

Power Generation through Suspension

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ABSTRACT

Man in his lifetime, uses energy in one form or the other. In fact everything happening in nature is a result of continuous conversion of energy in one form to the other. But nowadays extensive usage of energy has lead to a energy crisis and whole world is suffering now with shortage of energy. This has lead to develop alternate methods to capture energy to face this shortage and minimize the cost of energy production. In this system our main aim was to capture the energy which is generally wasted during the compression and tension of the suspension spring in form of heat and which can be further utilized in form of electrical energy. This device converts the mechanical motion of the suspension and converts the motion into electrical energy which can be used to recharge the battery and for further processes. This project also explains clearly, the working principle of the designed system, its practical implementation, and its advantages. Design of each component has been carried out using standard procedures, and the components have been fabricated and assembled. This system consists of a rack and pinion arrangement connected to a DC dynamo which can produce current in both direction of motion of pinion i.e clockwise and anticlockwise. Practical testing of the system has been done with different loads at different speeds. The utilization of energy is an indication of the growth of a nation. One might conclude that to be materially rich and prosperous, a human being needs to consume more and more energy. And this project is best source of energy that we get in day to day life.

INTRODUCTION

1.1 Introduction to rack and pinion arrangement.

We propose a design plan that converts the mechanical energy in vehicles to electric energy much more efficiently. The electricity generated will then be used to recharge the batteries for further use.

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 etc. So somebody has to work on saving of the energy consumption. We see our automobiles they only consume energy and give us the work, so why not use any component in automobile which might bring a scope of generating power apart from performing its basic function. This leads to the development of a shock absorber which can produce electricity apart from performing its basic function of absorbing shock.

The rack and pinion assembly with shock absorber is a type of system that converts linear motion and vibrations into useful energy, such as electricity. The conventional shock absorber simply dissipate this energy as heat to surroundings.

Thus, the produced energy by the system can be harnessed and stored for operating the various needs of vehicle's components and thus adding some value to the overall efficiency of the vehicle.

We are using a rack and pinion arrangement to convert deflection of suspension in energy. A large amount of energy is wasted everyday due to deflection in suspension which can be used in our day to day life. This project convert the deflection from various jerks of roads to useful energy which can be further used to charge battery and other devices.

LITERATURE REVIEW

Paper 1 :- Power Generation Using Vehicle Suspension.

Inventor :- Shubham R Muley , Pallavi Bhople , Nitin Pandao.

Abstract

Regenerative shock absorber is a type of suspension system that converts parasitic intermittent linear motion & vibration into useful energy, such as electricity. Conventional shock absorber simply dissipates these energy as heat.

Description

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. 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 focus on to develop new similar methods that will allow engineers to design components of suspensions by using analysis based tools. Regenerative braking systems become increasingly popular, recapturing energy that would otherwise be exhausted through braking. The system was designed in SOLIDWORKS. When used in an electric automobile or hybrid electric vehicle the current generated by the suspension can be diverted to its power train to increase battery life. Analysis was performed in fluid dynamics methods and values were determined.

Paper 2:- Power Generation using speed breakers.

Inventor :-D.Venkata Rao , K.Prasada Rao , K.Chiranjeeva Rao.

ABSTRACT

In this paper they used speed breakers for generation of electricity by rack and pinion arrangements, Due to the motion of upper base the pinion is rotated to run dynamo.

DESCRIPTION.

This project attempts to determine how energy can be trapped and used with other types of system, the production of electricity through the speed bumps mechanism. Generation of electricity through the speed breaker mechanism is one of the most recent power generation concepts. This device converts the kinetic energy of the automobiles which goes over a speed bump into electric energy by installing movable speed breaker on the road, it takes the linear motion of the automobiles running on roads and converts it to rotary motion by rack and pinion mechanism and it generates the electricity. This project also explains clearly, the working principle of the designed system, its practical implementation, and its advantages. Design of each component has been done by recommended procedures, and the components have been constructed and assembled. Practical testing of the system has been done with different loads at different speeds. The utilization of clean energy is a clear signal of the growth and prosperity of a nation.

Paper 3 :- Energy Generation by Suspension System.

Inventor :-Ravindra Bhoite, Somanath Jadhav, Akshay Jape, Vikram Phadatare, Amardip Jadhav.

ABSTRACT

Regenerative Shock absorber is a type of suspension system that converts parasitic intermittent linear motion and vibration into useful energy, such as electricity. Conventional suspension simply remove this energy as heat. In our project, we used simple suspension, rack & pinion arrangement and dynamo. 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 assembled on the cylinder which is connected to shaft of dynamo. Due to this mechanism, rotary motion of pinion is used to rotate dynamo. As dynamo rotation leads to generation of energy. And this energy is 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.

DESCRIPTION

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 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 .There is a wide scope for regeneration of energy like regeneration of breaking systematic.

EXPERIMENTAL PROCEDURES

CONVENTIONAL SHOCK ABSORBER

In this section, we will first give an overview about the general type of suspensions , working of general suspensions and their applications.

