POWER GENERATION THROUGH SPEED BREAKER

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ABSTRACT

Nowadays, Energy and Power become a backbone of every country out there Energy plays an immense role in any country development .Every country energy demand is fulfilled through conventional sources like fossil fuels which mostly going to end in near future .So ,there is need of fulfillment of energy demand and moreover ,using conventional sources leads to pollution and also leads to global warming .So there is immense need of using non- conventional methods to generate energy .This paper focusses on generating power through speed breaker mechanism. Our project focusses on using weight of vehicle passing over breaker to convert force energy to mechanical energy by rack and pinion and later to electrical energy by dc motor. By incorporating this method will certainly help to use collected electrical energy to use further in street lights or for electric vehicles charging station.

Keywords: Rack And Pinion, Speed Breaker, Generator, Sprocket.

I.   INTRODUCTION

Starting from early civilization of human kind ,There is ultimate need of Energy which at that time were fulfilled by natural resources but as the time passes ,Human kind developed technologies and as the population increases ,There is immense need of energy/electricity and to fulfil this ,we mostly focusses on conventional sources like fossil fuels .As India's 80% electricity generation is from fossil fuels ,which indicates energy dependancy on fossil fuels and fossil fuels, certainly going to exhausted in coming few decades. There is need of generating electricity through new non-conventional methods which will help to generate electricity and to lessen the dependancy of energy production from conventional ones and also provide a high advantage of not producing pollution .One of the same method is power generation through speed breaker and India has a lot of roads and vehicles .According to data provided by Ministry of Road Transport and Highways, the total length of national highways in India was 132,500 km till year 2019[1][2]. In 2002 ,58.8 million and in year 2004, 72.7 million vehicles are running on Indian roads and the annual rate of almost 10% increase in vehicle population in a decade [2]and while running vehicles losses energy on speed breaker and due to traffic jams too ,this speed breaker can be used as arrangement for generation of energy through various method but in this ,we will use rack and pinion method for its high efficiency outcome. This will certainly help to meet a certain level of energy demand for people. As we know various places in India or every other country, faces electricity shortage issue. One such review was finished by the Tamil Nadu power board. As presented by this study, the power devoured by a distant town for 45 days is equivalent to the power devoured by all the streetlamps in one night around Chennai.[3] So this power generation through speed breaker will surely help to provide electricity to small villages or other places.

II.   METHODOLOGY

There are different methods through which we can generate electricity through speed breaker and following are the methods –

1. Spring coil mechanism

2. Rack and pinion mechanism

3. Crank shaft mechanism

4. Roller mechanism

Only spring coil method and Rack and Pinion mechanism are mostly used than others methods because other methods have a lot of disadvantage in comparison to these two .As in Crank shaft mechanism ,There is lot of wear and tear in components and a lot of energy is waste due to heat energy and Both methods demands a lot of maintenance ;Therefore ,we are choosing Rack and Pinion mechanism for this project ,for its simplicity in making and it also required less cost in maintenance and has high productivity.
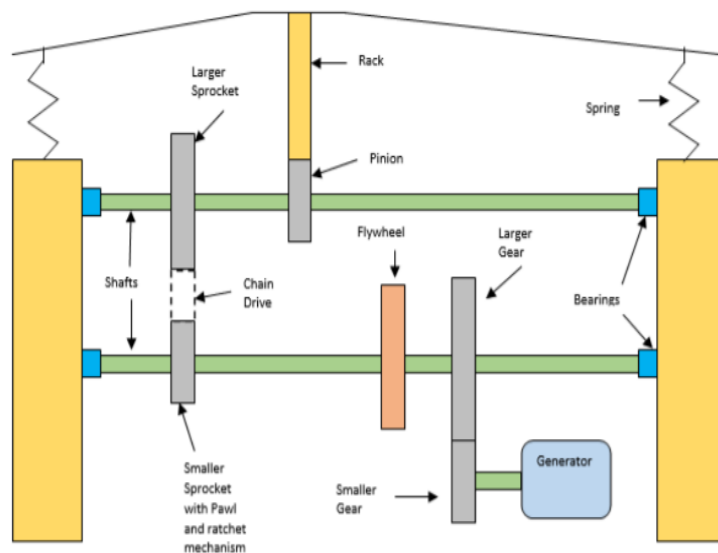
Figure 1: Rack and Pinion arrangement

Construction and working:

In order to construct it, we require 4 springs of equal stiffness to attach to sides of speed breaker and a rack is attached vertically to bottom end of speed breaker and a pinion is attached to a steeped shaft .Thus, rack and pinion arrangement is set and that shaft is further connected with a larger sprocket and that larger sprocket is connected to smaller sprocket through chain sprocket arrangement and smaller sprocket is mounted on another shaft and on that shaft a flywheel is mounted and after that a larger gear is too mounted and It is meshed with a smaller gear and that small gear is coupled with a generator and ball bearing is also used in every shaft to lessen the friction .

