Magnetic Shock Absorber for Two Wheelers

Malunjkar N.G.[1], Kute G. B.[2], Pawar S.S.[3], Kanawade S.B. [4]
, Satpute.M.B[5], Kotkar S.S.[6]

[1] Student, Mechanical Engineering, AVPoly, Maharashtra, India
[2] Student, Mechanical Engineering, AVPoly, Maharashtra, India
[3] Student, Mechanical Engineering, AVPoly, Maharashtra, India
[4] Student, Mechanical Engineering, AVPoly, Maharashtra, India
[5] Lecturer, Mechanical Engineering, AVPoly, Maharashtra, India
[6] Lecturer, Mechanical Engineering, AVPoly, Maharashtra, India

ABSTRACT

This paper is based on suspension system of a two wheeler. This paper gives information about magnetic suspension system. The aim of this paper is to highlight we can use the use of magnet in two wheeler shock absorber, when it is subjected to road surface irregularities with the hope that it would help automobile industry. This paper presents construction and working of magnetic suspension system. we can use the electromagnets as passive dampers, which is used to reduce displacement and acceleration of sprung mass in order to improve ride comfort.
By using this type of absorber we can absorb the more number of shocks and variations are absorbed with the more accuracy. This type of Suspension has no problem of leakage of oil like hydraulic shock absorber. Also this has less maintenance than other types of shock absorber that we can made this type of shock absorber for the efficient work of vehicle and for reducing the maintained cost of vehicle.

Keyword: - *Magnets, Coil Spring.*

1. INTRODUCTION

A shock absorber in common parlance (or damper in technical use) is a mechanical device designed to smooth out or damp sudden shock impulse and dissipate kinetic energy. It is analogous to a resistor in an electric RLC circuit. Shock absorbers must absorb or dissipate energy. One design consideration, when designing or choosing a shock absorber is where that energy will go. In most dashpots, energy is converted to heat inside the viscous fluid. In hydraulic cylinders, the hydraulic fluid will heat up. In air cylinders, the hot air is usually exhausted to the atmosphere. In other types of dashpots, such as electromagnetic ones, the dissipated energy can be stored and used later.

Shock absorbers are an important part of automobile and motorcycle suspensions, aircraft landing gear, and the supports for many industrial machines. Large shock absorbers have also been used in structural engineering to reduce the susceptibility of structures to earthquake damage and resonance. Shock absorbers, linear dampers, and dashpots are devices designed to provide absorption of shock and smooth deceleration in linear motion applications. They may be mechanical (e.g., elastomeric or coil spring) or rely on a fluid (gas, air, hydraulic), which absorbs shock by allowing controlled flow from outer to inner chamber of a cylinder during piston actuation. In conventional shock absorbers the piston rod is typically returned to the unloaded position with a spring. Shock absorbers typically contain either a fluid or a mechanical dampening system and a return mechanism to the unengaged position. They vary from small device application to large industrial and civil engineering uses. Linear dampers is an inclusive term that can be applied to many forms of dashpots and shock absorbers; typically used for devices designed primarily for reciprocating motion attenuation rather than absorption of large shock loads. Dashpots are typically distinct in that while they use controlled fluid flow to dampen and decelerate motion, they do not necessarily incorporate an integral return mechanism such as a spring. Dashpots are often relatively small, precise devices used for applications such as instrumentation and precision manufacturing.

Shock absorbers or damper types for shock absorbers, linear dampers and dashpots can be hydraulic, air, gas spring, or elastomeric. The absorption or damping action can be compression or extension. Important parameters to consider when searching for shock absorbers, linear dampers and dashpots include absorber stroke, compressed length, extended length, maximum force (p1), and maximum cycles per minute. Absorber or spring stroke is difference between fully extended and fully compressed position. Compressed length is the minimum length of shock (compressed position). Extended length is the maximum length of shock (extended position). The maximum rated force for shock absorber or damper, referred to as the p1 force. The maximum cycles per minute are the rated frequency of compression/extension cycles.

