Electricity generation by using shock absorber

1T. Prakash, 2R. Guru prasath, 3R. Hari Vignesh, 4A. Harish.

1Associate Professor, 2UG Students
Department of Mechanical Engineering, K.S.R College of Engineering, Tiruchengode-637 215,
Tamil Nadu, India.
2 hariravi769@gmail.com, 2gururavi1996@gmail.com

Abstract- For smooth and comfortable ride the disturbing forces should be eliminated. In conventional system we are attaching the shaft of dynamo (permanent magnet DC generator) to the engine to charge the battery. In this project/paper we are going to highlight a new method by using which we can eliminate the shocks as well as improve the overall efficiency of vehicle. Conventional shock absorbers simply dissipate this energy as heat. In our project, we are going to harvest this waste energy to charge the battery of vehicle. This can be done by using two methods, either by redesigning the shock absorber which will accommodate various parts of harvesting system or by simply using rack, pinion arrangement attached to shock absorber. Out of these two we are using the second method. As shock absorber effect formed, spring is compressed and linear movement of rack is converted in rotary motion due to pinion moves as the rack is meshed with pinion. And the pinion is mounted on the shaft which is connected to shaft of dynamo. Due to this arrangement, rotary motion of pinion is used to rotate dynamo. As dynamo rotation leads to generation of energy. And this energy is used to charge the battery and this stored energy is used for different vehicle accessories like power window, lights and air conditioner etc. This energy is applicable in most of the military vehicles, race automobile and maximum suspension systems.

Keywords-Rack, Pinion, Dynamo

I. INTRODUCTION

Fossil fuels are being consumed with very fast rate. Also the cost of fuel is increasing with a very fast rate. So somebody has to work on saving of the fuel consumption. Our aim is to demonstrate how the kinetic energy from the suspension of a car can be utilized to achieve our goal of obtaining maximum energy that would otherwise have gone waste. We propose a design plan that converts the mechanical energy in cars to electrical energy more efficiently than has been done before. The electricity generated will then be used to recharge the battery for further use and functioning of vehicle. There is a wide scope of regeneration of energy like regeneration of breaking systematic. We have decided to work on utilization of suspending mass of a vehicle through regeneration system with the help of shock absorber. Shock absorbers are having reciprocating motion in it. Although the reciprocating distance is very low the suspending mass is very high i.e. the total mass of vehicle. When vehicle is on a normal road then also shock absorbers are working due to uneven roads, sudden breaking or sudden acceleration. So this reciprocating motion of shock absorbers can be converted into rotary motion and through small gearbox attached to alternator of automobile, electricity will be generated when shock absorbers will be reciprocating.

Although the reciprocating distance is very low the suspending mass is very high i.e. the total mass of vehicle. When vehicle is on a normal road then also shock absorbers are working due to uneven roads, sudden breaking or sudden acceleration. So this reciprocating motion of shock absorbers can be converted into rotary motion and through small gearbox attached to alternator of automobile, electricity will be generated when shock absorbers will be reciprocating.

![Block Diagram](image)

**Fig.1 Block Diagram**

II. LITERATURE SURVEY

[2] Rahul Uttamrao Patil, Dr. S. S. Gawade,“Design and static magnetic analysis of electromagnetic regenerative shock absorber”
[3] Zhongjie Li, Lei Zuo, JianKuang, and George Luhrs, Department of Mechanical Engineering, State University of New York at Stony Brook, Stony Brook, NY, 11794
III. WORKING PRINCIPLE

The complete diagram of the power generation using shock absorber is given below.

Fig. 2 Construction

The vehicle running time the shock absorber piston is moving up and down motion. This movement is converted to the electrical energy by using Rack and pinion arrangement. The rack & pinion is fixed at the shock absorber which is mounded bellow the L-angle window. The pinion shaft is connected to the supporter by end bearings as shown in fig. The larger sprocket also coupled with the pinion shaft, so that it is running the same speed of pinion. The larger sprocket is coupled to the small cycle sprocket with the help of chain (cycle). This larger sprocket is used to transfer the rotation force to the smaller sprocket. The smaller sprocket is running same direction for the forward and reverse direction of rotational movement of the larger sprocket. This action locks like a cycle pedaling action. The flywheel and gear wheel is also coupled to the smaller sprocket shaft. The flywheel is used to increase the rpm of the smaller sprocket shaft. The gear wheel is coupled to the generator shaft with the help of another gear wheel. The generator is used here, is permanent magnet D.C generator. The generated voltage is 12Volt D.C. This D.C voltage is stored to the Lead-acid 12 Volt battery. The battery is connected to the lights of vehicle and other applications.

