Design and Fabrication of Magneto Rheological Damper

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***Abstract*:- A shock absorber is a mechanical device designed to smooth out or (A slight wetness) damp a sudden shock impulse and dissipate kinetic energy. In a vehicle, it reduces the effect of traveling over rough ground. Without shock absorbers, the vehicle would have a bouncing ride, as energy is stored in the spring and then released to the vehicle, possibly exceeding the allowed range of suspension movement. Control of excessive suspension movement without shock absorption requires stiffer (higher rate) springs, which would in turn give a harsh ride. Shock absorbers allow the use of soft (lower rate) springs while controlling the rate of suspension movement in response to bumps. In our project, permanent magnet is used to shock absorber the vehicle. The shock absorber is designed by controlling for equipment, auto mobiles and movers are suitable arrangement.**

I. INTRODUCTION

The automobile frame and body are mounted on the front and rear axle not directly but through some form of springs and shock absorbers. This is done to damp to road shocks transmitted to the frame by the wheels as they roll over the road. All these parts which perform this function are collectively called a suspension system. Thus, the suspension system includes springs, shock absorbers and their mountings. The suspension system of a motor vehicle is divided into the rear end suspension and front-end suspension.

II. OBJECTIVE

The main purpose of this chapter is to introduce the topic of magneto-rheological(MR) dampers to the reader. Also presented is an explanation of the mechanism through which MR fluid works. Lastly, the project objectives and the approach taken to evaluate different MR damper designs are discussed.

III. LITERATURE SURVEY

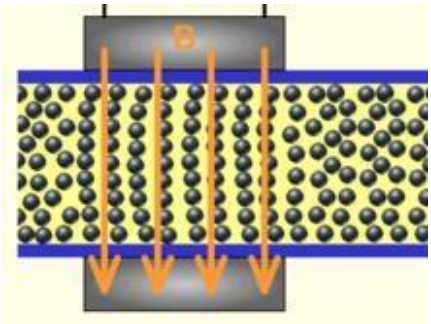
Milica B. Naumovic & Boban R. Veseli described that the two magnets are placed in a piston. One magnet is fixed with piston. Another one is movable, which is connected with rod. With magnets are replaced by air. Our magnetic shock absorber works on the basic principle of magnet that
―opposite poles attract each other and same poles repel each other‖. In this both magnets are facing same poles (both magnets are placed facing north and north or south and south). Both magnets are same pole. When the rod moves inside the piston, movable magnet moves towards the fixed magnet. Since both magnets are of same pole repulsion force is created between the magnets. So the movable magnet opposes the rod action and moves the rod up. The piston or cylinder is made up of nonmagnetic material. V.V.Borole and prof. K.
K. Chaudhari studied and described the Electromagnetic suspension system for automobile and studied different ways to recover energy from suspension system by using piezoelectric material to increase the efficiency of the automobile. Vehicle during running condition vibrate by means suspension operate by using motion of the shock absorber produce energy. Due to this tried to generate electricity from this system they proposed to use this electricity for headlamps and indicators etc. They also proposed to use these electro-magnets for preventing the tyres of vehicles from puncturing due to nails by attracting them to the magnets.

Prof N.Vivekanand etc. all described about the analysis of suspension spring to determine and its fatigue life using finite element methodology. One of the most important part of the suspension system is the coiled spring which are helical in shape steel bar that absorb the shock. They also stated the advantages and disadvantages of conventional suspension systems, which helped us in designing a magnetic shock absorber in order to overcome the disadvantages of conventional suspension systems. They also stated design considerations of spring and due to this it helped in designing the spring in between the magnets.
B. V. Jayawant described about the design and fabrication of magnetic suspension system. According to authors of these papers the coil spring suspension system have imitation that after some period of time coils become not only harder but also reducing cushioning effect and these limitation overcome by the new concept of ―magnetic suspension system‖ the cushioning effect provided by these system existing long life. They select material by considering Mechanical properties. This selection of materials also helped in selecting materials for the shafts, cylinder and spring.

