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Fabrication and Analysis of Hybrid Power Ramp

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ABSTRACT

Nowadays energy is one among the most important issues in the world. Especially in India scarcity of energy is a big problem. Renewable energy sources can be a great medium to solve this energy crisis. It is obvious that natural resources are going to end up one day. To introduce substitute energy sources from nature research are going. The alternative energy source must be green and not harmful for the environment. The capturing of minute amounts of energy from one or more of the surrounding energy sources is known as energy harvesting. The energy harvesting technology has been already started in the form of windmill, geothermal and solar energy. Due to increasing life style of the human beings', - vehicles on the earth keep on increasing and also consumption of energy is more. Traffic in the major city increasing so we can extract the energy from huge traffic density. In this project we can extract energy from hybrid power ramp. That involves Ramp mechanism, roller mechanism and piezoelectric mechanism. By using speed breakers the kinetic energy associated with the moving vehicle can be transformed into mechanical energy. This can be done by using rack and pinion mechanism. Then, this mechanical energy can be transformed to electrical energy using generator or dynamo which can be stored with the use of a battery. In the roller, mechanism conversion from mechanical energy to electrical energy by using the vehicle weight and motion. The method shows the possibility of tapping wasted energy in the road rollers. Wasted energy can be converted to electrical energy. In the piezoelectric mechanism, piezoelectric materials in order to collect the energy from waste mechanical stress for generating and accumulating the energy.

Keywords: *Speed breaker mechanism, roller mechanism, piezoelectric mechanism, hybrid power ramp*

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INTRODUCTION

Nowadays energy is one among the most important issues in the world. Especially in India scarcity of energy is a big problem. Renewable energy sources can be a great medium to solve this energy crisis. It is obvious that natural resources are going to end up one day. To introduce substitute energy sources from nature research are going. The alternative energy source must be green and not harmful for the environment. The capturing of minute amounts of energy from one or more of the surrounding energy sources is known as energy harvesting. The energy harvesting technology has been already started in the form of windmill, geothermal and solar energy. Due to increasing life style of the human beings',—vehicles on the earth keep on increasing and also consumption

of energy is more. Traffic in the major city increasing so we can extract the energy from huge traffic density.

International Energy Agency has stated that the world requires nearly 60% more energy in 2030 than in 2002. The power generation depends mainly on availability of the regular conventional fossil fuels, but the research has been revealed that, these fossil fuels are going to end up one day. Hence it is necessary that we can rely upon on non-conventional energy sources for power generation in the future. With the broad development of technologies different useful methods of power generation have been started. The major objective of these methods is cost effectiveness [1].

Due to the speed breakers a lot of energy is being wasted on the roads. In India, the total length of national highways was 101,011 km in 2015-16 according to Ministry of Road Transport and Highways. On an average there are 15 to 20 highways are there in each state. The number of vehicles on Indian roads has been increased tremendously from 1951 to 2001. Nearly there are 72.7 million vehicles are running across India in the year 2004. In India the growth of vehicles has increased almost 10 percent every year during the last decade [2]. The increasing traffic and number of speed breakers nowadays provides us conditions to manufacture an innovative device which can make use of the energy being wasted by the vehicle on the speed breakers and allow us to transform it into some profitable work [3].

This method of generating electricity from the speed breakers will help in conserving our natural resources. In coming days, this will be beneficial to the world, since it is going to save a lot of electricity of power plants that is being wasted in illuminating the street light. It's the right time to think of alternative resources because the sources of convectional energy are decreasing so fast [4]. In big cities vehicular traffic in is more now, which causes problem to human being. But it is possible to use this vehicular traffic for power generation by means of innovative technique called "power hump".[5] Since it does not utilize any external source, this idea not only provides substitute but also adds to the economy of the nation. Electric energy can be generated by three mechanism speed breaker mechanism is to convert kinetic and potential energy to electricity [6]. An electromechanical unit is fixed under the speed breaker. In this system we can convert reciprocating motion into rotary motion. The rotational power (i.e. mechanical energy) is transformed into the electrical energy by using chain sprocket, flywheel and dynamo and a generator which generates electricity.[7]

METHODOLOGY

Specification

Dimensions of different parameters are shown in specification Table 1 and Figure 1 is showing image of hybrid power pump.

