

Electricity Generation from Speed Breakers

Abhishek Gupta¹, Nikita Mittal², Pushendra Pal Singh³, Ram Arora⁴,
Ramkishan Dhakar⁵, Purab Chand⁶, Piyush Mangal⁷

¹Sr.Lecturer, ²Lecturer, ^{3,4,5,6,7}Students Department of Electrical Engineering
^{1,2,3,4,5,6,7}Swami Keshvanand Institute of Technology, Management and Gramothan, Jaipur, India

Abstract: Energy is the primary need for survival of all organisms in the universe. Everything what happens in the surrounding is the expression of flow of energy in one of the forms. But in this fast moving world, population is increasing day by day and the conventional energy sources are lessening. The extensive usage of energy has resulted in an energy crisis over the few years. Therefore to overcome this problem we need to implement the techniques of optimal utilization of conventional sources for conservation of energy. This project includes how to utilize the energy which is wasted when the vehicles passes over a speed breaker. Lots of energy is generated when vehicle passes over it. There are four mechanisms to generate electricity through speed breakers viz., Rack & Pinion mechanism, Crank Shaft mechanism, Roller mechanism and Spring Coil mechanism. 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 of the shaft through rack and pinion mechanism or some other mechanism. Then, this mechanical energy will be converted to electrical energy using generator which will be saved with the use of a battery. The energy we save during the day light can be used in the night time for lighting street lights. Therefore, by using this arrangement we can save lot of energy which can be used for the fulfilment of future demands.

Keywords: Rack and Pinion, Power Hump, Speed Breaker.

I. INTRODUCTION

On road vehicles waste a tremendous amount of energy on speed breakers, where there is a necessity to provide speed breaker to control the speed of the vehicles. The annual rate of growth of motor vehicle population in India has been almost 20 percent during the last decade^[1]. There is tremendous vehicular growth in year by year. The increasing traffic and number of speed breakers on roads motivate to manufacture an innovative device which can channelize the energy of vehicles that is wasted on speed breakers to some useful work. In this paper it is mainly focused on the principle of Potential Energy to Electrical Energy Conventional. Potential energy can be thought of as energy stored within a physical system. This energy can be released or converted into other forms of energy, including kinetic energy. It is called potential energy because it has the potential to change the states of objects in the system when the energy is released. If h is the height above an arbitrarily assigned reference point, then Kinetic energy of an object is the extra energy which it possesses due to its motion^[2]. It is defined as the work needed to accelerate a body of a given mass from rest to its current velocity. Having gained this energy during its acceleration, the body maintains this kinetic energy unless its speed changes. Negative work of the same magnitude would be required to return the body to a state of rest from that velocity. In this paper it is explained the working of a mechanism 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, it moves the breaker up and down. This 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. A vehicle weighing 1,000 kg going up a height of 10 cm on such a rumble strip produces approximately 0.98 kilowatt power^[3].

II. LITERATURE REVIEW

The energy crisis led to the idea of generating power using speed breaker. First to make use were South African people^[4], their electrical crisis has made them to implement this method to light up small villages of the highway. The idea of basic physics to convert the kinetic energy into electrical energy that goes waste when the vehicle runs over the speed-break was used. Since then a lot has been done in this field. The idea caught our working team and we have decided to develop such a project that will produce more power and store it for use at night time as it proves to be a boon to the economy of the country.

The Burger King on U.S. Highway, Customers pull in and out all day, and at least 100,000 cars visit the drive-thru each year^[5]. And a newly installed, mechanized speed bump will both help them slow down and harvest some of that coasting energy. The weight of a car is used to throw a lever, explains Gerard Lynch, the engineer behind the Motion Power system developed for New Energy Technologies, a Maryland-based company^[6]. "The instantaneous power is 2,000 watts at five miles-per-hour, but its instantaneous which means some form of storage will be required.

IIT Guwahati has evaluated the machine and recommended it to the Assam ministry of power for large scale funding. IIT design department says it is a 'very viable proposition' to harness thousands of mega watts of electricity untapped across the country every day^[7].

