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Power Generation Using Electro Magnetic Suspension

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Abstract-Regenerative shock absorber is a type of suspension system that converts parasitic intermittent linear motion & vibration into usefull energy, such as electricity. Conventional shock absorber simply dissipatesthese energy as heat.

In our project, we use shock absorber, rack & pinion arrangement and dynamo. As shock absorber effect formed, spring is compressed. Linear movement of crank is converted into the 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 leds to generation of energy. And these energy is used to charge the battery and these store energy is use for different vehicle accessories like power window, lights & air conditioners etc. this energy applicable in most of the militaryvehicles,raceautomobiles& maximumsuspensionsystem.

Keywords- Energy Generation, Suspension System, Dynamo

1. INTRODUCTION

We propose a design plan that converts the mechanical energy in cars to electrical energy much more efficiently than it has been done before. The electricity generated will then be used to recharge the car battery for further use for functioning of the car. This project fulfills the course requirements for Ohio State University's ECE Design Project and will be an entry into the Texas Instruments Design contest and the Honda DesignContest.

Fossil fuels are being consumed with very fast rate. Also the cost of fuel is increasing with a very fast rate. Every need of a human being is in/directly related with the cost of fossil fuels like petrol, diesel, cog, and log. So somebody has to work on saving of the fuel consumption. A wide experimentation & work is done on increment of IC engineefficiency.[1]

2. LITERATUREREVIEW

The purpose of this literature review Is to go through the main topics of interest. The literature reviews is concerned with design of spur gear, DC generator, design of shaft, Selection of bearings & shock absorber with Theoretical and experimental evaluation.

1. Zhongjie Li, Lei Zuo*, JianKuang, and George Luhrs , This paper deal with energy-harvesting shock absorber is able to recover the energy otherwise dissipated in the suspension vibration while simultaneously suppress the vibration induced by road roughness.It can work as acontrollable damper as well as an energy generator. The key component is a unique motion mechanism, which we called "mechanical motion rectifier (MMR)", to convert the oscillatory vibration into unidirectional rotation of thegenerator.[4]

Shock absorbers are a critical part of a suspension system, connecting the vehicle to its wheels. The need for dampers arises because of the roll and pitches associated with vehicle and from the roughness of roads. Thus focuses on to develop new correlated methodologies that will allow engineers to design components of shock absorbers by using FEM based tools. Bhoite R.et.al[5]

Regenerative braking systems become increasingly popular, recovering energy that would otherwise be lost through braking. The system was designed in SOLIDWORKS. When used in anelectric vehicle or hybrid electric vehicle the electricity generated by the shock absorber can be diverted to its power train to increase battery life. Analysis was performed in CFD and values are determined.[4]

Rack–pinion mechanism scheme proposed; mechanical motion rectifier (MMR) to convert the oscillatory vibration into unidirectional rotation ofthe generator and this prototype's regenerative efficiency was more than 60% at high frequency excitation, which was much better than previous one. Two over running clutches and a planet gear mechanism to drive a generator, which can realize the similar function. The rotary energy harvesting absorbers translate the up and down suspension vibration into the bi-directional oscillation of the electrical generation and produceelectricity.[5]

3. ELEMENTS

Rack & PinionAssembly

A rack and pinion mechanism is used to transform rotary motion into linear motion and vice versa. A round spur gear, the pinion, meshes with a spur gear which has teeth set in a straight line, the rack

.

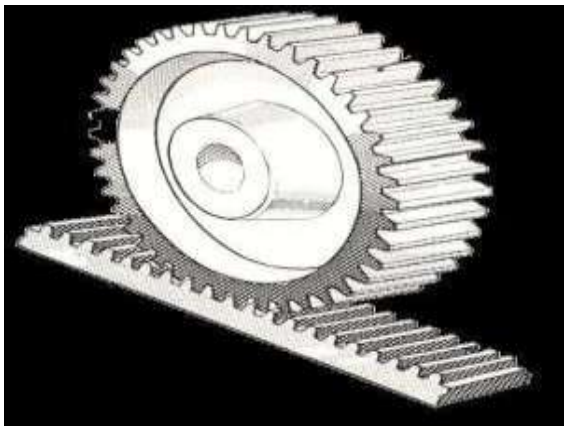

Fig 3.1 Rack And Pinion

A rack and pinion is a type of linear actuator that comprises a pair of gears which convert rotational motion into linear motion. A circular gear called "the pinion" engages teeth on a linear "gear" bar called "the rack"; rotational motion applied to the pinion causes the rack to move, thereby translating the rotational motion of the pinion into the linear motion of the rack[2].

D.C.Generator

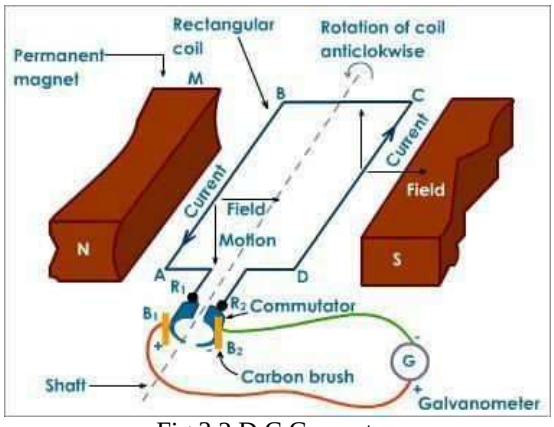

Fig 3.2.D.C.Generator

In electricity generation, an electric generator is a device that converts mechanical energy to electrical energy. A generator forces electric charge (usually carried by electrons) to flow through an external electrical circuit. It is analogous to a water pump, which causes water to flow (but does not create water). The source of mechanical energy may bea reciprocating or turbine steam engine, water falling through a turbine or waterwheel, an internal combustion engine, a wind turbine, a hand crank, compressed air or any other source of mechanical energy [5].