IV. PARTS

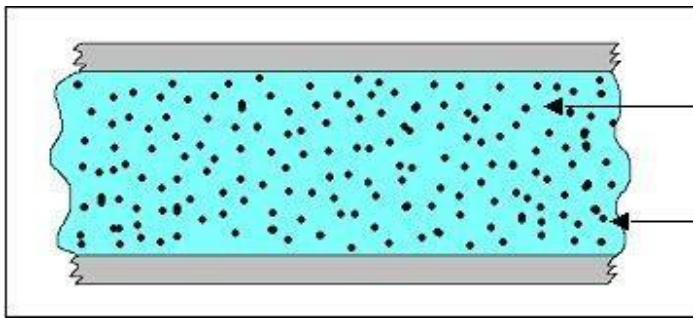
Magneto rheological fluid MR fluid is a type of smart fluid in a carrier fluid, usually a type of oil. When subjected to a magnetic field, the fluid greatly increases its apparent viscosity, to the point of becoming a viscoelastic solid. Importantly, the yield stress of the fluid when in its active state can be controlled very accurately by varying the magnetic field intensity. The upshot is that the fluid's ability

to transmit force can be controlled with an electromagnet, which gives rise to its many possible control-based applications. Extensive discussions of the physics and applications of MR fluids can be found in a recent book.
MR fluid is different from a Ferro fluid which has smaller particles. MR fluid particles are primarily on the micrometer-scale and are too dense for Brownian motion to keep them suspended (in the lower density carrier fluid). Ferrofluid particles are primarily nanoparticles that are suspended by Brownian motion and generally will not settle under normal conditions. As a result, these two fluids have very different applications.

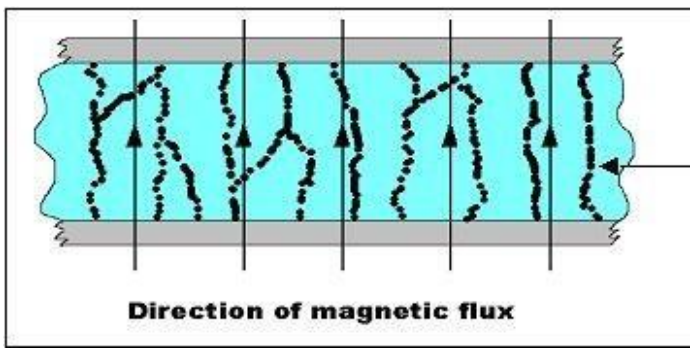


PRINCIPLES OF OPERATION

The magnetic particles, which are typically micrometer or nanometer scale spheres or ellipsoids, are suspended within the carrier oil are distributed randomly and in suspension under normal circumstances, as below.



When a magnetic field is applied, however, the microscopic particles (usually in the 0.1–10 µm range) align themselves along the lines of magnetic flux, see below.



CYLINDER:

A **cylinder** has traditionally been a three- dimensional solid, one of the most basic of curvilinear geometric shapes. It is the idealized version of a solid physical tin can having lids on top and bottom.

SPRING
A spring isan elastic object used to store mechanical energy. Springs are usually made out of spring

steel. There are a large number of spring designs; in everyday usage the term often refers to coil springs. Small springs can be wound from pre-hardened stock, while larger ones are made from annealed steel and hardened after fabrication. Some non- ferrous metals are also used including phosphor bronze and titanium for parts requiring corrosion resistance and beryllium copper for springs carrying electrical current (because of its low electrical resistance). When a coil spring is compressed or stretched slightly from rest, the force it exerts is approximately proportional to its change in length (this approximation breaks down for larger deflections). The rate or spring constant of a spring is the change in the force it exerts, divided by the change in deflection of the spring. That is, it is the gradient of the force versus deflection curve. An extension or compression spring has units of force divided by distance, for example lbf/in or N/m. Torsion springs have units of torque divided by angle, such as N·m/rad or ft·lbf/degree. The inverse of spring rate is compliance, that is: if a spring has a rate of 10 N/mm, it has a compliance of 0.1 mm/N. The stiffness (or rate) of springs in parallel is additive, as is the compliance of springs in series. Depending on the design and required operating environment, any material can be used to construct a spring, so long as the material has the required combination of rigidity and elasticity: technically, a wooden bow is a form of spring.

MAGNETS:

A **magnet** is a material or object that produces a magnetic field. This magnetic field is invisible but is responsible for the most notable property of a magnetic force that pulls on other ferromagnetic materials, such as iron, and attracts or repels other magnets. The overall strength of a magnet is measured by its magnetic moment or, alternatively, the total magnetic flux it produces. The local strength of magnetism in a material is measured by its magnetization.

