POWER GENERATION USING SHOCK ABSORBER BASED ON MECHANICAL MOTION FOR AUTOMOBILE ENGINEERING

M. RAVITEJA, M. RAHUL , C. MANIKANTA

V Kiranmayi

Sree Dattha Institute of Engineering and Science, Hyderabad.

Abstract: 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 a controllable damper as well as an energy generator. Abstract- Regenerative shock absorber is a type of suspension system which converts linear motion & vibration into useful energy, such as electricity. Conventional shock absorber simply dissipates this energy in the form of heat. In our project, we use shock absorber, belt & pulley arrangement and dynamo. As the effect of shock absorber, the telescopic link moves up and down. Linear movement of belt will rotate the pulleys which are mounted on dynamo shaft. So, dynamo shaft will rotate along with pulleys. Dynamo rotation led to generation of energy. And this energy is used to charge the battery.

DISCRIPTION:

- An innovative design of regenerative shock absorbers is proposed in this paper, with the advantage of significantly improving the energy harvesting efficiency and reducing the impact forcescaused by oscillation.
- The key component is a unique motion mechanism, which we called “mechanical motion Rectifier (MMR)”, to convert the oscillatory vibration into unidirectional rotation of the generator. Animplementation of motion rectifier based harvester with high compactness is introduced and prototyped. A dynamicmodel is created to analyze the general properties of the motion rectifier by making analogy between mechanicalsystems and electrical circuits.
- The model is capable of analyzing electrical and mechanical components at the same

time.

- Both simulation and experiments are carried out to verify the modelling and the advantages.
- The prototype achieved over 60% efficiency at high frequency, much better than the conventional regenerative shock absorbers in oscillatory motion.

INTRODUCTION

According to first law of thermodynamics, “Energy cannot be created, nor destroyed. It can only be changed from one form to another”. So we should be very careful while dealing with the energy. But most people do not feel it necessary or essential to save energy for future. Conservation of energy is not natural & takes a lot of time. So our aim is to utilize maximum kinetic energy generated from the suspension of a vehicle which is getting waste. Electricity is something that people cannot live without in the modern day. Without it, life will be so much difficult and slow. We need to learn how to value electricity and learn how to produce it from renewable sources. We propose a design plan that converts the mechanical energy in vehicles to electrical energy much more efficiently. The electricity generated can be used to recharge the small battery which can be further used for functioning of the vehicle accessories. In 2005, David Oxen writer of Boiling Springs, PA, presented a design for an electricity generating shock absorber. Experimental Bosch suspension systems have generated electricity. Problems have included the devices being too large, too expensive, and too inefficient in converting electricity or just poor shock absorbers because they dispensed with the spring or had the wrong damping characteristics. We have worked 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. This shock absorber is extended with a mechanism which will help to convert reciprocating motion into rotary motion. It will be used to generate electricity using the real-time motion available in suspension system of a two-wheeler or fourwheeler. In the constructional part, this electricity generating device is a mechanical link assembly, in which there are two sets of links- one is an outer set of links, which is fixed and other is inner set of links, which is collapsible one. The outer set of links supports permanent magnet DC generator, which are in physical contact with the collapsing or inner set of link of the link assembly. This link assembly can be mounted along with the suspension system of the vehicle. In two wheeler, two such types

