechanical Engineering, Sri Shakthi Institute of Engineering and Technology, Coimbatore, Tamil Nadu, India
Vengadesh A UG Student Department of Mechanical Engineering, Sri Shakthi Institute of Engineering and Technology, Coimbatore, Tamil Nadu, India
Yogesh Babu P UG Student Department of Mechanical Engineering, Sri Shakthi Institute of Engineering and Technology, Coimbatore, Tamil Nadu, India

ABSTRACT
Power is everything in this recent world, from the beginning of the science still people try to discover the source, modify and develop many concepts and method for better future. The efficiency of power generation is the key to making a country economically enriched. This project includes how to utilize the energy which is wasted from the vehicle which is passes every minute over a speed breaker. There are four mechanisms to generate electricity through the speed breaker like, Rack and pinion mechanisms, gear and flywheel mechanisms and spring coil mechanisms. We can tap the energy generated and produce power by using the speed breaker as power generating unit. The kinetic energy of the moving vehicles can be converted into mechanical energy through the rack and pinion mechanisms or some other mechanisms. Then, this mechanical energy will be converted into electrical energy using generator which will be saved with the use of a battery. 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 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 (a angular motion converter) which in turn rotates a geared shaft loaded with recoil springs. The output of this shaft is coupled to a dynamo to convert kinetic energy into electricity. This is the short process for Electrical power generation through speed breaker.

Keywords:
Power, speed breaker, electricity

I. Introduction
Energy is the fundamental and universal unit of measurement for all forms of labor, both human and natural. What we see around us is the manifestation of energy flowing in some way, and this applies to everything. When most people think of "energy," they picture crude fuels and electric power being used to power something, be it their bodies or machines. Electricity is a crucial source of energy for the average guy. Electricity is truly a scientific miracle. It's the second most revolutionary thing that's ever happened in the history of the world after man. It has changed the globe in all but name. Slowly but surely, increased reliance on electricity has led to remarkable shifts in manufacturing. It is used to operate the massive modern tools we rely on. Computers and calculators perform a wide variety of mathematical operations with pinpoint precision. Overnight,
millions of copies of newspapers and books are printed.[1] All facets of human existence owe something to the development of electricity. In light of this, our current era deserves to be named the "age of electricity." In modern society, electrical power is indispensable. We heat our homes, power our factories' machinery, and propel our public transportation. It's safe to say that electric

power has altered transportation forever. Because of this, we can now take planes into the freezing upper atmosphere and enjoy the experience of flying. In addition, our country is equipped with electric trains. So, with the growing population, the demand for electricity has skyrocketed. However, we all know that there is a finite amount of energy-generating resources, and that this is what has triggered the current energy crisis. In this situation, we need to create power from commonplace items[6]. In this experiment, we attempted to use roadside speed bumps as a source of renewable energy. Since the number of cars on the road is only expected to grow, installing speed bumps along major through fares is a great way to harness that growth and turn it into usable energy. The generated power can be put to several uses, including powering traffic signals and streetlights. Components like a gear shaft bearing are simple mechanical necessities for this arrangement. The battery, inverter, and other electrical parts are also included.

II. Problem Statement

The primary component of this set up is the bearing-carrying U-shaped shaft that is attached to the top of the speed breaker. The bearing is there to allow the shafts to move relative to one another. This is how we plan to transform vertical motion into rotating motion. A return spring will be installed towards the top of the speed breaker to keep it from shifting after being pushed down by vehicles' weight. The size of the spring is determined by the mass of the vehicles that will use it. The shaft's two ends will be held in place by the bearing's assistance. Mild steel is used to make the shaft. The sprocket, which will spin in the same direction as the shaft, will be included. This sprocket will be connected to another sprocket by a chain © Faculty of Engineering, AmericanInternational University-Bangladesh (AIUB) 2 drive that will be installed on the opposite shaft, much like a bicycle.[3] There's a gear on the lower shaft, too. There is a gear on the generator that meshes with a gear on the lower shaft; this rotation of the D.C. generator powers the battery for
later usage. This application makes use of a permanent magnet direct current generator. The DC output from the generator is 12 volts. The 12-volt lead battery stores this direct current. Inverter is linked to batteries. To power the lights, fan, and other appliances that require 230-volt, AC current, an inverter is utilized to change the voltage from 12 volts, D.C. The power rating can be raised by boosting the battery and inverter circuit's storage capacity. This setup is common on highways, and aside from the speed brake setup, everything is stored below ground.

