Electricity Generation from Speed Breaker

Akshay Sakhare[1] Suraj Waghmare[2] Mukesh Khade[3]
[1,2,3]Department of Mechanical Engineering
[1,2,3]Marathwada Mitra Mandal Institute of Technology, Pune, India

Abstract— Electric power is extremely necessary in most developing countries like India. Electricity is most widely used in every part of the world. Electric power obtained from the conversion of sources such as coal, natural gas, oil, nuclear power and other natural sources are called primary sources. The primary energy resources are the conventional types and are in limited quantity because they are not renewable, and on the other hand create a lot of pollution to the atmosphere. A revolutionary method of power generation through speed breaker power generators is proposed as an innovative method. On speed breakers, tremendous amount of energy is being wasted by vehicles, and several models were introduced to utilize this energy through speed breakers. This paper try to show different methods of renewable energy generation through speed breaker. Therefore, by using this arrangement we can save lot of energy which can be used for the fulfilment of future demands breaker.

Key words: CAD Model, Speed Breaker, Flywheel

I. INTRODUCTION

During last few decades, electrical energy is the basic requirement of human beings. The ratio of Electricity requirement is increasing day by day. But we know that the resources for power generation are Limited, and this has caused the energy crisis. The increasing power demand results reduce in Conventional resources for power generation and increase the pollutants emissions. It is a need of time to think about non-conventional energy resources or renewable energy resources which are eco-friendly to the environment. In order to minimize the emission of greenhouse gases, renewable energy technologies are widely used for electricity generation. Solar and wind technologies are frequently used for electricity generation. Fig. 1 is rearranged in MS Excel that shows power generation in Pakistan by each sector [1].

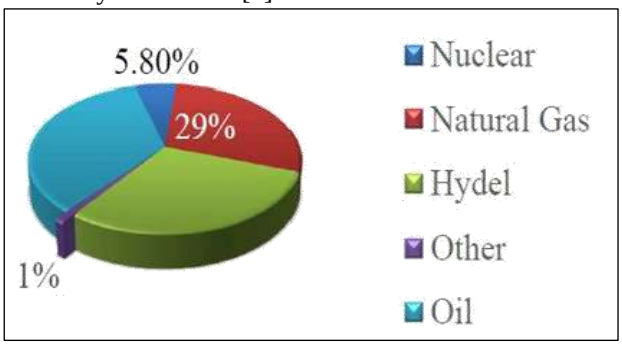

Fig. 1. Power generation in Pakistan by sector in 2014

Speed-breakers are movement quieting devices generally introduced to decrease speed related mischances [2]. Speed breakers are intended to be rolled over at a foreordained agreeable rate while bringing on surpassing inconvenience at higher rates. The diminishment in normal vehicular speed essentially enhances the security of individuals in the neighbouring territories. These devices are most common in developing countries [3]. Consequently, speed-breakers are regular in numerous developing countries, including India, Chile, Egyptian Empire, Ghana and Pakistan [4].

II. WORKING

This project explains the mechanism of electricity generation from speed breakers [1][2][3] The vehicle load acted upon the speed breaker system is transmitted to rack and pinion arrangements. Then, reciprocating motion of the speed-breaker is converted into rotary motion using the rack and pinion arrangement where the axis of the pinion is coupled with the sprocket arrangement. The sprocket arrangement is made of two sprockets. One of the sprocket is larger in dimension than the other sprocket. Both the sprockets are connected with chain which transmits the power from the larger sprocket to the smaller sprocket. As the power is transmitted from the larger sprocket to the smaller sprocket, the speed that is available at the larger sprocket is relatively multiplied at the rotation of the smaller sprocket. The axis of the smaller sprocket is coupled to a gear arrangement. Here we have two gears with different dimensions. The gear wheel with the larger diameter is coupled to the axis of the smaller sprocket. Hence, the speed that has been increased at the smaller sprocket wheel is passed on to this gear wheel of larger diameter. The smaller gear is coupled to the larger gear. Therefore, as the larger gear rotates it increases the speed of the smaller gear which is following the larger gear and multiplies the speed to more intensity. Though the speed due to the rotary motion achieved at the larger sprocket wheel is less, as the power is transmitted to gears, the final speed achieved is high. This speed is sufficient to rotate the rotor of a generator and is fed into the rotor of a generator. [4]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 an inverter, where the generated emf is regulated. This regulated emf is now sent to the storage battery where it is stored during the day time and can be used in night time for providing power to street lights.

III. LITERATURE REVIEW

Firstly, South African electrical crisis has made them implemented this method to light up small villages of the highway. The idea is basic physics, to convert the kinetic energy into electrical energy that gone wasted when the vehicle runs over speed-breaker. Since then, a lot has been done in this field. An amateur innovator in Guwahati has developed a simple contraption that can generate power when a vehicle passes over a speed breaker .Kanak Gogoi , a small time business-man, has developed a mechanism to generate power by converting the potential energy generated by a vehicle going up on a speed breaker in to kinetic energy . The innovation has caught the eyes of the Indian institute of technology (IIT), Guwahati, which will fund a pilot project to generate electricity from speed breaker. Electric vehicle

charging station at a McDonald's in Cary, N.C., a Burger King franchise in New Jersey said it would be testing speed bumps that harness kinetic energy in the locations busy drive-thru lane. If the kinetic energy generated by moving vehicles was captured by New Energy Technology's Motion Power speed bumps twice per day, then it could produce enough electricity to power over half a million homes each day, according to company officials. "More than 150,000 cars drive through our Hillside store alone each year, and I think it would be great to capture the wasted kinetic energy of these hundreds of thousands of cars to generate clean electricity," said Andrew Paterno. Paterno and his business partner, Michael Wildstein own and operate twelve Burger Kings in the New York Metro area.