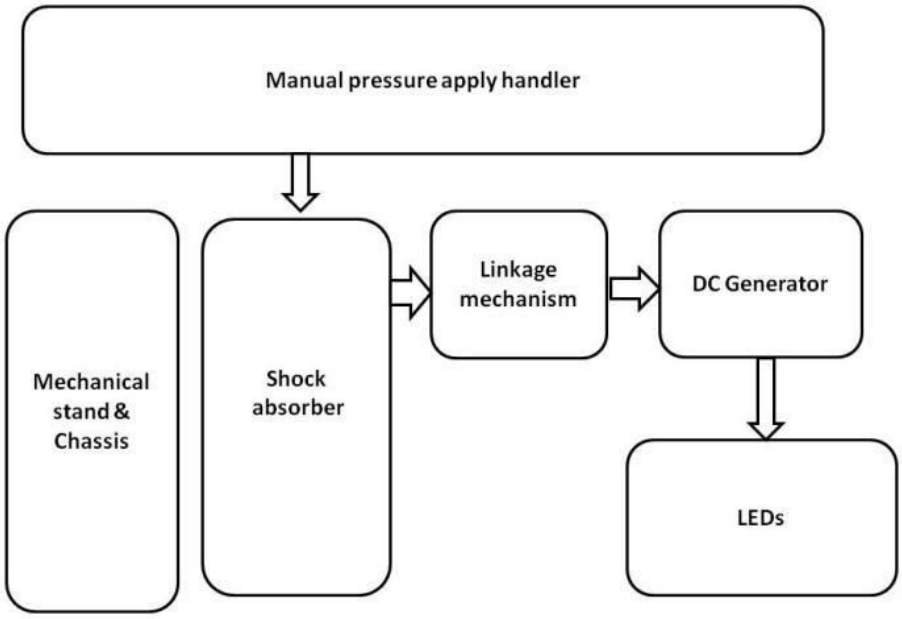
of electricity generating devices are used and in four wheeler, four such electricity generating devices are used. We are aggregating one such electricity generating device for one wheel's suspension unit. When the vehicle is in running condition there is always relative motion between wheel and the chassis thereby there will be relative motion between the two links of the electricity generating device, hence the permanent magnet DC generator are actuated and thus electricity is generated. This electricity can be used to charge the small battery.

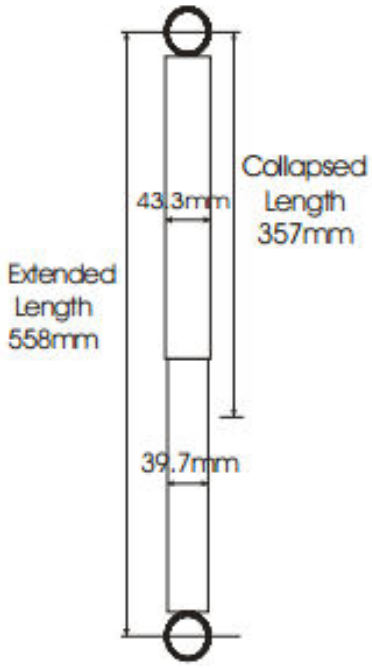
II. LITERATURE REVIEW

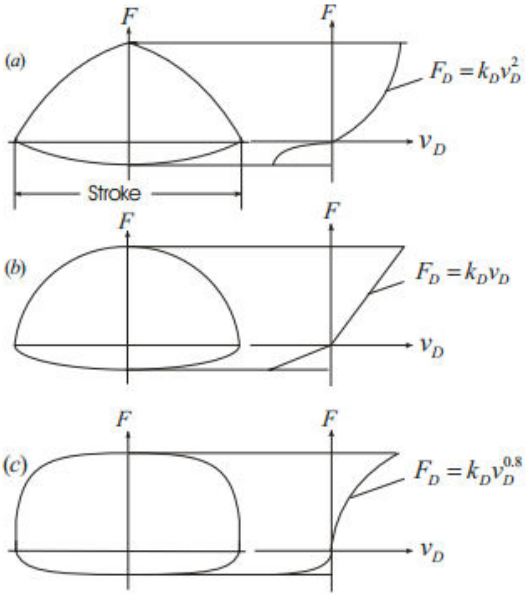
The research about energy recovery from vehicle suspensions began more than ten years ago, first as an auxiliary power source for active suspension control, and later also as energy regenerating devices in their own accord. During the past ten years, energy recovery from vehicle vibrations has achieved great commercialization success in hybrid or electric vehicles[11]. Some earlier efforts to recover energy from suspension are Lei Zuo, et al. have worked on a prototype design of Electromagnetic energy harvester for vehicle suspension. In that paper they have designed, characterized and tested a prototype retrofit regenerative shock absorber. Gupta et al, (2003) has studied the available energy from shock absorbers as cars and trucks are driven over various types of roads. They fabricated two prototypes of regenerative electromagnetic shock absorber: a linear device and a rotary device and installed them in vehicle to study energy recovery[8]. Goldner, et al. (2001) have carried out a proof-of-concept - to evaluate the feasibility of obtaining significant energy savings by using regenerative magnetic shock absorber in vehicles. They proposed electromagnetic (EM) shock absorbers to transform the energy dissipated in shock absorbers into electrical power. P. Zhang et al. have presented comprehensive assessment of the power that is available for harvesting in the vehicle suspension system and the tradeoff among energy harvesting, ride comfort, and road handing with analysis, simulations and experiments. Zhen Longxin and Wei Xiaogang have modeled the structure and dimensions of a regenerative electromagnetic shock absorber in CAD software package. S. Mirzaei. et al introduced a passive suspension system for ground vehicles based on a flexible Electromagnetic Shock Absorber (EMSA). They designed and provided a model of passive suspension. Bart Gysen et al., have studied design aspects of an active electromagnetic suspension system for automotive applications which combines a brushless tubular permanentmagnet actuator with a passive spring. N. BabakEbrahimi, presented the feasibility