Important physical specifications to consider when searching shock absorbers, linear dampers and dashpots include the cylinder diameter or maximum width, the rod diameter, mounting, and body material. The cylinder diameter or maximum width refers to the desired diameter of housing cylinder. The rod diameter refers to the desired diameter of extending rod. Mounting choices include ball and socket, rod end, clevis, eyelet, tapered end, threaded, and bumper or rod end unattached. Choices for body materials include aluminum, steel, stainless steel, and thermoplastic. Common features for shock absorbers, linear dampers and dashpots include adjustable configuration, reducible, locking, and valve. An adjustable configuration allows the user to fine tune desired damping, either continuously or at discrete settings. A reducible shock absorber, linear damper or dashpot has an adjustment style for gas shocks in which gas is let out to permanently reduce force capacity. In a locking configuration the position can be locked at ends or in the middle of stroke. Valves can be included for fluid absorbers, a valve or port, which can be used to increase or decrease fluid volume or pressure.

1.1 Selection of Problem

Shock absorbers are an important part of automobile and motorcycle suspensions, aircraft landing gear, and the supports for many industrial machines. Large shock absorbers have also been used in structural engineering to reduce the susceptibility of structures to earthquake damage and resonance.

Shock absorbers, linear dampers, and dashpots are devices designed to provide absorption of shock and smooth deceleration in linear motion applications. They may be mechanical (e.g., elastomeric or coil spring) or rely on a fluid (gas, air, hydraulic), which absorbs shock by allowing controlled flow from outer to inner chamber of a cylinder during piston actuation. In conventional shock absorbers the piston rod is typically returned to the unloaded position with a spring. Shock absorbers typically contain either a fluid or mechanical dampening system or a return mechanism to the unengaged position. They vary from small device application to large industrial and civil engineering uses. For the running of vehicle in smooth and comfortable Condition only suspension systems are used. Now a day hydraulically operated suspension systems are used but which having lot of problems e.g. Leakage of oil, spring tension, spring stiffness, etc. To avoiding such type of problem the oil less suspension introduces namely the magnetic suspension.

2. WORKING:-

The unit of two circular magnets and a rod (straight cylindrical rod which can be used as axle).One magnet is attached at the bottom of the rod is the base magnet. The other magnet is free with a float and has the similar pole placed towards the base magnet. The similarity of poles creates repulsion and a certain distance is maintained. As per load condition, the floating magnet moves and close the gap until the magnetic repulsion is strong enough to create the damping action. In this a shock absorber without spring working on the basic law of magnets-“Opposite poles attracts and similar poles repel” is prepared.

If the suspension springs are strong enough, they will absorb road shocks efficiently, and they are flexible enough, they will continuous to vibrate to long time even after the bump is passed. When vehicle wheel strikes a bump, the spring is compressed enough and little vertical up-ward motion is transferred to the frame. When the wheel comes down from road bump, the spring expands very rapidly. If this rebound is not controlled the spring starts vibrate heavily. To control this vibration, at the shock absorber is used in the suspension system. Similarly, when a wheel falls over a hole, a spring expands and is unable to take full vehicle load. The shock absorber takes part of this load.

In case of leaf spring suspension system, the friction between the leaves provide the damping effect. But the because of the uncertainly of the lubrication condition, the amount of vibration also varies and hence damping characteristic do not remain constant. Therefore, additional damping provided by means of dampers or shock absorber. Frequently, shock absorber housing is linked to the frame across the member and the shock absorber arm is connected to the spring, axle or suspension control arm.

Magnets suspension worked on magnetic repulsion force between die poles in vertical pass across a bump condition that time force acting lower side of magnet of the piston and bottom side magnet of the cylinder. The shock absorber due to repulsive force between piston bottom side magnet cylinder bottom side magnets. They are reflected at a certain distance as per load that we are mention. The gap between two magnets is about 1cm apart. At the jerk condition the piston moves upward side of the upper side magnet again the repulsive force between upper sides two magnets are repel to each other. And the piston returns its original position .i.e. center of cylinder. This suspension system easily absorbs road shock, damping, vibration to avoiding tear and wear.

