

# Design Development of Regenerative Shock Absorber

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**Abstract:** With the increasing quantity of possessed automobiles, it has received a great deal of attention from automobile manufacturers and government for the energy conservation and environmental protection both at home and abroad. To protect the environment and reduce vehicle emissions and fuel consumption of vehicles, it is necessary to recover the energy wasted by the car, such as the braking energy, engine exhaust emissions energy and vibration energy of suspension, etc. Usually the vibration energy caused by road roughness when car runs has not been paid attention to and it is wasted through conversion to thermal energy. If the vibration energy can be recovered and converted to other form of energy such as electric or hydraulic power so to supply for other devices, then the aim of eco-friendly energy-saving is reached. In this project the vibrational energy was converted to electric energy through the innovative shock absorbers, which rectifies the linear shock absorber motion and converts kinetic energy into electrical energy by using generator.

**Keyword:** Rack, Pinion, spring, Oil.

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## 1. INTRODUCTION

A **shock absorber** is a mechanical or hydraulic device designed to absorb and damp shock impulses. It does this by converting the kinetic energy of shock into another form (typically heat) which is then dissipated. A shock absorber is a type of dashpot.



Figure.1: Shock absorber

Shock absorber is one kind of damper used in automobile for smooth driving of vehicle on rough ground. The main purpose of a shock absorber is to limit overall vehicle body movement or sway. As a vehicle is driven, the body will move up and down or side to side by various degrees in response to driving and road conditions. These types of vehicle

movements are held in check by shock absorbers. Depending on road conditions or driving style, a vehicle can go from smooth and controlled to bumpy and erratic in a short time period. Shock absorbers stabilize the overall vehicle ride, preventing an excess of vehicle body lean or roll in any one direction, especially when cornering or navigating sharp turns

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.

## 2. NEW REGENERATIVE SHOCK ABSORBER

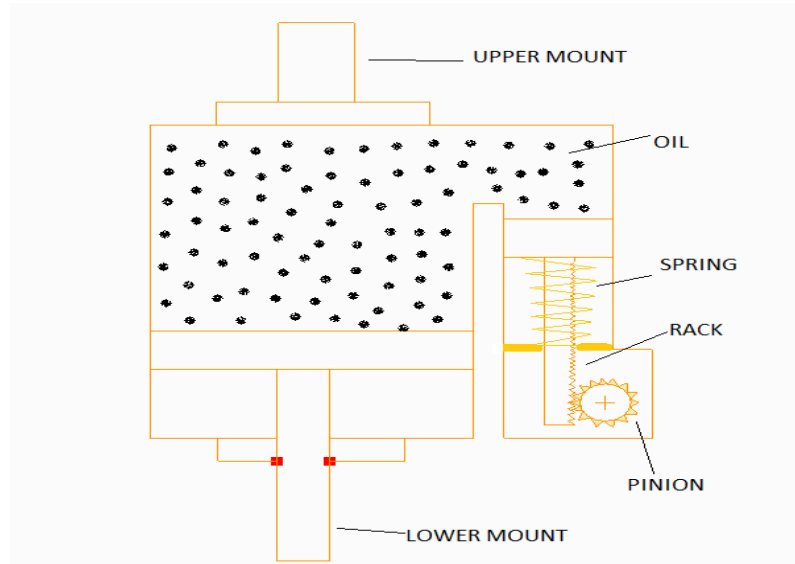


Figure.2: Regenerative shock absorber

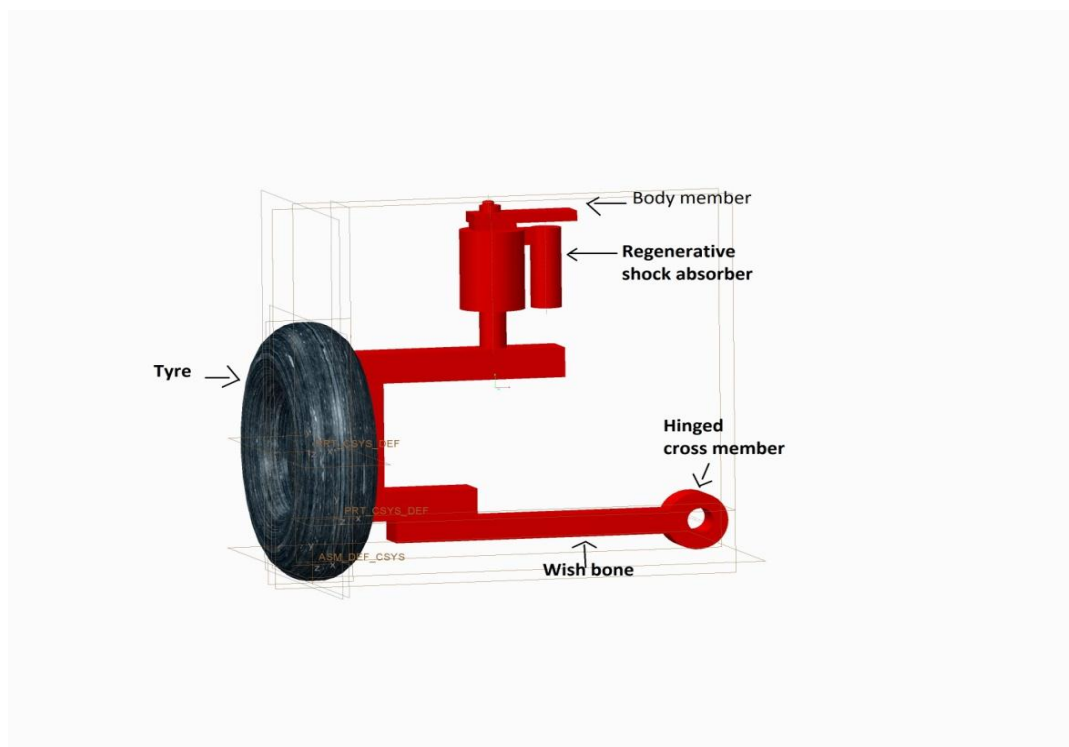


Figure.3: Regenerative shock absorber in suspension system

## 3. WORKING

Figure 2 shows the mechanism of regenerative shock absorber. Shock absorbers are installed between chassis and wheels to suppress the vibration, mainly induced by road roughness, to ensure ride comfort and road handling.

