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UNIVERSITI TEKNIKAL MALAYSIA MELAKA

Faculty of Mechanical And Manufacturing Engineering Technology

RESEARCH OF MAGNETIC SHOCK ABSORBER WITH USING SPRING

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DECLARATION

I hereby, declare that this report entitled “Research Of Magnetic Shock Absorber With Using Spring” is the result of my own research except as cited in the references.

Signature : .....

Author’s Name : .....

Date : .....

APPROVAL

This report is submitted to the Faculty of Mechanical and Manufacturing Engineering Technology of UTeM as a partial fulfillment of the requirements for the degree of Bachelor of Mechanical Engineering Technology (Automotive Technology) with Honours. The member of the supervisory is as follow:

…….

(Ts. Mohd Ruzi Bin Harun)

ABSTRACT

In the fast-paced world, the vehicle makes use of the shock absorber to achieve shock absorption and the different types of vehicles are used to move from one place to another. Therefore, the maintenance of the vehicle suspension system is a cost factor that consumers must bear to avoid accidents and to obtain a comfortable drive. In this project, a study on magnetic shock absorber with spring was carried out to replace fluid shock absorber where commonly used in vehicle suspension systems to save on maintenance costs incurred by users. For making a magnetic shock absorber prototype by using the old shock absorber part, the selection for magnet materials and some spring to support the magnet are done without any problems. The magnetic shock absorber were analyze by using load testing machine and the result show the magnetic shock absorber can be use in light vehicle and needs some improvement for be more effective.

ABSTRAK

Dalam dunia yang pesat membangun ini, kenderaan menggunakan penyerap kejutan untuk mencapai penyerapan kejutan dan pelbagai jenis kenderaan yang digunakan untuk bergerak ke sesuatu tempat ke satu tempat yang lain. Oleh itu, penyelenggaraan sistem pergantungan kenderaan adalah satu faktor kos yang perlu ditanggung oleh pengguna bagi menggelakkan kemalangan berlaku dan untuk mendapatkan pemanduan yang selesa. Untuk membuat prototaip penyerap kejutan magnetik dengan menggunakan bahagian penyerap kejutan lama, pemilihan bahan magnet dan spring untuk menyokong magnet dilakukan tanpa sebarang masalah dan memenuhi keperluan yang diperlukan. Menganalisa "Magnetic Shock Absorber With Spring" dengan menggunakan mesin ujian beban dan hasilnya menunjukkan "Magnetic Shock Absorber With Spring" boleh digunakan dalam kenderaan ringan dan memerlukan penambah baik untuk menjadi lebih berkesan

DEDICATION

Dedicated to my father, Borhan Bin Abdollah and my mother, Rohanida Binti Hasanuddin. To my supervisor, Ts. Mohd Ruzi Bin Harun, all lecturers, classmate and friends for all of their information, help and friendship.

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$E = Tension$

$G = Shear$

$\mu = Poisson's\ Ration$

N = *Newton*

Kg = *Kilogram*

Mm = *Milimeter*

CHAPTER 1

1.0 INTRODUCTION

This report follows the research and development of a third year mechanical manufacturing automotive project from inception to completion. It discusses the function of shock absorber, the problems encountered and what has been done to solve these problems.

This chapter will introduce the purpose and purpose of this project. The reason and its purpose will be represented in this chapter based on background, the problem of statement, objective, and scope.

1.1 Background

In automotive, shock absorber be use to reduce traction effect on rough ground, without the shock absorber vehicle will have a bounce while ride, as energy is stored in spring and released to the vehicle, probably exceeds the permitted movement limit of suspension. To controlling the excessive suspension movement without shock absorption it needed spring of stiffer, which might provides a uncomfortable ride. The shock absorber allows the use of soft springs while controlling the rate of suspension motion in response to the bump. In this project the system of suspension is based on permanent magnetic power which on future can be used in automotive industry. The suspension consists two of magnets where one are freely moving and another one is fix inside the cylinder of absorber with the same pole facing each other. Since permanent magnet poles pole suppresses one another while moving closer, upper and lower spring action is obtained.

