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Design and Fabrication of Power Generating System by Suspension System

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Abstract: *The Principle of thermoelectric phenomenon including Seeback Effect and Peltier effects are discussed. Personal and Industrial Context holds an important place of Thermoelectric devices. However, a more efficient materials need to be developed and a mass production techniques need to be adopted to reach this potential. The work here is to focus on development and mass production techniques which are need to be adopted to reach the potential. This work aims at developing combustion based micro power generator as an alternative to low power density electrochemical batteries. Experimental investigations on micro power generation using thermoelectric modules installed around a micro combustor are studied. Results indicate that the Swiss-roll combustors developed in the current study greatly enhance combustion stability in centre regions of the combustors. At times the excess enthalpy of combustor exceeds the extinction limits of methane /air mixtures. Similarly the configuration and thermal arrangements on temperature distribution were evaluated. It also concludes to the principle in applications including its construction and usage is also discussed earlier.*

Keywords: Seeback Effect, Peltier Effect, Heat Generation, Cooler, Suspension.

I. INTRODUCTION

Earlier, regenerative braking system's popularity has been increased, else the braking power would have been lost. Hence the other energy generation process is still in process is regenerative suspension system. The technology continuously recover vibrations that occurs due to road irregularities, vehicle acceleration, and braking and use the energy to reduce fuel consumption. Only 10-20 % fuel energy is required for driving to overcome resistance from road friction and air drag. In addition to both energy, one important loss is kinetic energy gets dissipated by shock absorbers. It was described to develop electricity using real time motion. when the perfect analysis was done it was concluded to generate electricity using relational motion available in a suspension system. Green manufacturing also known as environmentally conscious manufacturing, is mostly in demand today. The future of green manufacturing technology is foreseeable. Since the suspension is an important source, it is easy to treat the energy and convert into regenerative energy to improve efficiency. Instead of converting into heat waves, the damper in regenerative suspension will change into kinetic energy and will save it for future purpose. It can be used for damping force to improve suspension performance for increasing vehicle fuel efficiency.

The Harvested energy in the regeneration process is enough to reach the energy requirement in consumption process, which concludes in the decision that suspension is self powered.



Fig 1.1: Mini Shock Absorbers

Shock absorber is a mechanical device designed for smooth and damping impulse. It can be converted into kinetic energy. It transfers mechanical energy into thermal energy.

The Regenerative Shock Absorber is PGSA. Here PGSA refers to Power Generating Shock Absorber which converts kinetic energy into electricity instead of heat through a Linear Motion Electromagnetic System (LMES). It uses a strong permanent magnet embedded in main piston, coil windings, rectifier, electronic control system for electrical output and load management. The bottom shaft is mounted to moving suspension to reciprocate with annular array of stator winding to produce ac electricity. That is then converted into dc by full wave rectifier. After that it can be stored into required energy and can be stored into batteries to increase battery life. Various research are on the run but they had been concluded on development stage not on installed on production vehicles.



Fig 2.2 Shock absorber Prototype

A. Selection Of Project

There is an impending need to make an acclaim of the non conventional energy. It is also very important to sustain the energy store while utilizing it on conventional basis on large scale. On the other hand enhancing the suitable growth we can reutilize it. Such alternatives are environment friendly and easily replenish able. Growing nations are blessed with both the sufficient resource base and adequate non conventional energy for grid link energy generation and transmission in out of the way locales that are islanded from the grid. Adaption of technology and employing them should be pursued. Wind energy will be the most cost efficient energy resource. Yet this is also in a stable confusion if any other energy didn't hold a centre stage. Thus the theory proposed is "Energy in motion when it is suddenly applied with a sort of obstacle then according to Newton's third law of motion". The basic reason behind the selection of project work is utilization of the above reaction.