CONVENTIONAL SHOCK ABSORBER

A conventional shock absorber is a mechanical device which is designed to absorb various kinds of bumps and potholes and give us a smooth and comfortable ride. Most shock absorber are a form of dashpot(a damper which is used to resist motion via viscous friction).



Fig.-CONVENTIONAL SHOCK ABSORBER (1)

As a result, suspensions reduce the:-

- ❖ Bounce, roll and sway.
- ❖ Brake dive and acceleration squat.

WORKING OF SHOCK ABSORBER

A conventional shock absorber reduce the movement of body to produce a coordinated action that keeps the tires planted on the road. Shock absorber are used to damp oscillations be absorbing the energy stored in the spring or torsion bar when the wheels of an automobile moves up and down.

Conventional shock absorbers do not support vehicle weight. They reduce the wheel load variations and prevent the wheel from lifting off the road surface. The shock absorber converts the kinetic energy of suspension motion into thermal energy or heat energy to be dissipate to surroundings.

RACK AND PINION ASSEMBLY

A rack and pinion mechanism is used to convert rotating motion into horizontal motion and vice-versa. A round gear meshes with a spur gear which has teeth set in a long strip.

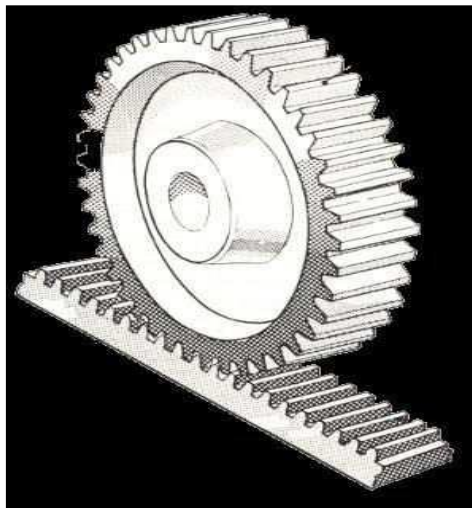


Fig-RACK AND PINION ASSEMBLY Fig(2)

A rack and pinion is a type of linear mechanical device that comprises a pair of gears which converts rotating motion of pinion into linear motion. A circular gear called “Pinion” engages teeth on a linear gear bar called “Rack”. The rotational motion applied to the pinion causes the rack to move, thereby translating the rotational motion of the pinion into the linear motion of rack.

DYNAMO.

A dynamo is an electrical generator that produce direct current with the use of a commutator. Dynamos was the first electrical generators capable of producing power for industry. The foundation upon which many other later electric power conversion device was based, including the electric motor, rotary converter and current alternator.

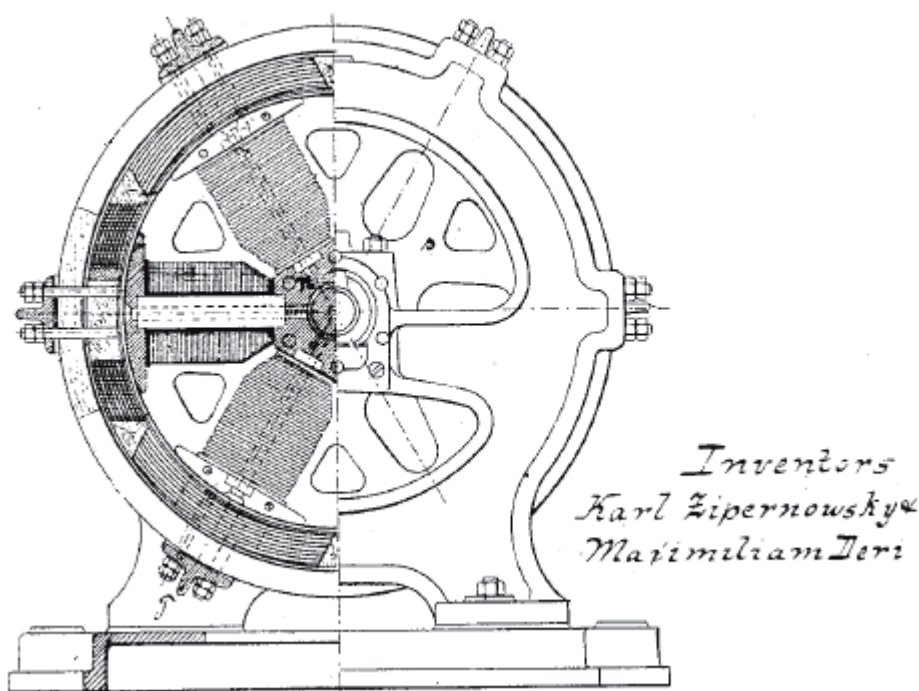


Fig- DYNAMO (3)

The electric dynamo uses rotating coils of copper wound wire and opposing magnetic fields to convert mechanical motion into a DC current through Faraday’s law of induction. The commutator is needed to produce direct current. When a loop of wire rotates in a magnetic field, the magnetic flux through it and thus the potential induced in it, reverse with each half turn, generating an alternating current.

