Non-Conventional Electricity Generation Through Speed Breaker

Vishaldeep Singh[1], Manjeet Singh[1], Prashant Kumar Pandey[1], Hitesh Arora[1]

[1]Mechanical Engineering Department, Lovely Professional University, Phagwara, Punjab, India.

Abstract: In twenty first century the demand of industry is increased. With the growth of industry the demand of electric power has also increased. The major electric power has been generated from the source of fossil fuels. With the current demand of electricity the sources will be depleted, if we will not switch to alternate sources. Instead of having fear of depletion of fossil fuels the other threat of the use of the fossil fuels is pollution, the harmful effect on nature. Nuclear energy can also be used to complete the demand but deliberate treatment of the raw material and the waste material is the main concern. Electricity is the secondary source of energy which is converted from other sources. The main focus is shifting towards the non-polluting energy sources. In this paper the study is being discussed to how to generate electricity using speed breaker. For this study a prototype is developed. The 12V D.C generator is used to produce electricity. The electricity thus produced is stored in battery and used for electrical appliances.

Keywords: Electricity, speed breaker, servo DC generator

1. Introduction

Electricity is produced by converting one form of energy to other. Electricity is the major need of human being for daily life. The electricity is generated by converting the kinetic energy to electrical energy by using electro mechanical arrangement which is to be assembled under the speed breaker. When the automobile will move over the speed breaker, the electricity will be generated which will be stored in the battery and can be used for lighting the street lights, traffic lights and nearby areas. Also the power generation can be increased by installing the speed breaker in series[1].

Day by day the vehicles are increasing and to take care of the safety on roads the speed breakers are installed. When the automobile moves over the speed breaker the whole load of automobile and the passengers applies a force on the speed breaker. Each vehicle tire passes twice over the speed breaker, the energy thus is wasted. The mechanical devices can be placed near to the speed breakers, as soon as the vehicles pass over the speed breakers the kinetic energy of the vehicles can be converted to electrical energy. This electrical energy can be stored inside the batteries and can be used latter when required. A brief review of work done for producing electricity with the help of speed breakers is discussed.

Aswathaman and Priyadharshini in their work has discussed the power generation by using the electro mechanical device near the speed breaker. They have attached the rack with the flexible

speed breaker and pinion is attached with the shaft. As soon as the automobile crosses the speed breaker it presses down and the translatory motion is changed to rotary motion which will revolve the shaft. The power transmitted to the other shaft with the help of chain and sprocket mechanism and will help to rotate the generator which will produce electrical energy. In their paper they have found that with the increase in the load the voltage produced by the mechanism will increase whereas with the increase in the speed of the automobiles as they pass over the speed breaker the voltage will keep on decreasing. Srivastava and Asthana [2] proposed the design for producing electricity with the help of speed breakers. The design consist of installing a roller in between the speed breaker. As soon as the automobile crosses the speed breaker, the roller will rotate. This roller is connected with the chain drive which is directly connected with the generator. The electricity thus produced is stored inside the batteries which can be used as per the demand. They have also discussed that why these rollers cannot be installed on plane road. The main reason is that if the automobile comes at high speed the roller will rotate and electricity will be produced. If the cycle or the automobile with low speed passes over the roller immediate after the automobile with high speed, there will be collision because of the difference in the speed. Gupta *et al.* [3] proposed a setup when the automobile crosses the ramp the kinetic energy of the automobile is used to generate electrical energy. In their experimental setup they have installed the iron roller in between the speed breaker. The roller when revolves the power is transmitted to the DC motor with the help of chain drive and belt drive. They observed that when the roller rotates, up to 7 volts of electricity is produced if the roller rotates with the speed of 4m/sec. They analyzed these values when one automobile crosses the speed breaker but if the number of automobiles per minute will increase the electricity produced will be more. Adaileh *et al.* [4] utilized the waste kinetic energy of the automobiles to produce electrical energy. According to their research work they proposed to install the rollers at such locations where the speed of the automobiles is low like entrance of malls, universities or drive thru of hotels etc. They designed the drum made up steel which is connected with generator with the help of pulleys and flat belt drives. They have found that up to a speed of 20km/hr which is the optimum speed to get the maximum amount of electricity. With the increase in rotational speed the voltage produced will keep on increasing but after certain point it will start decreasing. Mishra *et al.* [5] developed the setup which consist of speed breaker, gears, shafts, generator to produce electricity. Their model is almost similar to the model proposed by Aswathaman [6] but according to Mishra *et al.* they proposed that their device can produce 10.5kW of electricity in 24hours. They have analyzed this amount of energy produced by assuming the load of up to 300kg is applied on to the speed breaker. Singh *et al.* [7] proposed the idea in which they have used the springs which are attached with the speed breaker. When the automobile crosses the speed breaker it will compress and after that with the help of springs it will come back to its own position. The speed breaker is also connected with the U shaped shaft which rotates as the automobile crosses the speed breaker. This U shaped shaft is connected with the chain drive which is used to transfer the power to the other shaft. The gears attached on this shaft will rotate the generator and the electricity is produced which can be stored in batteries. Islam *et al.* [8] designed the mechanism in which they have used the lever which is attached with the speed breaker. This