1.2 Problem of Statement

As we know, for vehicle and motorcycle which makes use of the shock absorber to achieve shock absorption. However most of shock absorber are not optimally design in its strength and durability. In addition, the user maintenance costing are not carefully taken into account during design process. This also can reduce the cost of maintenance because it maybe does not require repairs, changing the springs or leakage problems in spring or oil on shock absorbers.

To analyze durable and strong the magnetic shock absorber is the main purpose of this project. As the same time, the maintenance of the user also will put into consideration in designing with a comfortable ride on the normal road and on the bumpy road.

1.3 Objective

The purpose of this report is :

i. To build prototype of magnetic shock absorber with a strength and durability.
ii. To analyse the magnetic shock absorber by using load testing machine.

1.4 Scope

This project scopes are:

i. Focus on the term of low costs maintenance of product in order to deliver saving costing of maintenance to the user.
ii. Making a magnetic shock absorber prototype by using the old shock absorber part, magnet and some spring to support the magnet.
iii. Anaylze the strength and durability magnetic shock absorber by using load testing machine.

CHAPTER 2

2.0 LITERATURE REVIEW

This chapter is about literature studies and research on journals, reference of books, and the articles are related to this project. The journal has been carefully consulted as there are some knowledge and information from paper that can be used and applied until the project ends. A literature review is a process that will complete this project. Sources of the literature review are journals, references of books, thesis and other sources from the internet.

2.1 The Suspension of Vehicle

In the automotive industry, to reduce the effect of travel on the rough of ground, lead to improving driving and traveling qualities, and increase the comfort of driver and passenger, vehicle suspension its use because the amplitude of the disturbance is significantly reduced. If there no has a shock absorber, a bounce trip will have on the vehicle. We need to use a harder stiffer spring to control the excessive suspension movement, which will be a hard ride. To control the movement rate of suspension where it reacts to the bumps using the soft springs are needed, Since the spring are softer than the tires, for the motion of vehicle alone, it may be required stiffer shocks more than ideal for effective wheel bounce damping. In tensional shocks as well, torsion bars can be used but the coil springs or leaf springs are commonly in spring-based uses The spring only store and doesn't release or absorb the energy and the ideal spring is not a shock absorber. Hydraulic shock absorber usually uses employ springs and torsion bars on the typical vehicle. In this combination, the piston of hydraulic that absorbs and eliminates the vibration is allocated specifically for the shock absorber.

2.2 Shock Absorber

As a device that helps to the recovery of the movement and controls the impact of the spring and suspension of our vehicles the shock absorber known as a hydraulic pump. The shock absorber's main role is to ensure the road surface and the tires of the vehicle always in contact at all of the times, which ensures the braking response and the safest control from our car with smoothening out the vibration and bumps.

By taking the energy of kinetic (movement) of our suspension and change the form to the energy of thermal (heat) and then disappear to the atmosphere surface through the change mechanism of heat is that how shock absorber works.

As stated earlier, the oil pump is essentially a shock absorber. At the final part of the piston rod, the piston is were attached to it and works with the fluid of hydraulic inside the pressure tube. When the movement of suspension is upward and downward, inside the piston, the fluid of hydraulic is be forced to through the orifices hole (small holes). Cause the small amount of fluid can be through on the piston, the piston slowly thus slowing down the movement the spring and also the suspension.

The shock absorber automatically adjusts to the road conditions as faster the suspension moves, the more obstacles they provide.

2.3.Sock Absorber Working Principle

Although shock absorber already is used since the vehicle has been to introduce, they are not understood by the general public. Even automotive fans will ignore and always ignore the shock absorber on their car, damaging the performance of vehicle handling and travel comfort.

Whereas, it can be dangerous if the shock absorber is already worn or damage, especially during a severe movement that may be needed to avoid accidents. As we should see, we have less respect to shock absorber cause look like simple things but it's an effective device.