III. Literature

Roadside speed bumps are installed in congested locations to slow down drivers. Vehicle weight lost on a speed breaker represents potential energy that can be put to good use. This paper discusses how this form of energy can be harnessed from highways and put to productive use. Compressed air is stored with the help of a piston cylinder compressor arrangement, and the steps of construction of a speed breaker device are detailed, as well as the mechanism to generate energy using a rack and pinion and speed increasing gear box and generator [4]. Any time a car is allowed to drive over the dome of a speed breaker, the dome is forced down on the vehicle. Rack at the base of the dome travels down and up in a reciprocating action while springs at the top of the dome are squeezed. Since the rack is attached to the pinion via teeth, the rack's reciprocating action can be transformed into the pinion's rotating motion, though the two gears turn in the opposite directions. A belt driveconnects the shafts to the generators, which transforms the mechanical energy into electrical energy at a predetermined RPM. Because the rack is connected to the piston rod of the cylinder, the downward stroke of the rack can be used to compress air in the reservoir. An arrangement of piston cylinders that move in unison compresses air and stores it in a reservoir. Both the electricity and the compressed air that are produced have multiple potential © Faculty of Engineering, American International University- Bangladesh (AIUB) 3 uses. Search Terms: Speed Breaker; Rack and Pinion; Gear; Air Compressor; Generator; Electricity Generation.

a)Electricity Generation Using Speed Breaker

Conventional speed bumps are swapped out for a more straightforward device that generates electricity. Whenever a car drives over the speed bumps, the rack and pinion mechanism inside the breakers gets to work, producing electricity in the process [5]. As the number of cars on the road continues to rise, this technology can be used to generate electricity efficiently. It works well at intersections, parking garage entrances, and other high-traffic areas. The motion is transmitted to a DC motor/generator using a rack and pinion, spring assembly mechanism. Using this technique, roads, highways, parking lots, etc. can effectively generate power from the kinetic energy of driving automobiles.

b)Modeling and Analysis of Flat Spiral Spring Based Speed Breaker Device for Generation of Electricity

To be a modern person without access to electricity is a daunting prospect. To fulfill the needs of a growing population, conventional methods of electricity generation are insufficient. As a result, the authors proposed an innovative approach of harnessing electricity from unconventional sources in order to solve this issue. In this paper, we focus on renewable energy sources, which are gaining in popularity since they are both environmentally friendly and readily available. One such source is the creative and novel concept of employing speed breakers to generate electricity. Because most highways are so congested, converting the kinetic energy of moving automobiles into electrical energy could be a viable option [6]. The invented rack and pinion mechanism stores and releases the energy of the flat spiral torsion spring, which is the system's key component, to produce electricity. The SOLID WORKS model with the spiral spring is examined in ANSYS, and the results are encouraging. Lights, signs, and streetlamps are just few of the things that benefit from the electricity that is produced.