II. LITERATURE SURVEY

Ajinkya Pagar [1] proposed a research paper naming Development of Mechanism for Recovery of Lost Energy of Suspension System: Regenerative Shock Absorbers. In these We know that automobiles are inefficient, wasting over 74% of energy which is stored in fuel as a heat. It includes various losses occurring in different parts like vibration of engine, losses while braking, losses of drag, etc. Thus only 26% of the available fuel energy is used to drive the vehicle that is to overcome the resistance from road friction. One important loss is the dissipation of vibration energy by shock absorbers in the vehicle suspension under the excitation of road irregularity and vehicle acceleration or deceleration. In this paper, some of the results and ways which show the effectiveness of efficiently transforming that energy into electrical power by using optimally designed regenerative shock absorbers are discussed. In turn, the electrical power can be used to recharge batteries or other efficient energy storage device rather than be dissipated. The study suggests that a significant amount of the vertical motion energy can be recovered and utilized.

Himanshu S. Rewatkar[2] proposed a research paper naming The main objective of designed the controller for a vehicle suspension system is to reduce the discomfort sensed by passengers which arises from road roughness and to increase the ride handling associated with the pitching and rolling movements. This necessitates a very fast and accurate controller to meet as much control objectives, as possible. Therefore, this paper deals with an artificial intelligence Neuro-Fuzzy (NF) technique to design a robust controller to meet the control objectives. The advantage of this controller is that it can handle the nonlinearities faster than other conventional controllers. The approach of the proposed controller is to minimize the vibrations on each corner of vehicle by supplying control forces to suspension system when travelling on rough road. The other purpose for using the NF controller for vehicle model is to reduce the body inclinations that are made during intensive manoeuvres including braking and cornering. A full vehicle nonlinear active suspension system is introduced and tested. The results show that the intelligent NF controller has improved the dynamic response measured by decreasing the cost function.

Ravindra Bhoite [3] proposed a research paper naming Energy Generation by Suspension System .Regenerative Shock absorber is a type of suspension system that converts parasitic intermittent linear motion and vibration into useful energy, such as electricity. Conventional shock absorbers simply dissipate this energy as heat. In our project, we used shock absorber, 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 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 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.

Zhang Jin-qiu [4] proposed a research paper naming Energy-Regenerative Suspension System for Vehicles -The conventional vehicle suspension dissipates the mechanical vibration energy in the form of heat which waste considerable energy. The regenerative suspensions have attracted much attention in recent years for the improvement of vibration attenuating performance as well as the reduction of energy dissipation. Above all, the amount of energy dissipation and the potential of energy regeneration are discussed, then the research and development of regenerative suspension is reviewed, and the energy

harvesting schemes and their characteristics are summarized and remarked. In conclusion, only combining vibration reducing performance and energy harvesting efficiency can the regenerative suspensions have a promising prospect.

Dr. M.SEKAR [5] proposed a research paper naming Design of Power generation system using Vehicle Suspension. All vehicles have suspension system. Only 26 % of the available fuel energy is used to drive the vehicle, i.e. to overcome the resistance from road friction. One important loss is the dissipation of vibration energy by shock absorbers in the vehicle suspension under the excitation of road irregularity and vehicle acceleration or deceleration. The suspension system mainly consist of a mechanical spring. The objective of this project is to design a vehicle suspension system which can harness the energy. In the present work, spring is a one type of suspension system that converts parasitic intermittent linear motion and vibration into useful energy, such as electricity. In our project, we used spring, rack & pinion arrangement and doubly fed induction generator. 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 doubly fed induction generator. Due to this arrangement, rotary motion of pinion is used to rotate generator. Generation of 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. Power generation is monitored by using PCB circuit with the help of visual basic software.

III. PROBLEM DEFINITION

- A. In Today's Generation, the need for advancement in technology is at priority. In the new Era we need to figure out, how to make comfortable vehicle bodies along with power generation. Our project holds the same aspect as mentioned.
- B. The major problem hold while functioning in inefficient converting of Energy and devices are way being too large due to wrong damping characteristics.
- C. Even the Technical aspects used for the removal of the flaws are making the advancements in shock absorbers, using light weight to improve the efficiency.

