

Pankaj D. Jagtap
Electrical Engineering
K.J.C.O.E.M.R.
Pune, India.

Sanket D. Pardeshi
Electrical Engineering
K.J.C.O.E.M.R.
Pune, India.

Angad G. Khade
Electrical Engineering
K.J.C.O.E.M.R.
Pune, India.

Varun Sathe
Electrical Engineering
K.J.C.O.E.M.R.
Pune, India.

A Review : Comparison of different Mechanisms for Electricity Generation using Speed Breaker

Abstract

Electricity is a basic part of nature and it is one of the most widely used forms of energy across the globe. Researches show that the world has already had its enough shares of its energy resources. Fossil fuels pollute the environment. Nuclear energy requires careful handling of both raw as well as waste material. Therefore, the focus now is shifting more and more towards the renewable sources of energy, which are essential and non-polluting. Energy conservation and conversion are the cheapest new sources of energy. The goal of this paper is to show the detailed survey of how speed breakers can be now used as a source of power.

Keywords: *Electricity, conservation and conversion, power source*

1. INTRODUCTION

In today's world, almost every equipment requires electricity for its working and the demand for the electricity is increasing in many folds. In this paper, we are going to discuss about one of the available conventional methods for the generation of electricity from the otherwise wasted energy. All moving vehicles possess kinetic energy, which can be used for the generation of electricity. The entire model is built

under a speed breaker and when a vehicle passes through the speed breaker it generates electricity. The power thus generated is stored in a rechargeable device such as battery (conservation) for future use (conversion). Generating electricity by speed breakers is an innovative and useful concept.

It is an attractive technology for optimal use of available sources. This paper attempts to show how energy can be tapped and used in a commonly used system like the road-speed breakers. Due to ever increasing population and social structure of society the number of vehicles passing over the speed breaker in roads is increasing day by day. There is a possibility of tapping the energy and generating power by making the speed breaker as a power generation unit.

In our paper, we are going to represent the changes made from basic designs of speed breaker generation model till present.

2. TYPES OF MECHANISMS

There are different types of mechanism used for generating electricity using speed breaker.

A) *Roller Mechanism:*



Fig 1. Roller mechanism [1]

In this set up, an iron roller is fixed on a wooden ramp on which vehicle can pass due to which roller rotates in the direction of the vehicles passing over it. The roller is linked with the shaft of DC motor (used as a generator) through a chain and sprocket arrangement. Now as vehicle passes over it; the roller rotates the shaft of the DC

motor thus producing electricity. Hence DC power is produce through the roller mechanism which can be stored in the battery and used for future use.

The advantage of this mechanism is that electricity can be relatively produced in a simple manner without polluting the environment. But strength and losses are the limitations of this method which is to be considered.

B) Rack and Pinion Mechanism :

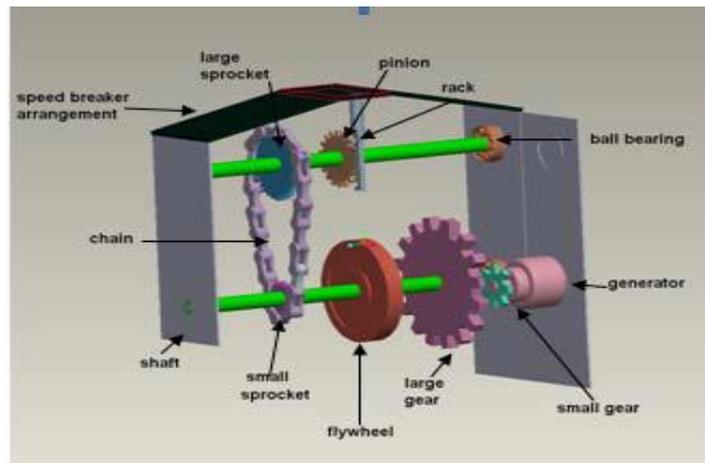


Fig 2. Basic rack and pinion mechanism [2]

After roller mechanism, there was a major improvement in speed breaker generation unit. The improvement was using rack and pinion mechanism in which the reciprocating motion of the speed-breaker is converted into rotary motion. In this mechanism, the top part of the rack is connected to the speed breaker and the lower part is linked with pinion. As the vehicle passes over the speed breaker the rack moves in the downward direction which in turn rotates the pinion in clockwise direction. The axis of the pinion is coupled with the sprocket arrangement on the shafts.

The sprocket arrangement is made of two sprockets. One of larger size and the other of smaller size. Both the sprockets are connected by means of a chain which serves in transmitting 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. As the smaller sprocket rotates the shaft rotates which in turn rotates the shaft of DC motor through gear assembly.

Also a flywheel is connected on the shaft of the smaller sprocket so as to get continuous rotation of the shaft and thus the generator. Thus, electricity is produced when pinion is rotates in clockwise direction but what when the rack moves in upward direction?

Therefore the pinion will rotate in anticlockwise direction and cancel the movement of clockwise direction thus decreasing the efficiency of the overall system. Hence due to this major drawback even rack and pinion mechanism has its own limitations.

c) Air piston mechanism:

Various approaches were made to generate power through speed breakers but in some way every approach had its own limitations. Air piston mechanism is a different kind of approach with high efficiency as compare to previous mechanisms. In this, when the vehicle (load) passes over the curved shape metal sheet i.e. dome, it goes down due to the load of vehicle.



Fig 3. Air piston mechanism [3]

This assembly pushes down to the spring. This curved dome is connected with the piston via connecting rod. This quick action (movement of piston downward) compresses air in the compressor cylinder which escapes out (exhaust stroke) from the delivery valve and it stored in the air cylinder (tank). When the vehicle goes away from the speed breaker, the dome along with piston moves up quickly due to which the action of spring allows air intake into the compressor cylinder (suction stroke). These steps are repeated with the successive passing of vehicles. The frequent up and down movement of air compressor piston (attached with speed breaker dome) completes the intake and exhaust strokes of the air compressor repeatedly thus rotating the shaft of the generator.

Therefore, these repeated cycles will be possible with busy roads will store a good amount of pressurized air in the air cylinder that can be further utilized for useful purposes. Hence power is generated with maximum efficiency. But this set up is not beneficial from economical point of view.

3. COMPARISON

Sr. No.	Parameters	Roller Mechanism	Rack and Pinion Mechanism	Air Piston Mechanism
1.	Cost	Cheap	Moderate	Costly
2.	Mechanism Setup	Very Easy	Difficult	Very Difficult
3.	Maintenance	Less Required	Weekly Basis	Daily Basis
4.	Efficiency	~50%	~70%	~85%
5.	Design	Easy to design	Depends upon weight sustaining capacity	Depends upon compressing power of air pistons

Table No. 1: Comparison of parameters of different speed breaker mechanism

4. CONCLUSION

Looking at the recent conditions of the electricity crisis in India, government focuses on utilizing the non-conventional energy sources for electricity generation and reducing the share of global warming. So, the techniques described in the paper will also contribute to the power generation nationally with some more modifications in the model.

In our survey, we referred different papers for different mechanisms and every mechanism has its own advantages and disadvantages.

Therefore as per our survey we conclude that rack and pinion mechanism is efficient as well as cost effective mechanism for generation of electricity from speed breaker.

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