2.3.1 The Gravity On Situation

Quitely strange, through the name of shock absorber, the shock absorbers do not absorb the shocks. In fact, it is a spring job in a system of the vehicle suspension, the wheel will move upward when the wheel unexpectedly be faced with a bump by compresses and storing the bumping energy into the spring. The bump shock as the truth absorbs by this compression.

Now the spring has been compressed, it is contains the energy of potential that must to removed. The spring will be bouncing back to the original length if it is uncompressed, on that time the spring will push the vehicle body to move upward. An a example of some old statement "what goes up, must come down," the earth gravity pulls the vehicle body weight to down, it is compressing the spring. If that the shock absorber already worn, the vehicle will not stop bouncing until all the energy is used. The bounce will make vehicle tire not touch the road or ground surface, its a worst experience ride and vehicle will be uncontrolled. [Source: Kevin Clemens, 2019.]

2.3.2 How Shock Absorber Work

For as we all know the working system of the shock absorber is the same way. At the inside of shock absorbers there is a piston moving in a tube

filled with oil. When the piston are moving, the oil will be forced through the small holes and valve in the piston, with accurately controls the amount of resistance to movement. The resistance to the movement converts that energy to be a heat.

Unless there is an existing moisture structure, the car spring will expand and at an rate of uncontrolled, the energy absorbed from the bump are be released. At its natural frequency, the spring will continuing bouncing so that all the energy that is first inserted into its used. The suspension are built on spring only will make very bouncy ride, depend on the road surface and an a car are not in handling condition.

The damper is a device to control unwanted spring movement in a process shock absorber or snubber. To slow down and reduce the vibratory movement magnitude, the shock absorber is releasing the energy of heat through the hydraulic fluid by turning the energy of kinetic on suspension movement into the energy of heat. For more understand how it works the best way is a looking inside the shock absorber for look the function and the structure.

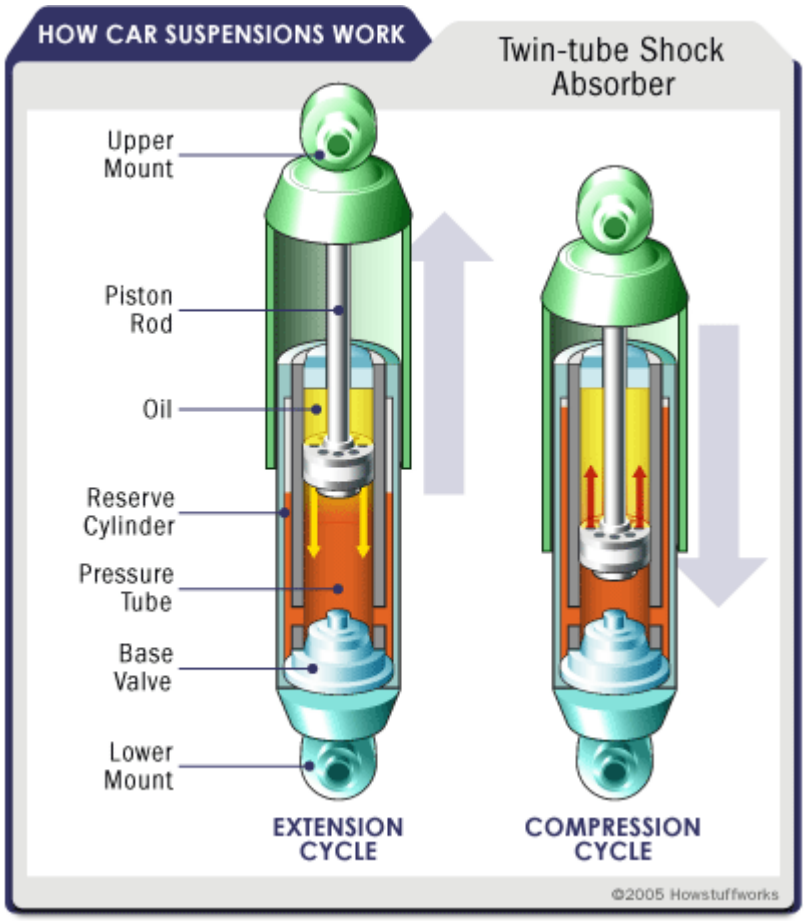

Figure 2.1: Example of Shock Absorber

[Source:(JAMALUDIN & A, 2012)]