IV. METHODOLOGY

The Power Generating Shock Absorber referred as PGSA helps in converting kinetic energy into electricity instead of heat through Electromagnetic system. They are installed between chassis and wheels to suppress the vibrations, mainly caused due to unevenness of road, roughness and road handling. Conventional rotary /regenerative shock absorber converts oscillatory vibrations into bidirectional rotation. Figure shows assembly, where the rotary motion is changed by 90 degree with a pair of bevel gear and electricity is generated in this mechanism.

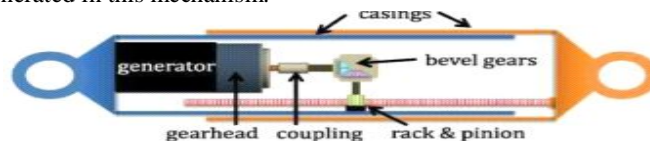


Figure 3: Design of Rack and Pinion Generating Power

- 1) Suspension system holds two types of cylinders. Both having a larger and smaller diameter respectively. When the suspension is applied, the smaller gets into larger diameter suspension and the electricity gets generated and gets stored in battery.

V. DESIGN CALCULATIONS

A. Design Of Rack And Pinion

Lewis form factor is

$Y = 0.289$ for 24 teeth

C_s = service factor

$C_v = 3 / (3 + v)$

And $v = 3.14dn / (60 \times 100)$

$P_t = 2Mt/dp$, $P_{eff} = (C_s \times P_t) / C_v$

Wear Strength, $S_w = bQdpK$

$Q = 2ZG / (ZG + ZP)$

$K = 0.16(BHN) / 100)^2$

BHN = 270 for cast iron material, $K = 1.17$

FOS = S_w / P_{eff}

= $298.77 / 575$

= 0.51



B. To Calculate Time For 6 Volt Battery

$$\begin{aligned}\text{Charging Time} &= \text{Battery time (Ah)} / \text{Current Generated (A)} \\ &= 4.5(\text{Ah}) / 3.2(\text{A}) \\ &= 1.40 \text{ hr}\end{aligned}$$

But it was noted that during charging 40% get loss

$$\begin{aligned}&= 4.5 * 40 / 100 \\ &= 1.8 \text{ Ah}\end{aligned}$$

$$\begin{aligned}\text{Charging time} &= 4.5 + 1.8 / 3.2 \\ &= 1.9 \text{ hr}\end{aligned}$$

To charge a 6 volt battery with this suspension including 40% loss we can charge the battery with 1.9 hr.

C. To Calculate Time For 12 Volt Battery

Consider that the suspension system is mounted on both side of the front suspension.

Total Voltage produced by this suspension system in 18 volt, 64A

Therefore time required to charge a 12 volt, 233Ah battery is,

$$\begin{aligned}\text{Charging Time} &= \text{Battery Current (Ah)} / \text{current generated (A)} \\ &= 33(\text{Ah}) / 6.4(\text{A}) \\ &= 5.15 \text{ hr}\end{aligned}$$

But it was noted that 40% loss during battery charging

$$\begin{aligned}&= 33 * 40 / 100 \\ &= 13.2 (\text{Ah})\end{aligned}$$

$$\begin{aligned}\text{Charging time} &= 33 + 13.2 / 6.4 \\ &= 7.21 \text{ hr}\end{aligned}$$

VI. CONCLUSION

Not similar to conventional shock absorbers, regenerative shock absorbers stores energy and be used further. On the other hand, the conventional energy is dissipated as heat energy and can be further regenerated which brings hope for recycling the wasted energy. The required suspension and their advancement are reviewed in this paper. With the advancement, One day the regenerative will be the top most trend of the automobile industry. As the advancements are discovered, it ultimately raises the efficiency of the vehicle and can also be referred as a vista of green technology.

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