IV METHODOLOGY AND MODELING

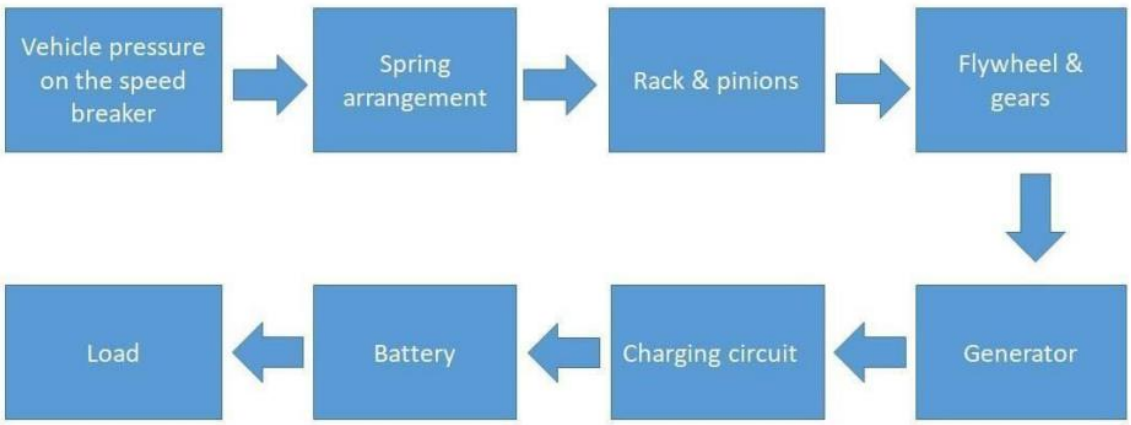

Fig.3.1 Block Diagram and Working Principle

With the right gear arrangement and some high-tech equipment, a speed breaker can be used to create energy, allowing for the cost-effective production of a substantial amount of power. It is possible to generate electricity from speed bumps by one of three fundamental mechanisms.

1) A roller system
2) The workings of a crankshaft
3) Rack and pinion.

For our project, we opted for a straightforward and efficient design for a generator based on the rack-andpinion mechanism's proven track record of producing a high output from a little input. The goal of the project is to create a system similar to speed breakers that can be used to generate electricity. Thereby, rack and pinion setups feel the force applied by the speed breaker setup. In this case, the rack and pinion setup takes the speed-reciprocating breaker's action and converts it into rotational motion. A gear is attached to the pinion's axis, allowing it to rotate. A pinion is woven into the mesh of this

gear. The available speed at the gear is approximately multiplied at the rotation of the pinion, which is related to the gear arrangement, as power is conveyed from the gear to the pinion. Here, we see two gears of varying sizes. The pinion's axis is connected to the gear's bigger dimension. This larger gear receives the speed that was multiplied at the smaller sprocket wheel. All of the pinions engaged with the gear. Therefore, the pinion that follows the gear continues to multiply the speed by a greater factor when the gear rotates at the pinion's multiplied speed. When a result, even though the speed achieved at the first gear is lower because of the circular motion achieved there, the speed is multiplied as the power is sent to higher gears. The rotor in a generatorcan be rotated at this speed. The electric drive comes from the rotor'srotation within a static magnetic stator, which reducesthe surroundingmagnetic flux (emf). After producing an emf, the resulting alternating current (AC) is delivered to a bridge rectifier to be transformed into direct current (DC). The lead-acid battery will now get this controlled emf.

