

MODIFIED DESIGN OF SPEED BREAKER FOR POWER GENERATION

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Abstract

Energy plays a prominent role in the day to day life, starting from the cells in the TV remote to the Air conditioner. But the scarcity in the power led to the increase in demand for the low cost power generation systems. There are many techniques evolved to overcome the problems in the power generation. One such attempt is made by our paper. To increase the efficiency of conventional "speed breaker power generator". The energy is getting wasted due to many moving parts in the present system. Loss compensation is possible by eliminating excess moving parts and incorporating the recoil spring, to increase the shaft rotation. This will ultimately lead to the effective usage of mechanical input. Other thing is that nowadays the demand for any technology depends on cost of deployment. By considering all those parameters it can be said that this system is economic to deploy.

Keywords: power generation, sustainability, speed breaker

1. INTRODUCTION

Many studies were made on this technique especially in the recent times where the natural resources are terminating. There is plenty of matter in the internet which deals with the design and propagation of speed breaker. But the main problem is to trap maximum energy out of it. So, the research has been started to make the effective usage of the available energy. My paper is going to bolster the research which has the plenty of scope.

It is said that the wonderful innovations comes from the place where the problem is severe. One such example is taken from worst power hit country. The First one to make use were South African people, their electrical crisis has made them to implement this method to light up small villages of the highway. The idea of basic physics to convert the kinetic energy into electrical energy that goes waste when the vehicle runs over the speed- break was used. Since then a lot has been done in this field. The idea caught our working team and we have decided to develop such a project that will produce more power and store it for use at night time as it proves to be a boon to the economy of the country

2. DESCRIPTION OF COMPONENTS

2.1 Rack and Pinion Gears

General function of this mesh is to convert linear motion into rotary motion and there by shaft starts rotating. In this system the rack is shortened so that the pinion rotates freely.

2.2 Ribbon Recoil Spring

It is incorporated inside the pinion so that for every one backward rotation of gear lead to the three forward rotations of the same gear. This helps to increase the number of rotations of the shaft which ultimately lead to the good power generation. Number of springs can be increased for more strength. i.e. fixing at two symmetric sides of the gear. Generally high strength materials can be used. The recoil spring is as shown in figure1.



Fig -1: Recoil Spring

2.3 Sprocket and Chain

This is arranged in order to transfer the rotational motion from one shaft to the other shaft. If we are able to make the sprocket size more in the primary shaft than in the secondary shaft then power developed will be more.

2.4 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.

2.5 Free Wheel

This is placed at one end of the shaft so that it won't rotate in the reverse direction which is undesirable. This is the crucial module which helps to reduce the lot of energy wastage. Without this there would be a chance of forming reverse current which is going to make use of available energy in the generator and finally there won't be any power left in the system output. The free-wheel is as shown in figure 2.

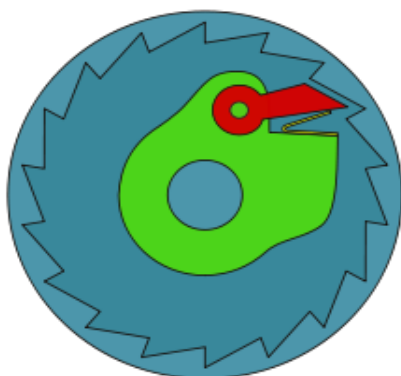


Fig -2: Free wheel

2.6 Flywheel

The purpose of this component is to reduce the thrust force and thereby reducing the fluctuations in the system. It is basically made of cast iron which is a heavier metal to restrict the shaft in the perpendicular direction.

2.7 Generator

It is the prime system which converts mechanical input to the electrical output in which the flux lines are cut by the armature coil in the presence of electrical current.

3. WORKING

The working model is quite same as the conventional design. That is, when the vehicle passes over the speed breaker the rack and pinion arrangement gets actuated by converting the linear motion into rotational motion. This in turn rotates the primary shaft. The chain drive consecutively attached to the primary shaft starts rotating. This will in fact rotate the secondary shaft. Passed into the generator there by the power get generated. The flywheel is arranged in between the chain drive and the generator for absorbing the shocks. The working of recoil spring and gear is shown in figure 3.

Our study mainly emphasise on the increasing the shaft rotation with the help of the ribbon spring and the gear arrangement which will tend to recoil as soon as it gets

uncoiled. The recoil ribbon spring designed in such a way that it can bear heavy loads and gives the more outward force in order to retain its original shape and structure. One more main aspect of the shaft is that the backward motion is restricted. Because the recoil spring need some stationary reference to get uncoiled. For this condition to be achieved free wheel is arranged at one end of the shaft which restricts the backward motion. The designed system for development is shown in figure4.