LIGHT DEPENDENT RESISTOR

A light dependent resistor(LDR) or photo resistor is a light controlled variable resistor. The resistance of a LDR decreases with increasing incident light intensity. A LDR can be applied in light sensitive detector circuit and light activated and dark activated switching circuits.

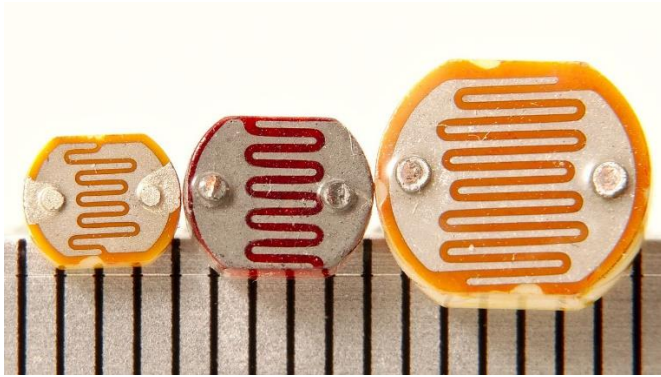


Fig- LIGHT DEPENDENT RESISTOR (4)

A LDR is made of a high resistance semiconductor. In a dark the LDR can have a resistance as high while in the light, a LDR have a resistance as low. When incident light on a LDR exceeds a certain frequency, photon absorbed by semiconductor gives bound electrons enough energy to jump into the conduction band. The resulting free electrons conduct electricity, thereby lowering resistance.

CONSTRUCTION DETAILS-

The rack and pinion assembly is made by using mild steel. The round gear pinion is engages teeth on a linear gear bar called rack.

- This system is constructed using mild steel for housing of the mechanism.
- The rack and pinion assembly is mounted over the housing in such a way that rack is in vertical position and pinion is attached with it.
- A helical compression spring is introduce at bottom of rack assembly, to provide axial force. This axial force is used to maintain position of the assembly.
- Helical compression springs is made up of mild steel.
- Then a dynamo is attached to small gear pinion by means of shaft. For dynamo a pinion rotation acts as input.
- Then it is connected to Li-ion batteries to store electrical energy.
- Accessories like light dependent resistor, control switch, micro-usb cable for mobile charging and LED lights are attached to it.
- In this mechanism, most of the component manufactured by mild steel due to its toughness malleability and good tensile strength.

Specifications of rack and pinion.

- Teeth of Pinion- 25.
- Teeth on Rack – 32.



Fig (5) Prototype

- The early prototype which depicts the approximate arrangement of the rack and pinion system with an actual working suspension.
- The rack will be fitted with the suspension body and the pinion will be attached to it.
- The pinion will be connected to a dynamo which will generate current in a DC form.



4.8 DETAILS OF MODEL

- The model will be fabricated and fitted with a proper working suspension system to provide damping for the vehicle.

- During the reciprocating motion of the suspension, the motion will be transferred to the system which will move the rack.
- The motion of rack will provide motion for pinion which will rotate in clockwise as well as counter clockwise direction.
- This system will be fitted to two wheeler vehicle and can be used with various types of suspension except push rod type.
- In this arrangement helical compression springs are provided at both end of rack. The helical spring regularly provide axial force during reciprocating motion.
- This helical compression springs helps to maintain rack position in the assembly.

RESULT DISCUSSION

- The project aims at converting the wasted energy due to the deflection of the spring in suspension into useful energy.
- The maximum travel of the rack in this arrangement is 5cm.
- This rack and pinion arrangement will be generally used for two wheeled vehicles because it has a higher population in this country.
- The pinion diameter is 5cm.
- The dynamo used is 12V DC dynamo which can produce current in both the rotations that is clockwise and anticlockwise.
- The current and voltage produced at one compression and release of suspension is 150ma and around 3-6volts.
- The output power produced by 1 hour of usage will be 4.905watts.
- The construction is very simple and it can be fitted with any 2 wheeled vehicles.
- This system can be used to generate power in every potholes and speed breakers.

CONCLUSION

- In this project a study has been done on the working of a suspension and also power generation through it.
- This system is very useful for converting wasted energy due to the deflection of the spring in suspension to useful electrical energy.
- The fabricated model of the design will be portable, cost efficient and can be assembled and dismantled according to the use which will increase the mobility of the machine and can be easily carried.

- The machine would be easy to handle because of its mobility and portability and can easily be maintained.
- The parts used to make this system are very easily available and are very cheap and also very reliable.
- Currently this system is only for 2 wheeled vehicles but in future it can also be used for 4 wheeled as well as commercial vehicles.
- This system will be highly effective for rural areas where there is no electricity and the generated power can be used to light homes and localities.

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