FRAME STAND

The frame stand or the work table is the place where the work piece is placed and then machined. The frame stand also makes as the base support for the machine. Both the jaws (fixed and the movable) are fixed and made fitted to the frame.

BEARING WITH BEARING CAP:-

The bearings are pressed smoothly to fit into the shafts because if hammered the bearing may develop cracks. Bearing is made up of steel material and bearing cap is mild steel.

INTRODUCTION

However, such bearings cannot be used indiscriminately without a careful study of the loads and operating conditions. In addition, the bearing must be provided with adequate mounting, lubrication and sealing. Design engineers have usually two possible sources for obtaining information which they can use to select a bearing for their particular application:

a) Textbooks
b) Manufacturers'

Catalogs Textbooks are excellent sources; however, they tend to be overly detailed and aimed at the student of the subject matter rather than the practicing designer.

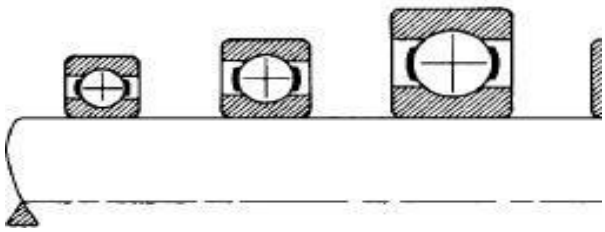
They, in most cases, contain information on how to design rather than how to select a bearing for a particular application. Manufacturers' catalogs, in turn, are also excellent and contain a wealth of information which relates to the products of the particular manufacturer.

These catalogs, however, fail to provide alternatives – which may divert the designer's interest to products not manufactured by them. Our Company, however, provides the broadest selection of many types of bearings made by different manufacturers.

For this reason, we are interested in providing a condensed overview of the subject matter in an objective manner, using data obtained from different texts, handbooks and manufacturers' literature. This information will enable the reader to select the proper bearing in an expeditious manner. If the designer's interest exceeds the scope of the presented material, a list of references is provided at the end of the Technical Section. At the same time, we are expressing our thanks and are providing credit to the sources which supplied the material presented here.

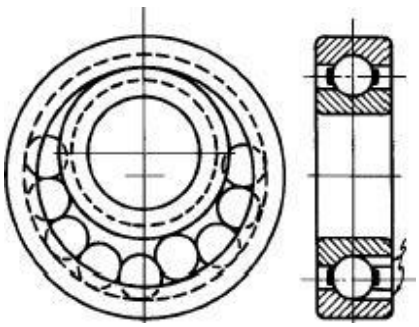
Construction and Types of Ball Bearings

A ball bearing usually consists of four parts: an inner ring, an outer ring, the balls and the cage or separator.
To increase the contact area and permit larger loads to be carried, the balls run in curvilinear grooves in the rings. The radius of the groove is slightly larger than the radius of the ball, and a very slight amount of radial play must be provided. The bearing is thus permitted to adjust itself to small amounts of angular misalignment between the assembled shaft and mounting. The separator keeps the balls evenly spaced and prevents them from touching each other on the sides where their relative velocities are the greatest. Ball bearings are made in a wide variety of types and sizes. Single- row radial bearings are made in four series, extra light, light, medium, and heavy, for each bore,