lever is linked with the shaft on which chain drive is attached. This power is transferred to the shaft which is connected with the gears which is used to generate the electricity using DC motor. According to their mechanism the power generated was approximately 2W with an efficiency of 13.75%. Bhagdikar *et al.* in their model have used three rollers which are connected with the chain drive and gears. The rotational motion of the roller is used to generate electricity with the help of generator. According to their study the voltage produced with in the range of 3 to 4 Volts when the automobiles crosses the speed breaker with the speed upto 15km/hr. Ashtankar *et al.* [9] used the flip plate mechanism in the speed breaker to produce electricity. When the automobile crosses these plates will slide over the speed breaker which is used to transmit power to the shaft which is connected with the generator. According to them 4.5W of electricity is produced when 1 automobile with the mass of 270kg passes over the speed breaker. Ullah *et al.* [10] discussed about the mechanism in which the speed breaker is attached with hydraulic system. When the automobile crosses the speed breaker the hydraulic press is used to revolve the shaft on which the generator is attached. After the automobile crosses the speed breaker the compression springs are attached with the speed breaker to bring the speed breaker back to its shape. According to them 12kW electricity can be produced in 24hours.

From the literature review it is observed that speed breakers can be used to produce electricity. The main objective of this research paper is to produce 10MW of electricity through speed breaker.

2. Methodology

The electricity can be generated with the conventional and non-conventional method. In this research paper we are using the non-conventional method to generate the electricity. Figure 1 explains the methodology to produce electricity with the help of speed breakers.

When the automobile will cross over the device which is installed below the speed breaker, the plate of the device which is attached with the springs will compress because of the weight of the automobile. The rack is attached with the plate which will also move downward. The rack is in contact with the pinion, the translator motion from the rack is changed to the rotational motion with the help of pinion. As the pinion revolves the gear attached to it will also revolve which is compounded to another small gear that is directly connected to the generator. As this small gear rotates electricity is produced by the generator, which can be reserved in a battery.
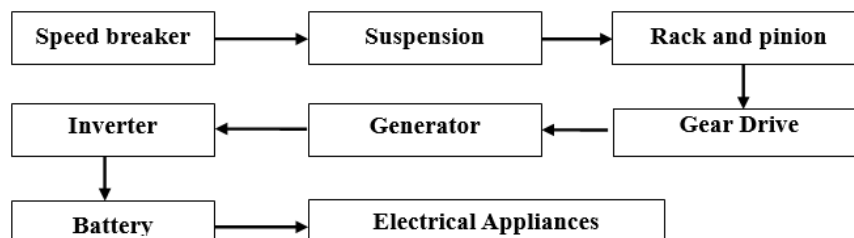
Figure 1: Block diagram explaining the process of electricity generation through non-conventional method.

The components used in proposed work is suspension system, rack and pinion, gear drive, drive shaft and generator. Figure 2 shows the actual model of the design.

Figure 2: Model of the proposed design.

The specification if the components used in the model are given in Table 1

Table 1: Specifications of the components used.