IV. OUTPUT POWER CALCULATIONS

Let us consider, the mass of a vehicle moving over the speed breaker = 250Kg

Height of speed breaker = 10 cm

Work done = Force x Distance

Here,
Force = Weight of the Body
= 250 Kg x 9.81
= 2452.5 N

Distance travelled by the body
= Height of the speed breaker
= 10 m

Output power = Work e/Sec
= (2452.5 x 0.10)/60
= 4.0875 Newton (for one pushing force)

Power developed for 1 vehicle passing over the speed breaker arrangement for one minute = 4.0875 Watts

Power developed for 60 minutes (1 hour) =245.25 Watts

Power developed for 24 hours = 5.866 KW.

IV. DESIGN SPECIFICATIONS

- Shaft Diameter= 1.5 cm
- Diameter of flywheel = 17 cm
- Thickness of flywheel = 2.8 cm
- Sprocket and chain
  - No. of teeth on large sprocket= 52
  - No. of teeth on small sprocket=25
  - Diameter of large sprocket= 18.4 cm
  - Diameter of small sprocket = 7.4 cm
  - Length of chain =128 cm
  - Optimum Centre distance = 42 cm
- Springs
  - Diameter of wire = 1mm
  - Mean diameter of coil = 20mm
  - Free length of spring = 154mm
  - Pitch of the spring = 9mm
- Spur Gears
  - No of teeth driver=122
  - No of teeth drives=28
  - Pitch circle diameter driver =200mm
- Rack
  - No Of Teeth on Rack = 18
  - Rack Length = 240mm
- Pinion
  - No Of Teeth on Pinion =38
  - Thick of pinion gear=26mm
V. EXPERIMENTAL INVESTIGATION

The experimental investigation is performed by placing the speed breaker arrangement in a pit with a depth of 75 Cm. Vehicles move over the speed breaker arrangement and the voltage generated is measured by a millimeter and the various readings are plotted in a graph. The graphs are drawn for various parameters as shown below.

- Voltage generated (Vs) Trial No.
- Voltage generated (Vs) speed of vehicle
- Voltage generated (Vs) Load

a) Voltage generated (Vs.) Trial No.

Table No. 1 Readings

<table>
<thead>
<tr>
<th>Load (Kg)</th>
<th>Voltage generated (V)</th>
</tr>
</thead>
<tbody>
<tr>
<td>60</td>
<td>8.33</td>
</tr>
<tr>
<td>130</td>
<td>9.45</td>
</tr>
<tr>
<td>170</td>
<td>10.22</td>
</tr>
<tr>
<td>200</td>
<td>11.23</td>
</tr>
</tbody>
</table>

(b) Voltage generated (Vs) speed of vehicle

VI. ADVANTAGES

- Energy Saving, Low operating cost...
- Low noise and vibration.
- Automatic control for charging.
- Robust and simplified structure, Low failure rate.
- Higher Reliability.
- Improved overall efficiency of vehicle.

VII. APPLICATIONS

- Applications such as battery charger.
- All two wheeler applications
- Automobile industry
VIII. RESULTS AND CONCLUSION

We are taken the reading for different number of teethes of gear.

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>No. of teethes on pinion</th>
<th>Voltage (volt)</th>
<th>Current (Ampere)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>14</td>
<td>7.0</td>
<td>0.26</td>
</tr>
<tr>
<td>2</td>
<td>18</td>
<td>5.0</td>
<td>0.17</td>
</tr>
</tbody>
</table>

Table No.3 Reading for different number of teethes of gear

Vehicle Suspension Energy Generation is very efficient and useful in converting the Kinetic Energy from the movement of the vehicle, especially the suspension, which usually goes waste, to electric energy that can be used to fulfil the needs of the auxiliaries in the vehicle. Currently the batteries of automobiles are charged by specific alternator which is attached to IC engine shaft. So that the fuel used in automobiles is also consumed for rotating the alternator to charge the battery. This consumption is found to be 4% of total consumption. By newly designed suspension, regeneration system presently using alternator is detached from the engine and attached to the suspension system. If we install this regeneration system for all 4 wheels then we can generate high amount of electric power. This high amount of electric power can be used for the working of car air conditioner or refrigeration system of vehicles. This suspension system will be mostly useful for heavy compressed vehicles, milk trucks, fire brigade trucks and also those having high requirement of electricity inside it. From result table we are observed that for a small number of teeth of gear we get the maximum voltage and current.

REFERENCES

[1]. Rahul Uttamrao Patil, Dr. S. S. Gawade, “Design and static magnetic analysis of electromagnetic regenerative shock absorber”.


[3]. Zhongjie Li, Lei Zuo, JianKuang, and George Luhrs , Department of Mechanical Engineering, State University of New York at Stony Brook, Stony Brook, NY, 11794.