Alternator

Without a commentator, a dynamo becomes an alternator, which is a synchronous singly fed generator. When used to feed an electric power grid, an alternator must always operate at a constant speed that is precisely synchronized to the electrical frequency of the power grid. A DC generator can operate at any speed within mechanical limits, but always outputs directcurrent.

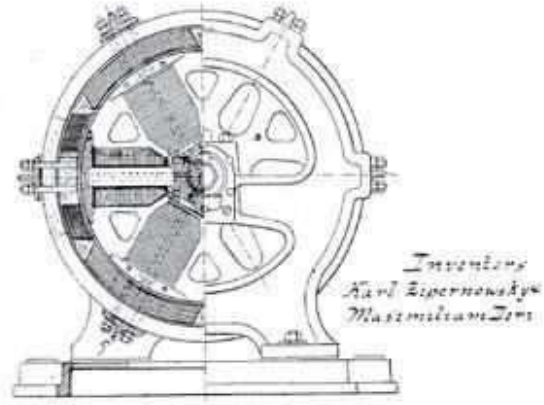

Fig 3.3 Alternator

Typical alternators use a rotating field winding excited with direct current, and a stationary (stator) winding that produces alternating current. Since the rotor field only requires a tiny fraction of the power generated by the machine, the brushes for the field contact can be relatively small. In the case of a brushless exciter, no brushes are used at all and the rotor shaft carries rectifiers to excite the main field winding.

List may be presented with each item marked by bullets and numbers.

Before the connection between magnetism and electricity was discovered, electrostatic generators were invented that used electrostatic principles. These generated very high voltages and low currents. They operated by using moving electrically charged belts, plates and disks to carry charge to a high potential electrode.[4]

4. WORKING

In this project we have to develop a suspension energy generation unit by using rack and pinion method. It is less costly than the hydraulic unit.

1. Vertical movement of rack in actual operation is happened due to suspension movement, but for

experimental purpose we give its movement by hand operation.

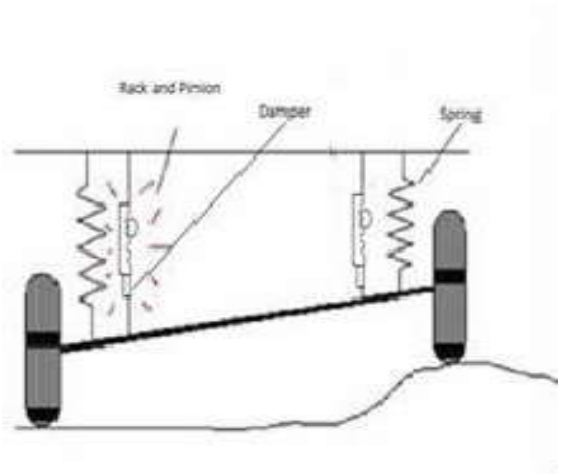

Fig 4. Working system

2. Hand lever is pushed by hand, this pushing of lever results in vertical movement of rack attached to the suspensionframe.
3. This rack drives the pinion meshing withit.
4. On the pinion shaft 2nd gear is mounted which rotates with same RPM as of the pinionspeed.
5. This 2nd gear drives the 3rd gear having bigger dia. Of 98 mm mounted on 2ndshaft.
6. On this 2nd shaft V-groove pulley is mounted.
7.Another pulley is mounted on alternator which is driven by beltdrive.
8. As alternator shaft rotates it cuts the magnetic flux and EMF is generated at theoutput.
9. This EMF generated is used to glow the LED lamp, or we can measure the output voltage and current by using DMM for analysispropose.[5]

5. ADVANTAGES

1. The"electricity-generating suspension system" has a much higher energy yield than other, known inventions for example from the USA, which couple an electricity generator to a conventional suspension system, keeping normal steel springs or airbags and hydraulic shock absorbers. For more information, see: www.levantpower.com
2. In contrast, with the present invention, a much greater proportion of the kinetic energy from the vertical wheel suspension movements and the excess body acceleration energy is converted into electricity by the coupled linear generators, as the usual steel springs and shock absorbers are completely omitted and replaced by a different, completely novel suspensionsystem.
3. The support and suspension function is provided by an electronically controlled, double-action hydraulic cylinder.
4. The vibration-damping function is provided by the mechanically coupled linear generator, the power and damping of which are likewiseelectronically controlled, while it generates electricity at the same time by means of the opposing induction forces ("Lorentz force").[1][4]

6. RESULT

1. Output power at alternator is 3 watts of minimum 5 mm lift of rack which sufficient to glow the LED lamp attached to thealternator.

2. For the variation of lift ±5mm to ±20mm DMM shows the following readings. LED lamps glow when we operate the rack byhand.

3. The experimental results indicate that advantage of motion rectifier is more important, further more the feasibility of this principle and the prototype is verified by experimentaltest.
4. The rack and pinion gears is transmitted to D C generator to the bearing and D C generator generate electricity.

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