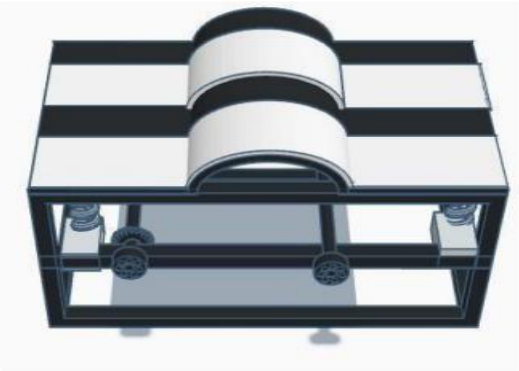

Figure 3.2: 3D Model

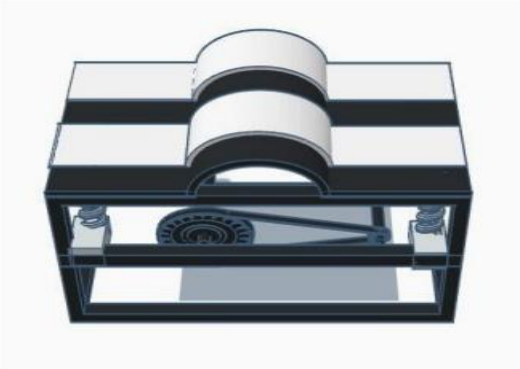

Figure 3.3: Upper 3D model view

V. RESULTS ANALYSIS & CRITICAL DESIGN REVIEW

The generation of electricity has become a major issue in modern civilization, making the pursuit of improvement all the more pressing. Speed breakers can be used in three distinct ways to generate electricity: as it is a prototype project so we could not do real-time experiments using heavy vehicles. We took various weights 5kg to 40kg and measured the output voltage and current using a multi-meter and we ensure 220-ohm resistance during this process. The result we got was not sufficient as there were multiple losses such as friction, torque, and mechanical loses. In light of this, this article explores the potential of the highway's speed breaker as a source of renewable energy.

Industrial Engineering Journal
ISSN: 0970-2555
Volume : 53, Issue 5, No.13, May : 2024

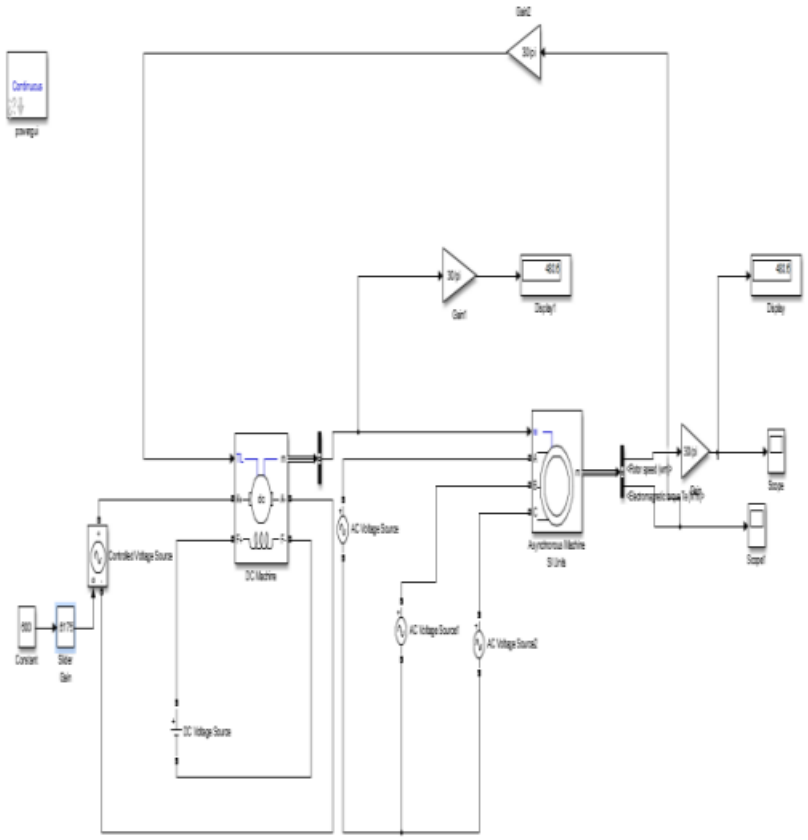

Figure 5.1: Simulation Result

Fig.5.2 Frame work

This model demonstrates how a voltage can be produced from the movement of vehicles on the road. The city as a whole has extremely heavy traffic, and some roads move at a snail's pace. The primary component of this set up is the bearing-carrying U-shaped shaft that is attached to the top of the speed breaker. We don't need to rely on those unreliable external power sources to get the job done. The increased volume of traffic on the roads in today's major cities is a major nuisance for residents there.