III. BLOCK DIAGRAM

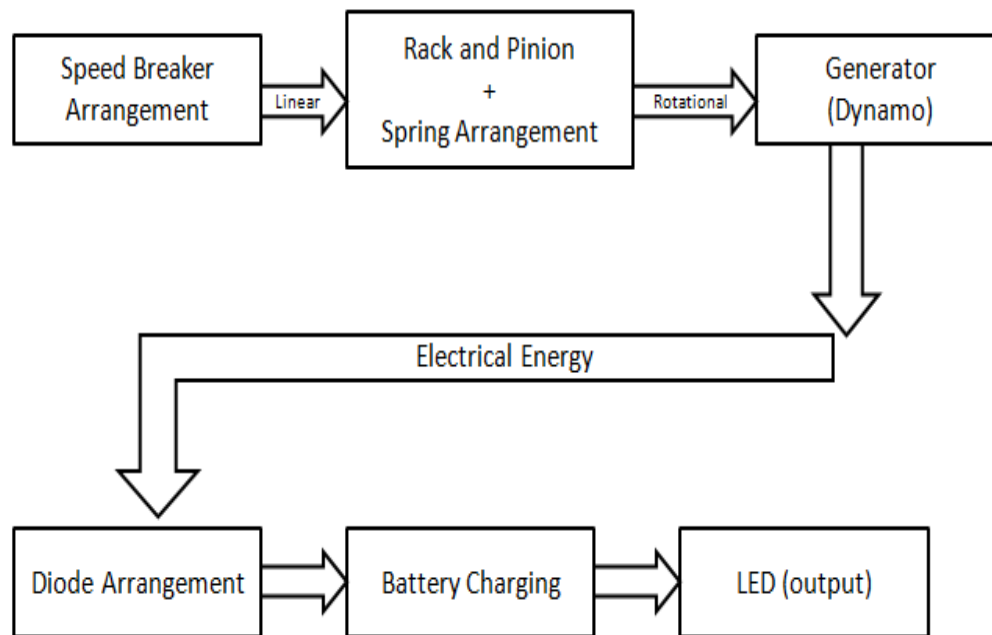


Fig. 1. Block Diagram

IV. WORKING AND PRINCIPLE

Electricity can be generated with the help of speed breaker by making gear arrangement and using electronic gadgets, thus a huge amount of electricity can be generated saving lot of money. We can develop electricity from speed breakers by using 3 Mechanisms basically they are as follows:

- 1) Roller mechanism
- 2) Crank-shaft mechanism
- 3) Rack-pinion mechanism

Since Rack-pinion mechanism is convenient to produce ample amount of energy with maximum efficiency^[8], we have chosen this method for our project with a very simple and effective design for generating electricity using a generator. The

project is concerned with generation of electricity from speed breakers-like set up. The load acted upon the speed breaker setup is there by transmitted to rack and pinion arrangements. Here the reciprocating motion of the speed-breaker is converted into rotary motion using the rack and pinion arrangement. The axis of the pinion is coupled with a gear. This gear is meshed a pinion. As the power is transmitted from the gear to the pinion, the speed that is available at the gear is relatively multiplied at the rotation of the pinion which is coupled to gear arrangement.

Here we have two gears with different diameters. The gear (larger dimension) is coupled to the axis of the pinion. Hence the speed that has been multiplied at the smaller sprocket wheel is passed on to this gear of larger dimension^[9]. The pinion is meshed to the gear. So as the gear rotates at the multiplied speed of the pinion, the pinion following the gear still multiplies the speed to more intensity. Hence, although the speed due to the rotary motion achieved at the first gear is less, as the power is transmitted to gears the speed is multiplied to a higher speed. This speed is sufficient to rotate the rotor of a generator. The rotor which rotates within a static magnetic stator cuts the magnetic flux surrounding it, thus producing the electric motive force (emf). This generated emf is then sent to a bridge rectifier, where the generated AC current is converted to DC. This regulated emf is now sent to the lead-acid battery^[10].