Table 1. *Specification.*

Sl. No.	Parameter	Dimension
1	Length of the power ramp	930 mm
2	Thickness of the power ramp	2 mm
3	Diameter of the gears	88 mm
4	Diameter of the sprocket	72 mm
5	Number of teeth's on the gear	54
6	Number of teeth's on the sprocket	20
7	Thickness of the spring	8 mm
8	Voltage of dynamo	6V

MECHANISM

Rack and Pinion Mechanism

It consists of three systems for proper working.

Damper System

Damper system is necessary to support the speed breakers. The speed breaker designs may be: the "Sleeping Policeman", which

has a rounded to the "Speed Cushion", which is a raised square in the middle of a lane; and the "Speed Table", which is a wide flat-topped speed breaker. Damper system consists of a spring which will push the speed breaker upwards when it is acted upon by the weight of the vehicle downwards. They are also necessary to absorb the shocks produced when the vehicles move over the speed breakers.

Motion Conversion System

This arrangement is needed to convert the basic vertical reciprocating motion of the damper system into rotary motion of the shafts. For this a rack & pinion mechanism is used. The vehicle load acted upon the speed breaker is transmitted to rack and pinion arrangements. This vertical motion is converted to rotary motion and transmitted to a sprocket assembly. The sprocket assembly consists of two sprockets one larger diameter and the other of smaller diameter. The bigger sprocket is coupled to the axis of the pinion. The pinion and the larger sprocket are installed on the same shaft. Now the larger and smaller sprocket is joined with each other through a chain drive. Smaller sprocket is installed on another shaft. The smaller sprocket consists of a pawl and a ratchet which avoids the rotation in reverse direction of the shaft on which smaller sprocket is installed. Thus, the shaft on which smaller sprocket is installed rotates only in one direction. I.e. it rotates only when the rack moves downward due to load of vehicle. Thus mechanical energy is available at the output of motion conversion system (Figure 2).

Energy Conversion System

In this system the mechanical energy available at the smaller gear (i.e. at the output of the motion conversion system) is converted to electrical energy with the help of a dynamo or generator. The smaller gear is joined to the dynamo or generator. The conversion will be proportional to traffic density.

Roller Mechanism

In this Mechanism, a roller is installed before a speed breaker. Some kind of a grip is provided on the speed breaker so that when a vehicle moves over speed breaker it rotates the roller. The friction force due to the vehicle movement across the speed breaker acted upon the rollers and rotates them. Dynamo is connected to rough surface of shaft as the dynamo rotates, it produces electricity (Figure 3).

Piezoelectric Device

The principle of piezoelectricity lies behind the crystals. Electrical voltage is induced when crystalline materials are subjected to external force, pressure, or strain. There are different types of natural crystals, which are available at the surface or deep within the earth's crust, which can be used to generate electricity by piezoelectricity effect. There are different types of artificial crystals are made by combining different chemical compounds together, as well. These include Barium Titanate, Lead Titanate, and Lead Zirconate Titanate, etc.

The efficiency of piezoelectric devices is influenced by the type of crystals due to the variety of their properties. To achieve a high piezoelectric effect Lead Zirconate Titanate (PZT) crystals are being used. It can be made in to any complex shape easily, high Material strength and long-life service, resistant to humidity and heat temperature over 100°C, are all distinctive factors of PZT.

RESULT AND DISCUSSION

Analysis of hybrid power ramp is done for two cases: one is for constant speed and varying load and second is constant load and varying speed to observe the voltage generated (Figure 4).