2.1 Modern Magnetic Material:-

Ceramic also known as ferrite. Magnets are made of iron oxide and barium carbonate (BaCO3) or strontium carbonate (SrCO3). Widely available since the 1950's, this material is commonly available and at a lower cost than other types of materials used in permanent magnets. Ceramic magnets are made using pressing and sintering. Sintered magnets are a type of ceramic composed of the compressed powder of the alloy material being used. Sintering involves the compaction of fine alloy powder in a die and then fusing the powder into a solid material with heat. While the sintered magnets are solid, their physical properties are more similar to a ceramic and easily broken and chipped.

Ceramic magnets are brittle and hard generally requiring diamond wheels to grind and shape. These magnets come in a number of different grades. Ceramic-1 is an isotropic grade with equal magnetic properties in all directions. Ceramic grades 5 and 8 are anisotropic grades. Anisotropic magnets are magnetized in the direction of pressing. The anisotropic method delivers the highest energy product among ceramic magnets at values up to 3.5MGOe (Mega Gauss Oersted). Ceramic magnets have a good balance of magnetic strength, resistance to demagnetizing and economy. They are the most widely used magnets today.

Beneficial characteristics of ceramic magnets include their low cost, high coercive force, resistance to corrosion, and high heat tolerance. Drawbacks include their low energy product or "strength", low mechanical strength, and the ferrite powder on the surface of the material which can rub of and cause soiling.

2.2 Alnico

Alnico magnets are made up of an alloy of aluminum (Al), nickel (Ni), and cobalt (Co) with small amounts of other elements added to enhance the properties of the magnets. Alnico magnets have good temperature stability, good resistance to corrosion but are prone to demagnetization due to shock. Alnico magnets are Produced by two typical methods, casting or sintering. Sintering offers superior mechanical characteristics, whereas casting delivers higher energy products (up to 5.5 MGOe) and allows for the design of intricate shapes. Two very common grades of Alnico magnets are 5 and 8. These are anisotropic grades and provide for a preferred direction of magnetic orientation. Alnico magnets have been replaced in many applications by ceramic and rare earth magnets.

Beneficial characteristics of Alnico magnets include their high corrosion resistance, high mechanical strength, and very high working temperatures. Drawbacks include their higher cost, low coercive force and low energy product.

2.3 Rare Earth Magnets

Rare earth magnets are magnets composed of alloys of the Lanthanide group of elements. The two Lanthanide elements most prevalent in the production of permanent magnets are Neodymium (Nd) and Samarium (Sm). There are numerous alloy formulations of rare earth magnets covered under many different patents but the most common commercial varieties are Neodymium-Iron-Boron ($Nd_2Fe_{14}B$) and Samarium Cobalt ($SmCo_5$, Sm_2Co_{17}).

Rare earth magnets are available in sintered and bonded forms. Bonded magnets use a polymer base to hold the alloy powder together. The energy product of bonded magnets is much lower than that of the sintered magnets. Sintered NdFeB magnets are generally platted or coated with a material to prevent corrosion.

2.4 Samarium Cobalt

Samarium cobalt is a type of rare earth magnet material that is highly resistant to oxidation, has a higher magnetic strength than ceramic and alnico and better temperature resistance than neodymium materials. Introduced to the market in the 1970's, samarium cobalt magnets continue to be used today. Samarium cobalt magnets are divided into two main groups: $SmCo_5$ and Sm_2Co_{17} (Commonly referred to as 1-5 and 2-17). The energy product range for the 1-5 series is 15 to 22 MGOe, with the 2-17 series falling between 22 and 32 MGOe. These magnets offer the best temperature characteristics of all rare earth magnets and can withstand temperature up to 350^o C. Sintered samarium cobalt magnets are brittle and prone to chipping and cracking and may fracture when exposed to thermal shock. Due to the high cost of the material samarium, samarium cobalt magnets are used for applications where high temperature and high corrosion resistance is critical. Beneficial characteristics of samarium cobalt magnets include their high corrosion resistance, high energy product and high temperature stability. Drawbacks include their high cost and very low mechanical strength.