First produce linear motion in big cylinder by road roughness. This linear motion rectify in second cylinder by volume difference in two cylinders, so second cylinder have large linear motion compare to first cylinder. This linear motion of second cylinder converts into rotary motion by rack and pinion gears. Suitable size generator is attached with the pinion gear, which rotate and convert kinetic energy into electrical energy. This output electricity we can use either for store in battery or other purpose.

How and how much power produce by this mechanism is we can shown by using secondary mechanism in which hydraulic mechanism replaced by mechanical linkage to show the concept of actual mechanism. This secondary mechanism is not actual mechanism, But it shows only concept how motion rectify and power produce in actual mechanism.

#### 4. SECONDARY MECHANISM

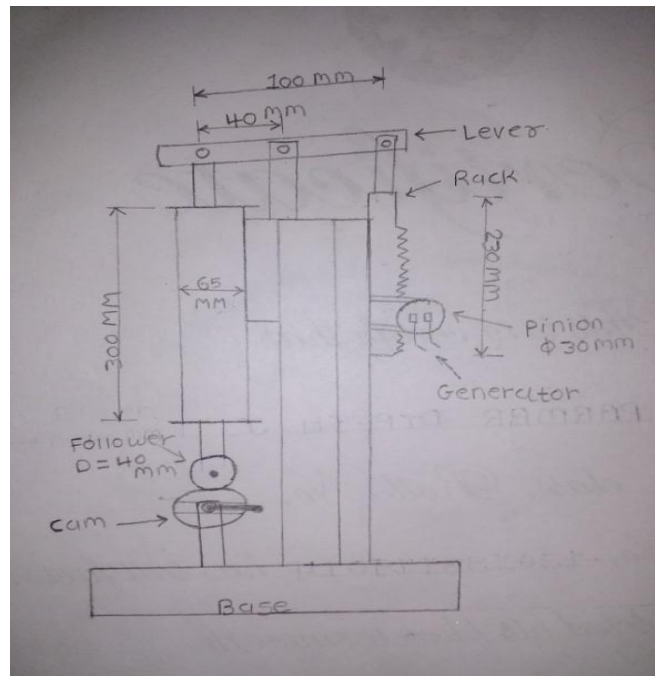


Figure.4: Secondary Mechanism

As shown in figure, in secondary mechanism jerk produce on shock absorber is rectifying by lever. Shock absorber is joined with small end of lever while rack is joined with mechanical linkage at big end of lever. So small motion of shock absorber rectifies and we get large linear motion at big end. Linear motions of rack produce rotary motion on pinion. Two generators is couple with pinion which rotates with pinion. So both generator produce electricity, one generator at downward motion of rack and one generator at upward motion of rack

#### 5. PRODUCE POWER CALCULATION

Pinion diameter: 40 mm

Lever small end length=  $L_1 = 40$  mm

Lever big end length =  $L_2 = 100$  mm

Shock absorber diameter = 65 mm

Shock absorber length = 300 mm

Rack length = 230 mm

Follower diameter = 40 mm

Now, outer stroke of follower is 65 mm. So due to jerk linear motion get shock absorber is 65 mm.

Rectifying motion produce in second cylinder:

$$\frac{L_2}{L_1} = \frac{R_2}{R_1}$$

$$\therefore \frac{100}{40} = \frac{R2}{65}$$

$$R2 = 112.5 \text{ mm}$$

$$R2 \cong 162 \text{ mm}$$

45 mm linear motion rectifies in lever and produces 162 mm motion. But rack is hinged at second end of lever, So linear motion get by rack is 162 mm.

$\therefore$  Pinion rotation/ jerk in absorber:

$$= 162/40$$

$$= 4.05 \text{ Revolution.}$$

Pinion get near about 4 revolutions per jerk. Both generators is coupled with pinion so both generator get 4 revolution per jerk and produce power.

Power measured from both generators during jerk acting of absorber by MultiMate in one generator is 8 volt, so both generator produce:

$$= 8+8$$

$$= 16 \text{ Volt}$$

So, Generator produces 16 voltage per 65 mm jerk produce in regenerative shock absorber.

## 6. ADVANTAGES OF REGENERATIVE SHOCK ABSORBER

- Improved the fuel economy
- Continuous supply of energy
- Mechanism is not so complex
- Easy to mount and use of shock absorber
- Low Maintenance cost
- Regenerative shock absorbers more efficiently work on train and have wide scope in train, Because in train, Continuous vibration produce and we get continuous motion in each and every coach. If we implement this system in train, we can get large amount of electrical energy which west in the form of heat energy.

## 7. CONCLUSION

Regenerative shock absorber uses west heat into useful work. Design development of this new regenerator shock absorber is used working medium is fluid (Oil) and it produce power by rectify the motion. This is shown by concept of secondary mechanism. So, we concluded that regenerative shock absorber efficiently work and produce power which we can use for other purpose.

## REFERENCES

In preparing this report, we took help of following books:

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