
Study of Energy generation from weight of moving vehicles

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ABSTRACT

The world is getting better everyday making life easy for living but as the population is increasing day by day and the conventional energy sources are lessening & the tremendous usage of energy has resulted in an energy crisis over the years. Moving towards renewable energy has now become a step towards it. So this paper focuses on to generation of energy in an economical way. Whenever there is loss of energy somewhere in a system we can extract that energy in some different form. When the four wheeler passes the speed bump it loses a part of its kinetic energy which we can utilize for running air conditioners, also to charge the batteries, to power street lights etc., Also how the weight, speed, bumps, affects this generated energy can be reviewed.

Keywords: *Speed bump, Energy, Vehicle Weight, Rack-Pinion mechanism etc.*

1. INTRODUCTION

Harnessing the energy has become the foremost purpose for the engineers these days. Some researches have this prediction that non-renewable sources are about to go out so to look for alternative sources has become the need (1-2). By researches people have known that wasted energy is also useful as far as power generation is concerned. This is considered most efficient and economical way of recovering energy. In this case study we are to observe that whether the possibility lies or not to generate energy in this way.

The vehicles today are very comfortable which has made possible to travel at longer distance even by roads. The comfort lies in suspension systems of the cars damping and absorbing the shocks caused from the bumps. These bumps breaks the speed of the car causing its small displacement in vertical direction, you can call it that the part of its velocity in horizontal direction broke into two, horizontal and vertical components from the conservation of momentum equation. This vertical component of velocity acts due to the variation of normal reaction from roads when the car passes the speed bump.

Energy conversion from mechanical to electrical is going to happen in the system. The generated kinetic and potential energy will be converted to electrical energy by using suitable mechanisms.

It can be an excellent solution to recover the energy in the countries short of non-renewable sources or those which are developing. By doing this street lights can be lighted during night time saving the considerable amount of power.

The rest of paper is divided in 3 parts :-

- Various energy generation mechanisms
- Conclusion
- Applications / Future scope

2. VARIOUS ENERGY GENERATION MECHANISMS:

The principle of these mechanisms would be converting kinetic and potential energies to electrical energy. These energies are produced when a vehicle moves from over a speed-bump. Talking more precisely we will get reciprocating motion when the vehicle passes over the rollers and we need to convert that motion into rotary motion. The generators rotor shaft require constant rotary motion. It is the dynamo that generates power when the rotor shaft of it rotates and the generator stores the corresponding generated energy.

Mechanisms to generate constant rotary motion are :

2.1 RACK AND PINION MECHANISM

In a rack-pinion system the rack is attached to speed breaker. The speed breaker moves down as the vehicles move over it making the rack take vertical displacement (3). Here rack and pinion form a pair hence the pinion will rotate due to displacement of the rack motion and generated kinetic energy. This power is transferred to a dynamo to which pinion shaft is connected.

To continue this cycle springs are attached below the speed breaker so that they again retain that position of the breaker. It is the simplest mechanism.

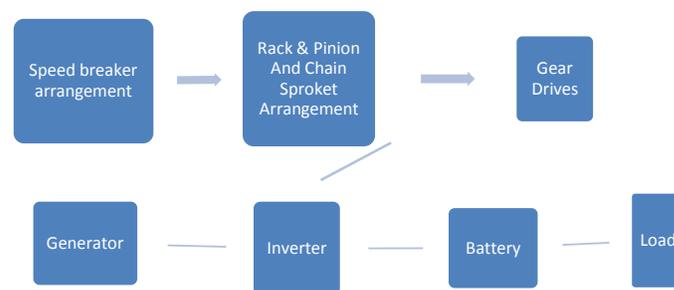


Fig.1 Block diagram of rack and pinion mechanism

2.2 ROLLER MECHANISM

In this system rollers rotate as the vehicle passes the breaker (4). This rollers make the flywheel rotate and flywheel via belt gives power to generator shaft. Maintenance of this system is difficult.

2.3 HYDRAULIC ACTUATOR MECHANISM

In this method as the vehicle passes bump the weight of the vehicle fills the accumulator cylinder with the oil the cylinder having spring return type mechanism this uses the force by the vehicle to pump oil in the accumulators. This hydraulic fluid collected by accumulator is then forwarded to perform the required work. Here hydraulic motor converts the fluid's hydraulic (pressure) energy into mechanical energy.

2.4 CRANK SHAFT MECHANISM

The crank-shaft mechanism consist of the piston, connecting rod and the crank shaft. As the vehicle passes bump the piston goes down, connecting rod attached to piston rotates the crankshaft similar to IC engines crankshaft mechanism. The crank-shaft further connects to flywheel and generator through flywheel generates power.

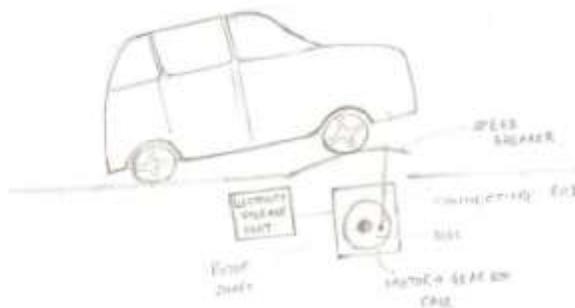


Fig.2 Crank shaft mechanism

2.5 MAGNETIC MECHANISM

A magnetic mechanism consists of translators and stators [5]. When the vehicle passes over the bump, the power gets generated in stators as the translators move downward.

2.6 REGENERATIVE SHOCK ABSORBERS

It has four modules-

1. Suspension vibration input
2. Transmission
3. Generator
4. Power storage

Suspension system because of shocks caused by bumps works and absorbs it. The springs get compressed, dampers take this potential energy and make it come to its original position.

This reciprocation motion through gears and clutch is converted to constant rotary motion through the transmission module. On creating rotary motion, the generator generates power which is then stored by the power storage module.

3 CONCLUSION

Above listed mechanisms are capable of using the kinetic energy of vehicles and converting them into electrical energy.

1. As the weight of the vehicle goes on increasing, more will be the force applied by it on the breaker. If more will be the force, fast will be the reciprocating motion of the rack and hence the rotary speed of the pinion will be more, giving high power to the generator. Similarly for other mechanisms too.
2. If the vehicle passes the breaker with high speed, then reciprocation will be faster and in case of the roller mechanism, rollers will rotate with high angular velocity, giving high power output.
3. If the height of the bump is more, then more is the potential energy gained by the vehicle and more will be the force by which the vehicle will press down the piston and hence more will be the energy generated.

As the regenerative shock absorber is the method by which we can generate energy in the vehicle means this mechanism is to be installed inside the car whereas the other mechanism are to be installed below the breaker or on the side of road.

4 APPLICATION AND FUTURE SCOPE

The generated power can be utilized in various ways. The energy will be generated during day time and It can be used to power up the street lights at night. To meet energy needs on highways this can be used. It also can be implemented on signals, toll booths etc.

To charge the car batteries regenerative shock absorber type mechanism can be used. In this way use of conventional sources can be minimized and efficiency of the vehicles can be boosted.

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