study of an electromagnetic damper, as senor/actuator, for vehicle suspension application. They have optimized geometry of shock absorber to achieve higher electromagnetic forces and magnetic flux induced in the system.

BLOCK DIAGRAM:







Regenerative shock absorber:

A **regenerative shock absorber** is a type of shock absorber that converts parasitic intermittent linear motion and vibration into useful energy, such as electricity. Conventional shock absorbers simply dissipate this energy as heat.

When used in an electric vehicle or hybrid electric vehicle the electricity generated by the shock absorber can be diverted to its power train to increase battery life.

USES:

- The Shock Absorber is used to generate the power.
- That generate the power and power is stored in the battery. It is a dc voltage its can used to only AC electrical appliances.
- So the Shock Absorber output of DC voltage is converted to AC through inverter section and the inverted output is used to electrical load. Thus the power is generated use of Shock Absorber.

ProjectMain features:

- Link Mechanisms.
- Dynamo working

Using Modules:

- Generator
- Shock absorber
- Link mechanism unit
- Pressure handler
- Base and chassis

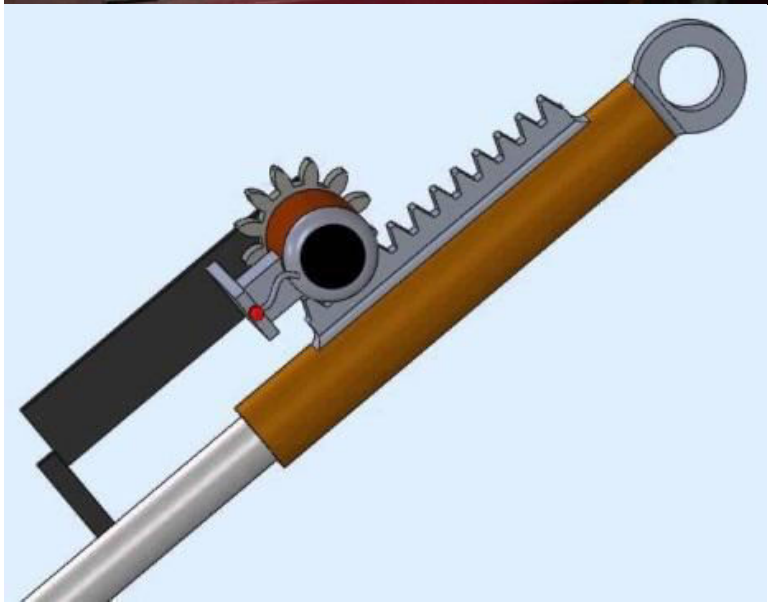
III. FABRICATING COMPONENTS

Sr. no.	Components	Details	Specification	Quantity (Nos.)
1	Dynamo Motor	4 -12 Volt	-	4
2	Horizontal Plates	85 mm X 105 mm	8 mm thick wooden plate	4
3	Vertical Plate	80 mm X 40mm	8 mm thick wooden plate	2
4	Flat Belt	35mm X 300 mm	1 mm thick rubber belt	1
5	Rectifier	-	Full Wave	1
6	Stud rods	5 mm diameter X 230 mm length	Stainless steel	8

4.2.Working of Project

When the electricity generation model is mounted on the vehicle, it moves linearly due to the movement of suspension of vehicle. So the initial working position of the model is as shown in figure.When the suspension works, the model moves linearly. Also the flat belt moves linearly with the model. The belt is of rubber material, as it rolled over the pulley. The movement of belt allows the pulley to rotate. The pulleys are mounted over the generator shaft. In this way linear motion is converted into rotational motion.