For basically, the oil pump is placed between the car frame and the wheel for shock absorber. The sprung weight is a shock upper mount are connected to the car frame and the lower mount connected to the wheel known as unsprung weight. For the design of twin-tube, the most common shock absorber types are used where the piston rod is connected with the upper mount then connected to the piston placed in the tube filled with hydraulic oil or fluid. The pressure tube and the reserve tube are known as an inner and outer tube, the reserve tube be used to store excessive fluid of hydraulic.

The spring from the coil to uncoil when the spring energy is transfer to shock absorber through the top mount by the rod of the piston into the piston. This is because the wheel encounters the road surface bump. When the movement of suspension is upward and downward, inside the piston, the fluid of hydraulic is be forced to through the orifices hole (small holes). Cause the

small amount of fluid can be through on the piston , the piston slowly thus slowing down the movement the spring and also the suspension.

The shock absorber has a two-cycle process of work where it is the compression and extension cycle. When the compression cycle process it is happening in the below of chamber, the piston moved downward and compress the fluid of hydraulicThe same way as the compression cycle but the difference with the extension cycle it is happening in upper of chamber. A typical car or light truck will have more resistance during the cycle cycle than their compression cycle. Thus, the compression cycle controls the weightless movement of vehicles, while the advanced weight control is heavier.

When the suspension movement is moving fast, it will produce more resistance on the shock absorber in the modern shock absorber where it is more sensitive with velocity. It will easy the shock be adjust by its self to controlling all unwanted motions depend on the road in any condition.[Source: WILLIAM HARRIS, 2019.]

While there are many different designs for shock absorbers throughout history of automotive, there are four basic types :

- Twin tube
- Mono tube
- Gas filled mono tube
- External reservoir

Not for all this type of shock absorber is included in the suspension of strut type which uses shock absorber as a support for the spring, but the basic principle still exists.

2.3.2.1 Twin-Tube Shocks

Twin tube designs are the most often used and the most expensive type. Because of this shock absorber most often used by all types of vehicles and trucks, it is easy to search for in a replacement. This type of shock absorber has two tubes inside one of which is for the external shock body and the other one is the tubes where the piston will move. The orifice (small holes) at the piston and the valve between both tubes function as to prevent the flow of hydraulic liquid for controlling the wheel movement.

The twin-tube shock restriction becomes clear when it is used on a very much bump road. In this situation, the piston fast movement will cause the oil to become too hot and foam, to control the wheel movement need to reduce shock absorption ability. The result is an increasingly careless journey, especially when traveling on the surface of the board. The twin-tube twin shock absorber is naturally stronger, with high-quality piston shafts and mounting, and it will use a highly durable oil quality, eventually, it will have the same limit.

2.3.2.2 Mono-Tube

Twin-tube generated the heat in both tubes will be trapped inside the tube and will reduce the effective controlling of wheel movement. By using one tube, the mono-tube is more prone to air. Therefore, there are some advantages to this type as in the following:

- The mono-tube is easier to release heat and it is not easily overheating on rough roads
- In the manufacture of the mono-tube, it is more expensive as all tolerances must be in high value including oil seal must be in high durability.

2.3.2.3 Gas Filled Mono-Tube

Gas-filled monotube are be design to avoid the foam and bubble in oil with high pressure of nitrogen inside the tube its makes hard to have a bubble and foaming in oil and absorb the shock fast either in rough or smooth road.

It's more expensive than others because of its need high requirement of manufacture tolerance and most popular among the off-road race and rally. It also is not the same as the air-shock where the air-shock is using separate air space form hydraulic fluid. Air-shock its an air spring system are can raise up and down the vehicle when the air is added or be removed to the system through the valve.