S. No	Component	Specification
1	Generator	Servo DC Generator 12V
2	Suspension	Length = 14.50in, Dia.= 4in(inner) 4.5in(outer), Thickness = 2in
3	Hollow pipes	Length = 9.5 in with dia.= 2.2in, Length = 10in with dia. = 1.8in
4	Hollow squares	Length = 9.45in Length = 6in
5	Shaft	Length = 5.5 in Dia.= 0.5 in
6	Body	Height = 14.50 in
7	Metal Sheet	Length = 25in, Breadth = 20.5in, Thickness = 0.4 in
8	Rack	Number of teeth = 40
9	Pinion	Number of teeth = 38
10	Gears	Larger gear (Teeth) = 95, Smaller gear (Teeth) = 12

The electricity produced by the proposed design can be stored in battery and can be used by electrical appliances.

3. Result and discussion

The electricity generated by the proposed model is based on the speed of the automobile and the mass of the automobile. The calculations in our work is considered based on the prototype model. The calculations are as mentioned below.

The mass of the automobile $= m$

Height of the speed breaker $= h$

Force $= m \times 9.81 = F\ N$

Work Done $W = F \times h$

Output Power (One push) $p = \frac{W}{60}\ watt$

Power developed for 24 hours $P = (p \times 60 \times 24) watt$

The efficiency of the system (Losses due to friction between gears and other moving parts) $= \eta$

Actual Power developed $= P \times \eta$

For 10MW electricity to be produced,

The number of arrangements required are $= \dfrac{10MW}{Actual\ Power\ developed}$

4. Conclusion

The electricity is generated by non-conventional method by converting the kinetic energy and weight of the automobile to produce electric energy. The electricity produced is not creating any pollution thus this method of electricity generation is echo friendly. Also this method can be utilized to meet the power crisis in near future. As the conventional sources are depleting, the alternate sources are to be thought of. The device has many advantages [10]. As the solar lightening system has some disadvantages like if it is rainy day then the batteries will not charge but our system can work all the time. These systems can be installed at the junctions to operate the traffic lights, near tollbooths, entrance of the societies. This system is effective and will also reduce the power crisis.

References

[1] A. Kaur and S. K. Singh, "Power Generation Using Speed Breaker with Auto Street Light," *Int. J. Eng. Sci. Innov. Technol.*, vol. 2, no. 2, pp. 488–491, 2013.

[2] S. Srivastava and A. Asthana, "Produce Electricity By the Use of Speed," *J. Eng. Res. Stud.*, vol. 2, no. 1, pp. 163–165, 2011.

[3] A. Gupta, K. Chaudhary, and B. N. Agrawal, "An Experimental Study of Generation of Electricity Using Speed Breaker by Hydraulik Mechanism," *Int. J. Mech. Eng.*, vol. 1, no. 1, pp. 35–40, 2012.

[4] W. Adaileh, K. Al-Qdah, and M. Mahasneh, "Potential of Power Generation Utilizing Waste Kinetic Energy from Vehicles," *Smart Grid Renew. Energy*, vol. 03, no. 02, pp. 104–111, 2012.

[5] A. Mishra *et al.*, "Electricity Generation from Speed Breakers," *Int. J. Electr. Electron. Res. ISSN*, vol. 4, no. 1, pp. 25–27, 2013.

[6] V. Aswathaman and M. Priyadharshini, "Every Speed Breaker Is Now a Source of Power," *Biol. Environ. Chem.*, vol. 1, pp. 234–236, 2011.

[7] A. K. Singh, D. Singh, M. Kumar, V. Pandit, and S. Agrawal, "Generation of Electricity through Speed Breaker Mechanism," *Int. J. Innov. Eng. Technol.*, vol. 2, no. 2, pp. 20–24, 2013.

[8] M. S. Islam, S. K. Rahman, and J. S. Jyoti, "Generation of Electricity Using Road Transport Pressure," *Int. J. Eng. Sci. Innov. Technol.*, vol. 2, no. 3, pp. 520–525, 2013.

[9] P. V. Ashtankar *et al.*, "Road Power Generation (RPG) by Flip plate Mechanism," *Int. J. Sci. Eng. Technol. Res.*, vol. 3, no. 3, pp. 560–562, 2014.

[10] K. M. Ullah, K. M. Ahsan-Uz-zaman, S. Hosen, R. H. Khan, and S. Parvin, "Electrical power generation through speed breaker," *Proc. 9th Int. Conf. Electr. Comput. Eng. ICECE 2016*, pp. 30–33, 2017.