100 Series 200 Series 300 Series Axial Thrust Angular Contact Self-aligning Bearing Fig. 1-3 Types of Ball Bearings

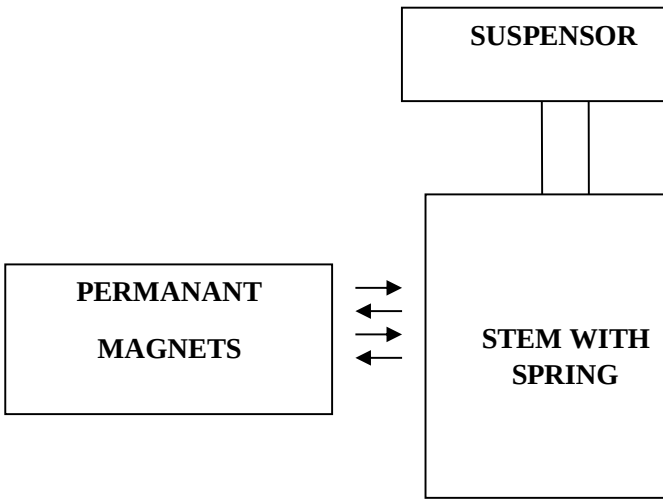
The heavy series of bearings is designated by 400. Most, but not all, manufacturers use a numbering system so devised that if the last two digits are multiplied by 5, the result will be the bore in millimeters. The digit in the third place from the right indicates the series number. Thus, bearing 307 signifies a medium-series bearing of 35-mm bore. For additional digits, which may be present in the catalog number of a bearing, refer to manufacturer's details.



Some makers list deep groove bearings and bearings with two rows of balls. For bearing designations of Quality Bearings & Components (QBC), see special pages devoted to this purpose. The radial bearing is able to carry a considerable amount of axial thrust.V.

WORKING PRINCIPLE

In this project consist of magneto rheological fluid, spring, cylinder, magnets, and battery. Mr Fluid Damper Suspension system works in the principle that the magnetic repulsion force of the same pole was to be used for performing the braking system. At the same time the MR fluid is used to suspension the magnets. The suspension is fixed to the frame stand. This magnetic shock arrangement is the additional suspension arrangement for the excising shock absorber arrangement. This magnetic suspension system arrangement will be activated automatically for the weight of the vehicle is exceeded for the particular load.
The load is applied to the suspensor which oils get hardened to repulsion the permanent magnet. This repulsion force causes the plunger to reciprocate. This reciprocating motion is converted to the liner motion of the suspension system.



VI. DESIGN

A. COMPONENTS

The DESIGN AND FABRICATION OF MAGNETO

RHEOLOGICAL DAMPER consists of the following components to full fill the requirements of complete operation of the machine.
SUSPENSION CYLINDER PISTON
MAGNET MR FLUID
FRAME

VII. APPLICATIONS

It can be used in sports car were the car can stay planted on road for better performance.

VIII. MERITS

1. Light in weight and easy operating.

2. It is use for real time operating system.

3. It is very less operating.

IX. CONCLUTION

This project work has provided us an excellent opportunity and experience, to use our limited knowledge. We gained a lot of practical knowledge regarding, planning, purchasing, assembling and machining while doing this project work. We feel that the project work is a good solution to bridge the gates between the institution and the industries.
We are proud that we have completed the work with the limited time successfully. The MAGNETO RHEOLOGICAL DAMPER is working with satisfactory conditions. We can able to understand the difficulties in maintaining the tolerances and also the quality. We have done to our ability and skill making maximum use of available facilities.
In conclusion remarks of our project work, let us add a few more lines about our impression project work. Thus we have developed a "MAGNETO RHEOLOGICAL DAMPER" which helps to design a robot. In this project, we have combined the mechanisms of robotic and monitoring systems using an electronic control units which actually moves and records the instants of the soil report and feeds it back to the control unit.

REFERENCES

[1] Mr. V. V. Borole, prof. K.K.Chaudhari.―A Review On Magnetic Shock Absorber‖ Mar-Apr 2015, pp 104-109.
[2] B V Jayawant, Rep. Prog. Phys.―Electro-magnetic Suspension and Levitation‖, 1981.
[3] Milica B. Naumovic, BobanR.Veselic, Automatic Control and Robotics, ―Magnetic Levitations Systems in Control Engineering Education‖, 2008 pp.151-160.
[4] Ayman A. Aly, and Farhan A. Salem, IJCAS, ―Vehicle Suspension System Control: A Review‖ July 2013.
[5] Assistant Prof N. Vivekanand, AbhilashMunaki, ChinmayAcharya, IIJME, ―Design analysis and simulation of double wishbone suspension system‖, June 2014.
[6] Feng Sun advisor Koichi OKA (Special Course for International Students) Department of Intelligent Mechanical Engineering, Graduate School of Engineering ,Kochi University of Technology, Kochi, Japan ―Magnetic Suspension Systems Using Permanent Magnet‖ August 2010.
[7] V. B. Bhandari, Book of ―Elements of Machine Design