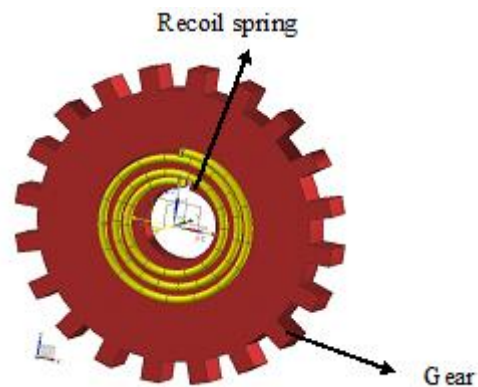


Fig -3: Recoil spring incorporated in the gear

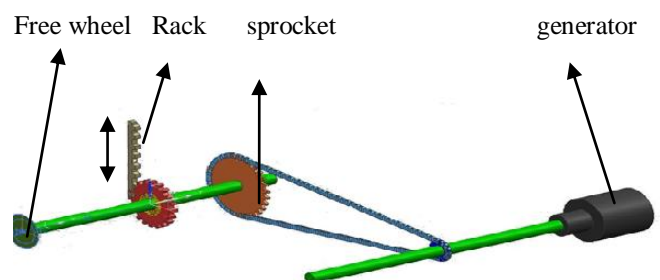


Fig -4: Design of the system

4. CALCULATION OF POWER GENERATED

Weight of the vehicle (pair of wheels) range from 250kg-300kg, Assume it to be = 275kg
 Distance travelled by the rack = 0.12m.
 Work done by the force = F*S. = 275*9.81*0.12.

Power estimated as $P = (F*S)/t$

$$p = \frac{275*9.81*0.12}{60}$$

= 5.3955 watts

As the recoil spring tends to rotate the gear 2.5 times more than conventional gear, the power should be multiplied by 2.5, then

$$P = \frac{275*9.81*0.12*2.5}{60} = 13.4887\text{watts.}$$

Power generated in 1 hour = 13.4 *60 = 804 watts

This power generation is twice that of the conventional system and the power generation is sufficient to run help stations and toll gates on highways.

As the shaft approaches final rotations i.e. 2 and 2.5 the power generation decreases because of the less torque and less speed production. So the graph above is perfectly depicting the situation of the motion.

The sum of powers for each rotation = $6+4+1.02= 11.02$ watts/hour (from the graph) compared to the 13.44watts/hour.

Error in the power calculation is given by $=13.44-11.02=2.42$ watts/hour.

Hence the value 11.02 watts/hour obtained by considering different speeds for different rotations of gear

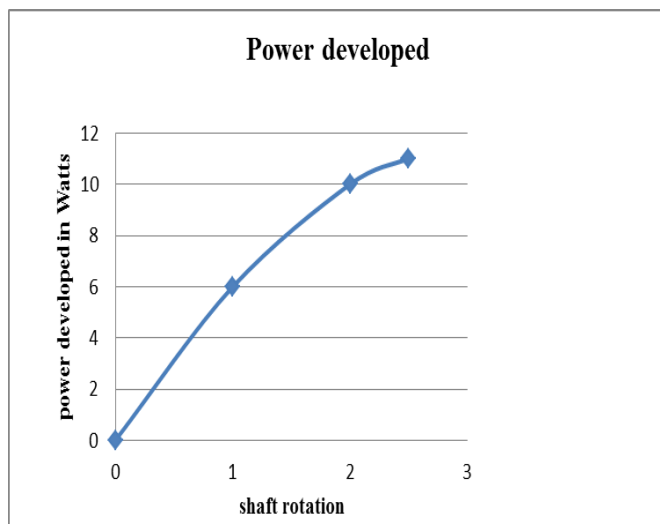


Fig -5: power generated based on shaft rotation

5. COMPARISON WITH CONVENTIONAL DESIGN

The shaft used here is free to move forward because of the shortened rack which remains in contact with the gear when the car wheels pass over the speed breaker. Further the other spur gears are removed because the flywheel can handle the fluctuations. This would help our system to reduce the number of moving parts and thereby increasing the power generation.

The ribbon coil spring is incorporated inside the gear so, that the gear makes more rotations which will lead to the considerable increase in the power generation compared to the conventional system. Another thing is that Free wheel is placed at one end of the shaft so that backward motion of the shaft can be restricted. And the reverse current can be restricted which is formed when the shaft rotates in the backward direction.

Power developed is higher when compared to the conventional working model. In the previous journals the power calculated is 441 watts in one hour but we were able to develop 840 watts because of the recoil spring arrangement. Further as the number of parts decreased the cost of investment will also be decreased. This is mentioned in the thesis of the journal and also necessary proof is given.

The general point is that the Electricity can be generated throughout the year without any delay. Not only can be used to lit street lamps but also for the other small scale companies. In fact it is Easy for maintenance and no fuel transportation problem. The reason is that there is no costly component involved in this system.

It is said to be a pollution free power generation. Because there is no usage of non-renewable resources like coal, petrol, Diesel. In deed less floor area required and no obstruction to traffic. No need of manpower during power generation. Except that there should be some maintenance.

6. CONCLUSION

As the demand increases for electricity the new techniques will be evolved to make effective use of all the available energy. So this technique would help street lights and other electric equipment which are located nearby the road to work. As the emissions from the system are zero it will be the most eco-friendly reliable one in the scope perception. Another thing is that huge power is getting wasted because of transportation to great distances but in our concept there will be no wastage because it is located behind the highway lamps. So, this concept is the most reliable and modifications can be done to generate more power.

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BIOGRAPHIES

Mr D.Ramana Reddy, Associate professor working in department of mechanical engineering, Methodist College of Engineering and Technology, Hyderabad. He holds a Master's degree from Indian Institute of Technology (IIT) Madras and has over

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