However, this novel method can harness this traffic to produce electricity. If installed on high-traffic roadways, the shafts can generate mechanical power using the weight and kinetic energy of passing vehicles, which is then transformed back into electricity. These are more reliable than any other power source because they do not rely on an external source and traffic will never be diminished. Moreover, from the perspective of the customer, it is possible in the ways that

The bearing is there to allow the shafts to rotate in relation to one another. This is how we plan to transform up-and-down motion into round-and-about motion. A return spring will be installed towards the top of the speed breaker to keep it in place after being displaced by the downward weight of vehicles. The load capacity of the spring is calculated based on the mass of the cars that will be driving over it. The aid bearing will be used to secure both ends of the shaft. Mild steel is used to make the shaft. The sprocket, which will spin in the same direction as this shaft, will be included. The chain drive will connect this sprocket to another sprocket positioned on the other shaft; this mechanism is similar to a bicycle's gear set-up. There's a gear on the lower shaft, too.

5.3 Upper view

VI. CONCLUSION

The approach to power generation is novel. Energy sources like coal, oil, etc., that are currently in use may not be sufficient to fulfil future energy needs. Traditional energy sources are also dwindling and may be depleted by the turn of the next century. Therefore, engineers need to make genuine and persistent efforts to investigate the feasibility of extracting energy from a variety of other sources. This endeavour represents the first stage along the route. The overarching objective during the creation of the speed breaker System was to keep the engineering, producer, and customer models under control. This feature was preferred over others because its effects on the whole system would be more noticeable. One can achieve the desired size, weight, and capacity by adjusting the asking price and size. We surveyed the market to determine the relative sizes of various storage options. Many lessons were gleaned about what to do and what not to do when conducting a survey.

References

[1]Sharma, P.C., “Non-conventional power plants”, Public Printing Service, New Delhi, 2003.
[2] Mukherjee, D. Chakrabarti, S., “Non-conventional power plants”, 2005.
[3] Sharma.P.C, Principle of renewable energy systems (Public printing service, New Delhi, 2003).
[4] Watts,G., “Effects of speed distribution on the Hormonoise model predictions”, Inter-noise Conference, Prague, 2004.

[5] Dr. Anders Brandt & MSc. John Granlund Swedish Road Administration. "Bus Drivers Exposure to Mechanical Shocks Due To Speed Bumps". Society for Experimental Mechanics, IMAC 25th Conference and Exposition on Structural Dynamics 2008.
[6] A. Padma Rao, A. Kiran Kumar and S. Suresh, "Power Generation from Speed Breaker by Rack and Ratchet Mechanism," International Journal of Current Engineering and Technology, sp. no. 2, February 2014.
[7] Abdul Razzak Pathan, Aniket Garate, Karthikeyan N and SonaliRetharekar, "Power generation through speed breaker,".
[8] Amanpreet Kaur, Shivansh Kumar Singh, Rajneesh, Parwez and Shashank, "Power Generation Using Speed Breaker with Auto Street Light," International Journal of Engineering Science and Innovative Technology (IJESIT), vol. 2, no. 2, March 2013.
[9] "Power System Stabilizers", by Mitsubishi Corporation-A release notes from Mitsubishi Co.
[10] P.M. Anderson and A.A. Fouad, „Power System Control and Stability", Galgotia Publications.
[11] "Power System Dynamics and Control", K.R.Padiyar, Interline Publishers Bangalore.
[12] D. Venkata Rao, K. Prasada Rao, Chiranjeeva Rao and R. Umamaheswara Rao, "Design and Fabrication of Power generation System using Speed Breaker," International Journal of Current Engineering and Technology, vol. 4, no. 4, August 2014.
[13] Nota, R., Barelds, R., "Engineering methods for road traffic and railway noise after validation and fine-tuning", Harmonies, 2005.