For Constant load of 200 kg

From the graph load is increases voltage is also increases in piezoelectric and ramp mechanism but voltage decreases when load is increases in the case of roller mechanism. By considering all three mechanisms we can arrive at a judgment that load is increases voltage is also increases in this mechanism.

For Constant Speed of 20 km/hr

From the graph speed is increases voltage is also increases in roller and ramp mechanism but voltage decreases when speed is increases in the case of piezoelectric mechanism. By considering all three mechanisms, we can arrive at a judgment that speed is increases voltage is also increases in this mechanism (Figure 5).

Fig. 1. *Hybrid power ramp.*

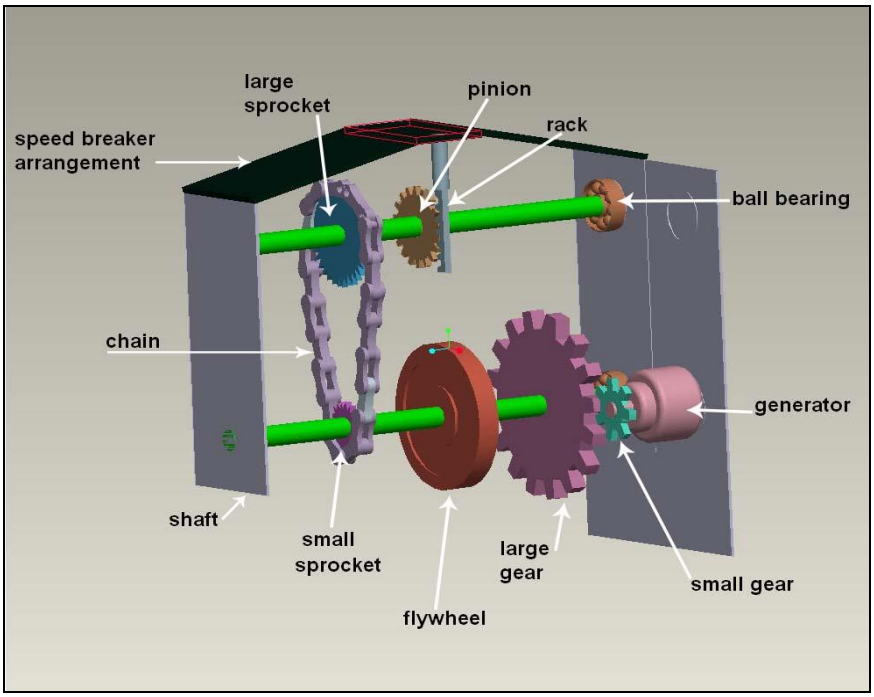

Fig. 2. *Rack and Pinion mechanism.*

Fig. 3*. Roller.*

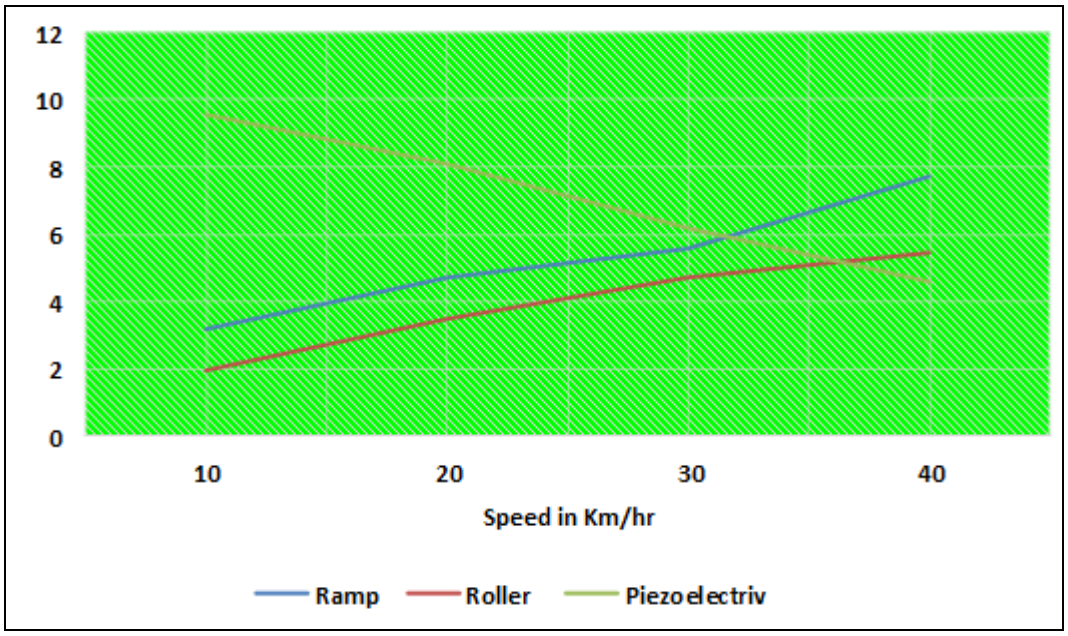

Fig. 4*. Graph of voltage generated vs different Speed of vehicle.*

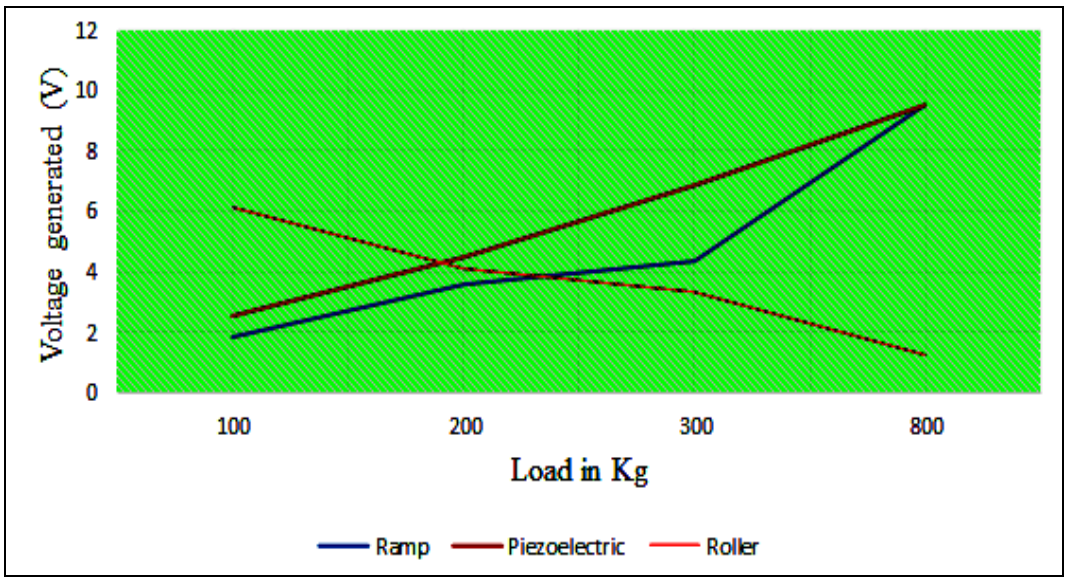

Fig. 5. *Graph of voltage generated vs different load of vehicles.*

CONCLUSION

In future, this will prove a great boon to the world, because the electricity generated in this method will be used in illuminating the street lights which leads to the saving of a lot of electricity of power plants. When speed of vehicle increases voltage generation increases. Because more kinetic energy increases the friction between the wheel tyre and grip on the roller. When speed of the vehicle increases voltage generation is decreased. Because when the speed is more potential energy is fewer loads on the piezoelectric material will be less piezoelectric material produces more voltage when load is applied in perpendicular direction. The piezoelectric mechanism is placed before the ramp because vehicle speed is decreases so we can get more amount of power. The roller mechanism is placed after the ramp because when vehicle is pass over the ramp its gradually increases its speed so we can get more amount power.

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