And for working, as any vehicle passes over speed breaker ,the weight of vehicle pushed the arch and that leads to downward motion of rack and it also starts the movemnt of pinion as rack moves downward ,this arrrangement converts the reciprocating motion of rack in to rotary motion of pinion and that leads to movement of shaft and larger sprocket ,as the motion leads to motion of smaller sprocket too as it is connected to larger sprocket through chain drive and speed in smaller sprocket is multiplied further times and that speed is handed to larger gear and that gear is meshed with a smaller diameter gear and further speed is multiplied at smaller gear end due to its gear arrangement and that small gear is attached to rotor of a generator and output electricity is transfer to battery and in between small sprocket and larger gear ,a flywheel is attached to store energy and to make shaft motion uniform and When motion stops ,flywheel releases the energy that further leads to motion of rotor of generator and as the motion stops ,spring helps the speed breaker to go back to its original state .

Figure 2: Constructional detail of Speed Breaker arrangement

III.   HARDWARE USED

1. RACK AND PINION

It is type of a actuator which has a combination of a linear gear engaging with circular gear .Moving circular gear leads to linear motion of other gear. They are mostly made of cast iron .This arrrangement ensures conversion of reciprocating motion to linear motion and vice versa.

2. SHAFT

It is a rotating machine element with circular cross section and it mainly used to transfer power from one part to another which are mounted on it.

3. BALL BEARING

It is a type of rolling element that uses ball to maintain separartion between its bearing .It main purpose is to reduce friction between its moving element and to reduce surface contact too.

4. SPROCKET AND CHAIN DRIVE

It is a profiled wheel with teeth that can work with a chain, or other punctured material. Its main purpose is to transfer rotary motion to other parts through chain drive. It is the lightest transmission that ensures solidness to any system.

5. SPUR GEAR

It is a pivoting component which transfers force through other parts through it teeth .These are the simplest type of gear with radial teeth parallel to its axis. They are mainly used for transfer motion from one shaft to another .

6. FLYWHEEL

It is a type of mechanical device to store the rotational energy and use when demand is high .The inertia of flywheel opposses and smoothes the fluctuation in speed .It is made typically of steel. It helps in to reduce they wastage of energy and helps in storing it in time of need. The essential or fundamental capacity of the flywheel is to reduce the changes in speed.

7. SPRINGS

These are the component which has great flexibility of absorbing shocks and vibration. It main property is to deflect under pressure and to get to its its original shape when load is released.

8. DC GENERATOR

It is an electrical machine whose main function is to convert mechanical energy into electricity. The dc generator of 500 rpm is utilized in this framework which convert the mechanical input to electrical output. It based on the principle of production of dynamically induced emf.

9. BATTERY

The yield created by dc generator is utilized to charge the battery and is utilized for different purposes. It collects and stores energy through a reversible electrochemical process.

IV.   RESULTS AND CALCULATIONS

Lets consider a vehicle of around 900 kg and a speed breaker of height of 15cm.

Force= mg = 900 * 9.81

      = 8820 N

Calculating work done

W= Force * Displacement(height of breaker)

  = 8820 *0.15 = 1323 Nm

  = 1323/60 = 22.05 watts

Work done is 22.05 watts for a minute

Calculating work done for a day

Work done =22.05*60*24 =31752 watts .

Total 31.75 KW power generated in a day(approx.)

Say for example,50 CFl bulbs are used each of 100 watts for a street lights for a km distance.

Power required by 50 bulbs= 50 * 100 =5000 watts =5 KW

So, a single day power generated by speed breaker can be used for around 6 days. This same calculation can be done for car, motorcycles and any other devices or things. This clearly shows ,power generated by a single speed breaker can be this vast to use at various purposes like street lightning or to charge electric vehicles at power station or many more. There is abundant of use of this power generated through speed breaker. This shows a great promise in future .

V.   CONCLUSION

There is increasing demand of electricity worldwide but this electricity generation is being produced by fossil fuels mainly ,which in near future going to end and it is quite harmful for environment and also all living organism on this planet .The aim is to use   another innovative method to generate power with non-conventional methods to cut off the dependancy on fossil fuels and to generate electricity in ecofriendly way .This power generation through speed breaker will help area which is deprived of electricity by installing this system in nearby highways or roads .This project has wide application as every country has roads. This will surely aid in improving electricity supply .

VI.   REFERENCES

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