- **Project demo view (Regular model)**



5.1. Component Cost Estimation Table

5.2 Advantages and Disadvantages

5.2.1. Advantages

There is generation of electricity without polluting

- the environment. It works on the mechanical motion caused by vehicle
- suspension; hence, no external source require for energy generation. with help of charge generating system the batteries

• are charged during running of the vehicle. Simple in construction there by low in maintenance

• because there are less moving parts in the system Will work with almost all type of electric vehicle as

• every vehicle require suspension system and the system being very easy to install there fore can be affixed to various vehicles easily. Do not increase unspring weight as the system's

• generator's are mounted on fixed link and the device is mounted between chassis and the suspension system. It is more reliable for light purpose in suspension

• bicycles. Low Noise

• & Low Vibration & Control for charging.

5.2.2. Disadvantages As the number of generating components

• & size of components is minimum, so power generation is restricted i.e. it can be used for lighting purpose only. On smooth road power generation is less.

• It will make the suspension system complex

.• As whole system consists of electric wiring, so there

• are chances of short circuits.

VI. CONCLUSION & FUTURE SCOPE

6.1.Conclusion

Energy Generation using vehicle suspension is very efficient and useful in converting the Kinetic Energy in to electric energy that can be used to fulfill 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. It can give better results than alternator by recovering the maximum amount of energy from the suspension. It will definitely extend the range of electric vehicles.

6.2. Future Scope

The scope for this project is that it is simple in construction and design and has low in price. It is easily mounted on the chassis of the vehicle. It is able to generate sufficient electricity for different accessories of vehicle. We can increase power of system by increasing the size and number of generators. By increasing the no. of DC motor, generation of power get increases which are used to charge high voltage battery. If we mount the system on each suspension & common output is taken then we can get the higher value of power generation. The size of this system is little bulky, so the design can be improved as per requirement, and size can be minimize as per the mountable conditions. Further improvement in the suspension design makes it suitable for any two wheelers. This system can be used on to the mono suspension system by making suitable design. By modifying this system, we can implement this on to the electric car.

REFERENCES

[1] Arekar, M.P. and Shahade, S. (2015). Power Generating Shock Absorber. International Journal of Innovative Research in Science, Engineering and Technology, Volume 4, Issue 3: 169-178.

[2] International Journal of Engineering Technology, Management and Applied Sciences www.ijetmas.com March 2015, Volume 3 Issue 3, ISSN 2349-4476.

[3] International Journal of Pure and Applied Research in Engineering and Technology, Research Article Impact Factor: 0.621 ISSN: 2319-507X SwapnilKamthe, IJPRET, 2014; Volume 2 (9): 169-178 IJPRET.

[4] Proceedings of the World Congress on Engineering 2013 Vol III, WCE 2013, July 3 - 5, 2013, London, U.K.

[5] International Journal of Engineering Science and Innovative Technology (IJESIT) Volume 3, Issue 4, July 2014.

[6] Automobile Engineering Vol.1 by Dr. Kirpal Singh-(181- 182).

[7] M.Sailaja, M.Raja Roy, S.Phani, “Design of rack and pinion mechanism for power generation at speed breakers”

[8] Rahul UttamraoPatil, Dr. S.S.Gawade, “Design and static magnetic analysis of electromagnetic regenerative Shock absorber”

[9] D.VenkataRaoȦ, K.Prasada RaoȦ, S.Chiranjeeva RaoȦ and R.Umamaheswara Rao “Design and Fabrication of Power generation System using Speed Breaker” International Journal of Current Engineering and Technology E-ISSN 2277 – 4106, P-ISSN 2347 - 5161 ©2014 INPRESSCO® Vol.4, No.4 (Aug 2014)

[10] C. M. Pramodh, S. R. Shankapal “Regenerative Shock Absorber for Hybrid Cars” Department of Automotive & Aeronautical Engineering, M. S. Ramaiah School of Advanced Studies, Bangalore- 58 Page No. 41 to 45