2.3.2.4 External Reservoir Shocks

The external reservoir is designed at the top of the shock absorber. This shock be designed are for especially ultra-high-speed performance and races by uses a lightweight shock body is connected from the hose to reservoir oil be installed in the different the vehicle part. The main of the objective external reservoir shock are :

- To get better handling by reducing the load on wheels
- To provide a more effective cooling system for oils in reservoirs
- to provide a good ventilation system in the oil reservoir so that it can expand when it heats and does not blow the seal
- When the oil flows from the shock absorber body it allows extraordinary adjustment.

It is very expensive and only needed in the extremely high-performance application.

2.3.3 Basic Cause Shock Absorber Need To Replace

The shock absorber can be used for a long time but it will eventually be damaged and harmful.

- In certain situations, the seal will rupture and the shock absorber that is covered with oil is a clue to it it will not function properly.
- In the previous test, shock absorbers should be replaced when the wheel collides with a fender if the gap of height wheel and fender are as a standard.
- Typically shock absorber damage can not be perceived or observed until we feel that the vehicle is difficult to control as before or accidentally bounces extraordinarily.
- 80 thousand to 100 thousand miles of modern shock absorber can be used but it depends on the surface of the road we go through and also when it has been used up to 60 thousand miles it will not perform as it is new. [Source: Kevin Clemens, 2019.]

The shock absorber can be checked by using a shock machine but it needs to be tested once with your car. For convenience and precautionary measures if the shock absorber has long been used it should be replaced with a new one as a safety.

To restore the vehicle's handling and stiffness, replacing the old shock absorber to the new one can help solve the problem. To get the most effective effect, a long-standing tire set to the new one is also helping new shocks to reduce shock on rough roads and vehicle handling.[Source: Kevin Clemens, 2019.]

2.4 Main Component Shock Absorber

There are three main function components for shock absorbers to function properly. It is a spring, damper, and bushing. All of these parts have their respective roles to work together to absorb effects and bouncing.

2.4.1 Damper

The damper is also known as simply damper it is a tool designed to absorb and smoothly slows down linear motion. The dampers can be either mechanical or rely on a fluid. Dampers same like other shock absorber absorb shock by controlling the flows from outside to cylinder internal spaces during piston movers. It can be adjusted to follow the road conditions and a good balance on the vehicle can be produced.

2.4.2 Spring

Spring shock absorber as the name suggests is used to absorb the jerks or bumps by using coil spring. The spring shock absorber is given stiffer character by tightening the spring. The center of the spring shock absorber usually contains rebound dampening unit. As the shock absorber changes the length the flow fluid inside the shock absorber starts.

Springs length is usually controlled by rotating the disc at the bottom of the spring on the thread. The shorter spring length increases the preload, making the rear wheel more resistant to upward movement. The dampening is controlled and adjusted in spring shock absorber by controlling the fluid reservoir. If the dampening is increased the movement of the shock is slowed down.

The spring type of shock absorbers are usually used to protect the smooth mechanism, such as the instrument, from the immediate impact or or the burden used immediately. These springs are often made of rubber or the same elastic material.

The springs that are used in different spring based shock absorbers are coil springs or leaf springs. In tensional shocks, torsion bars can be used. In most of the vehicles, springs or torsion bars as well as hydraulic shock absorbers are used.[Source: JAMALUDIN & A, 2012]

2.4.3 Bushing

A bushing or rubber bushing is a type of vibration isolator. It provides an interface between two parts, damping the energy transmitted through the bushing. he general application is in the vehicle suspension system, where the bushing (or, more often, synthetic rubber or polyurethane) separates the face of two metal objects while allowing certain movements. This movement allows the suspension parts to move freely, for example, when traveling over a large bump, while minimizing the transmission of small noise and vibrations through the vehicle chassis. A rubber 12 can also be described as mounting mounting flexible or anti-vibration mounting.

2.5 Magnetic Shock Absorber

The most important part of motorcycle, vehicle, and trucks in suspensions system are shock absorber,include gear of aircraft landing, and the machines of industrial as for support. The shock absorber is not only used in mechanical engineering but it is also used in engineering structures to aid structural weaknesses against earthquakes.