2.5 Neodymium Iron Boron

Neodymium iron boron ($Nd_2Fe_{14}B$) is another type of rare earth magnetic material. NdFeB is the most advanced commercialized permanent magnet material available today. This material has similar properties as the samarium cobalt except that it is more easily oxidized and generally doesn't have the same temperature resistance. However, NdFeB magnets have the highest energy products approaching 52MGOe and are mechanically stronger than samarium cobalt magnets.

NdFeB material is more costly by weight than ceramic or alnico but produces the highest amount flux per unit of volume or mass making it very economical for many applications. Their high energy products lend themselves to compact designs that result in innovative applications and lower manufacturing costs. Unprotected NdFeB magnets are subjects to corrosion. Surface treatments include copper, silver, gold, zinc and tin plating and epoxy resin coating.

Beneficial characteristics of NdFeB magnets include their very high energy product, very high corrosive force, and low corrosion resistance when not properly coated or plated.

2.6 Polymer Based Magnets

All of the magnetic materials described above can be mixed with various polymers to create broad range magnetic materials with their own magnetic and mechanical properties. The primary reason for mixing magnetic materials with polymers is to gain material flexibility, allow for increased shape complexity or increased control over the shape and direction of the magnetic fields. Once a magnetic material powder has been mixed into a polymer it can be injection molded, cast or calendared into flexible sheet magnets. The primary drawback to polymer based magnets is their low energy product.

3. Advantages:

[1] Magnet shock absorber will not create the problem of force in the spring due to the friction and other factor.
[2] This will be also reduced the maintenance cost as it does not need repairing, changing of spring.
[3] The magnetic shock absorber can be used in vehicle carrying heavy or less load.
[4] Manufacturing cost is very low.
[5] Life is more.
[6] Construction is very simple.
[7] Operation is better, to compare other suspension system.

[8] Magnetic shock absorber does not create noise, vibration, friction and wear and tear.
[9] Chain of more than two magnets can be used to tolerate the shock or weight and run the vehicle more comfortable.

3.1 Disadvantages

[1] Repulsive force of power magnet is quit uncontrollable.
[2] Cost of power magnet is high.
[3] It requires nonferrous material for handling purpose.
[4] While assembling the power magnets it offers difficulty to worker.
[5] In case load exceeds than permissible value of load the magnet may collide each other.

4. CONCLUSIONS

1. Now days the conventional shock absorbers are facing the problem of oil leakage and the shock absorber loses its capacity to absorb the road shocks and bumps. So for overcome this difficulty of oil leakage problem, we can remove the oil from the conventional shock absorbers and replace it from permanent power magnets and also this have no leakage.
2. As there is no direct contact between the two magnets hence there is no wear and tear of the magnets and therefore the life of the magnetic shock absorber is more comparatively conventional shock absorber

5. REFERENCES

[1] Design and fabrication of magnetic shock absorber: S.Gopinath, R.J. Golden Renjith, J. Dineshkumar.
[2] A Review on Magnetic Shock Absorber: Mr. V. V. Borole, Prof. K. K. Chaudhari. E-Issn: 2348-0831 Volume 2, Issue 3 (Mar-Apr 2015) Pp 104-109.
[3] Analysis For Suspension Spring To Determine And Improve Its Fatigue Life Using Finite Element Methodology: Chandrakant Chavan, G. M. Kakandikar, Swapnil S. Kulkarni.
[4] Design and Fabrication of Magnetic Suspension: Sushant Tandel, Bhagyesh Desai.
[5] Biti,J.2008.An investigation into the damping of a V8 supercar.
[6] Magnetic Suspension in Automobiles: Suvriti Dhawan, Ravi Nandu.
[7] Automobile Engineering: Kripal Singh.