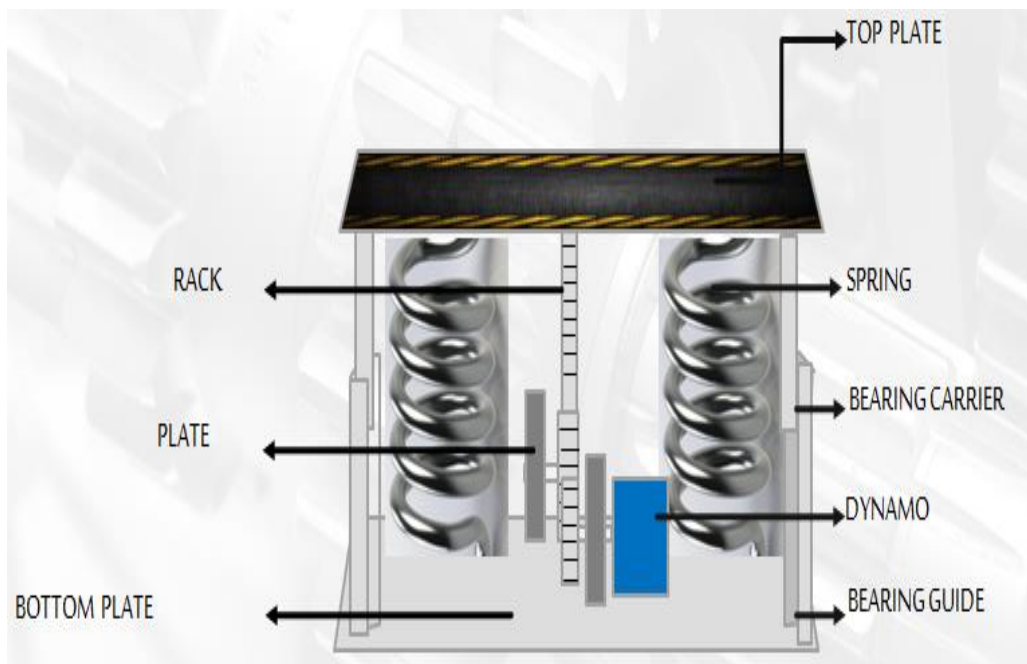


Fig. 2. Rack and Pinion Mechanism

V. CONSTRUCTION & OPERATIONS

In This model we show that how we generate a voltage from the busy road traffic. In all the city's traffic is very much high and on some road, traffic move like a tortoise. This setup mainly consist of an arrangement which is having a shaft with a U shaped projection carrying a bearing and is connected to the top of the speed breaker. The bearing is provided in order to permit the relative motion between the shafts. In this way vertical motion is to be converted into rotational motion. The top of the speed breaker will be provided with the return spring in order to retain its position after it will be displaced by the weight of the vehicles in the downward direction. The spring is designed depending on the weight of the vehicles passing through it. The two ends of the shaft will be fixed with the help bearing. The shaft is made of mild steel. This shaft will also be provided with the sprocket, as it will rotate in direction of the shaft. This sprocket will be connected with another sprocket with the help of chain drive, which is mounted on the other shaft this action is like the bicycle arrangement. The lower shaft also consists of a gear. A gear is also mounted on the generator and is meshing with gear on the lower shaft this will help to rotate the D.C. generator and in turn will generate electrical power, which will be stored in the battery and can be used accordingly. The generator used here is permanent magnet D.C. generator. The generate voltage is 12 Volt D.C. This D.C. voltage is stored to the lead 12-volt battery. The battery is connected to the inverter. The inverter is used to convert 12 Volt D.C. to the 230 volt A.C. voltage is used to activate the light fan etc. By increasing the capacity of the battery and the inverter circuit the power rating is increased. This arrangement is fitted in highways; the complete arrangement is kept inside the floor level except the speed brake arrangement.



Fig. 3. Construction Details

VI. CALCULATIONS & RESULTS

Let consider,

The mass of a vehicle = 500 Kg (Approximately)

Height of speed brake = 10 cm

Work done = Force * Distance

Force = Weight of the Body

$$= 500 \text{ Kg} \times 9.81$$

$$= 4905 \text{ N}$$

Distance travelled by body = Height of speed brake

$$= 10 \text{ cm}$$

Output power = Work done/Sec

$$= (4905 \times 0.1) / 60$$

$$= 8.175 \text{ W}$$

Power developed for 1 vehicle passing over the speed breaker arrangement for one minute is 8.175W

Power developed for 60 minutes (1 hour) = $8.175 \times 60 = 490.5 \text{ W}$

Power developed for 24 hours = $490.5 \times 2 = 11.772 \text{ KW}$

VII. CONCLUSION & FUTURE SCOPE

It is a non conventional type of producing the energy. 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 depleting and may be exhausted at the end of the century or beginning of the next century. Consequently sincere and untiring efforts shall have to be made by engineers in exploring the possibilities of harnessing energy from several non-conventional energy sources^[11]. This project is a one step to path of that way. The overall goal was to design the speed breaker System while keeping the engineering, producer and customer models in check. The reason why this feature was used more than all of the other features are because the other features would not have as much effect on the complete system. By changing the size and desirable price, weight and capacity can be realized. We used a survey to find out how the price, weight and capacity were scaled. Much was learned on how to and not to conduct a survey.

Advantages—

- Economical and easy to install.
- It is eco-friendly.
- Maintenance cost is low.
- Will solve some of the electricity problems of the world.
- This can be implemented on heavy traffic roads and toll booths and can be used to power the street lights.
- It can be a solution the electricity shortage in most villages.

REFERENCES

- [1] R.D.Sharma, S.Jain, K.Singh, "Growth rate of motor vehicals in India", Journal of economics and social studies, Vol.I, 2011
- [2] A.Padam Rao,"Power generation from speed breaker by rack and ratchet method", International Journal of Current Engineering and Technology Issue-2, Februry,2014
- [3] S. Srivastava, A. Asthana,"Produce electricity by the help of speed breakers", Journal of engineering research and studies, Journal of Engineering Research and Studies, Vol.II, April-June,2011
- [4] A. Mishra, P. Kale, International Journal of Engineering and Science, Vol. II, March 2013
- [5] G.R.Prabu, G.Ethiraj, International Journal of Advanced Research in Electrical,Electroncs and Instrumental engineering, Innovation in Engineering and Technology (IJJET) Vol.2 Issue 2, March 2013
- [6] R.Gupta, S.Sharma, "A Revolutionary Technique of Power Generation from speed breaker, International Journal of Engineering Research and technology, 2013
- [7] Amol Sheshrao Fawad, Air Compression and Electricity Generation by Using Speed Breaker with Rack And Pinion Mechanism, International Of Modern Engineering Research (IJMER) Vol.5 Issue 1, January 2015
- [8] Ankita, Meenu Bala, Power Generation From Speed Breakers, "International Journal Of Advance Research In Science and Engineering, 2013.
- [9] Aswathaman.V , Priyadharshini M. , "International Journal of Recent Research and Review," Vol. I, ISSN 2277-8322, March 2012
- [10] "Every speed breaker is now a source of power", IPCBEE Vol.1, 2011.