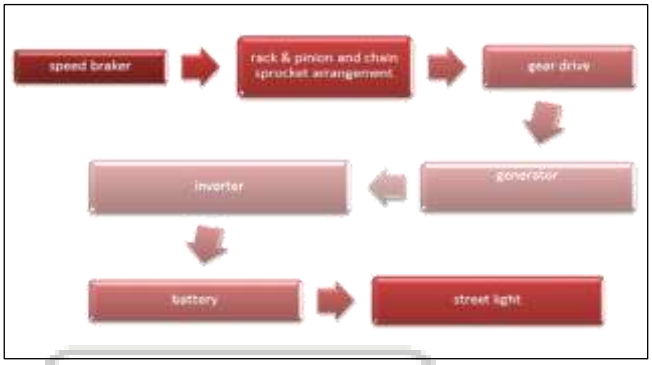

Fig. 2:

IV. EQUIPMENT REQUIRED

A. Rack and Pinion Gears

The rack and pinion used to convert between rotary and translator motion. The rack is the flat toothed part, while the pinion is the gear. Rack and pinion can convert rotary to linear of from linear to rotary motion [8].

B. Ball Bearings

A roller-element bearing is a bearing which carries a load by placing round elements between the two pieces. The relative motion of the pieces causes the round elements to roll (tumble) with little sliding. They reduce the friction and transmit the motion effectively.

C. Spur Gear

It is a positive power transmission device with definite velocity ratio. It is preferred for adjusting some linear misalignment. It should have high wear and tear, shock-absorbing capacity.

D. Flywheel

The primary function of flywheel is to act as an energy accumulator. It reduces the fluctuations in speed [9]. It absorbs the energy when demand is less and releases the same when it is required.

E. Shaft

It is a rotating element, which is used to transmit power from one place to another place. It supports the rotating elements like gears and flywheels. It must have high torsional rigidity and lateral rigidity.

F. Generator

It is a device, which converts mechanical energy into electrical energy. The generator uses rotating coils of wire and magnetic fields to convert mechanical rotation into a pulsing direct electric current through "Faraday" law of electromagnetic induction".

V. POWER CALCULATION

Let us consider,
The mass of any vehicle travelling over the speed breaker= 300Kg (Approximately) Height of speed brake = 15 cm
Work done = weight of the body x distance travelled by the vehicle Here, Weight of the Body = 300 Kg x 9.81 = 2943 N
Distance travelled by the body = Height of the speed breaker = 15cm Power = Work done/Second = (2943 x 0.15)/60 = 7.3575 Watts Output Power developed for 1 vehicle passing over the speed Breaker arrangement for one minute = 7.3575 watts
Power developed for 60 minutes (1 hr) = 441.45 watts Power developed for 24 hours = 10.5948 Kw
This power generated by vehicles is more than sufficient to run four street lights in the night time.

VI. CONSTRUCTIONAL DETAILS

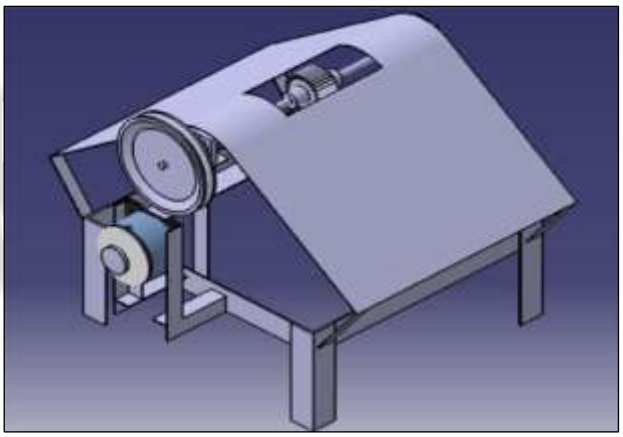

Fig. 3: CAD Model

VII. ADVANTAGES

- Power generation with low cost and using non-conventional energy sources which will help us to conserve the conventional energy sources to meet the future demand.
- By using this method, electricity will be generated throughout the year without depending on other factors.
- Easy for maintenance and no fuel transportation problem.
- Pollution free power generation.
- Less floor area required and no obstruction to traffic.
- No need of manpower during power generation.

VIII. CONCLUSION

This paper describes generation of electricity from speed breakers, the kinetic and potential energy. The power generated is not constant but it is a small step to produce energy from speed breaker it is not just alternative but

effective use of wasted energy. From the observations as compression is increased high power can be generated.

It is a small level power generation but if it is used in proper way then we can generate larger amount of power. Now it's time to put forte these types of innovative ideas and researches should have been done to upgrade their implication.

REFERENCES

[1] Sharma .P.C Principle of renewable energy systems (Public printing service, New Delhi, 2003).
[2] Sharma. P.C, Non-Conventional power plants (Public printing service, New Delhi, 2003).
[3] Mukherjee. D Chakrabarti. S, Non-conventional power plants (Public printing service, New Delhi, 2005).
[4] Ankita, Meen Bala, Power Generation from Speed Breakers, International Journal of Advance Research in Science and Engineering, 2(2), 2013.
[5] Miller R, Power System Operation, (McGraw- Hill, New York, 1970).

