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Review on Design & Fabrication of Magnetic Suspension

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ABSTRACT: Magnetic Shock Absorber which is mainly based on the principle of magnetic property like when the same poles of two magnets come in contact with each other then they are repulsed from each other. This unit is mounted in vehicle such as other type of shock absorber. The working of this absorber is very simple. Two magnets are mounted in this way that one is mounted below and other is on upper side. Poles of these magnets are same at inner side so that they are repulsed from each other and space is made between them due to this. When the vehicle is running on the bump or the muddy road then the space between two magnets is reduced and then shocks and variations present in the vehicle are absorbed by repulsion property of the magnet. By using this type of absorber we can absorb the more number of shocks and variations with the more accuracy. This shock absorber has no problem of leakage of oil like hydraulic shock absorber. Also this has less maintenance than other types of shock absorbers. We can make this type of shock absorber for the efficient work of vehicle and for reducing the maintenance cost of vehicle.

KEYWORDS: Magnetic suspension, shock absorber, damper, electromagnet

I. INTRODUCTION

Magnetic suspension is a method by which an object is suspended with no support other than magnetic fields. Magnetic force is used to counteract the effects of the gravitational acceleration and any other acceleration.

The automobile chassis is mounted on the axles not direct but through form of springs. This is done to isolate the vehicle body from the road shock which may be in the form of bounce pitch, roll or sway. These tendencies give rise to the uncomfortable ride and also cause additional stress in the automobile frame & body. All the part which performs the function of isolating the automobile from the road shocks are collectively called a Suspension System. It includes the springing device used & various mounting for the same. Broadly speaking, suspension system consists of a spring & damper. The energy of road shock cause the spring to oscillate. The oscillations are restricted to a reasonable level by the damper, which is more commonly called as Shock Absorber.

The first generation of magnetic suspensions was developed by Delphi corporation and debuted on the Cadillac Seville STS in the year 2002. due to its high cost, magnetic suspensions are currently found only on select sports cars and higher end luxury models.

Magnetic suspension systems are an alternative automotive suspension system that utilizes magnetically controlled dampers, or shock absorbers for a highly adaptive smooth ride

A model of the Magnetic Shock Absorber is based on the application of magnetic property like when the same poles of two magnets come in contact with each other then they are repulsed from each other. This unit is mounted in vehicle such as other type of shock absorber. The working of this absorber is very simple. Two magnets are mounted in this way that one is mounted below and other is on upper side. Poles of these magnets are same at inner side so that they are repulsed from each other and space is made between them due to this. When the vehicle is running on the bump or the muddy road then the space between two magnets is reduced and then shocks and vibrations present in the vehicle is absorbed by repulsion property of the magnet.

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Figure 1: conventional suspension system

II. OBJECTIVE

- To prevent the road shocks from being transmitted to the vehicle Components.
- To safeguard the occupants of vehicle from road shocks.
- To preserve the stability of the vehicles in pitching or rolling while in motion.
- To reduce the maintenance as well as initial cost.
- To increase the life of coil spring.
- To reduce the overall cost and weight of the vehicle.
- To prevents the vehicle body and frame from road shocks.
- To gives the good road holding while driving, cornering and braking.
- To gives cushioning effect.

III. LITERATURE REVIEW

An exhaustive literature review is carried out to know the recent practices and theories in shock absorber design. It will also help to obtain a superior understanding of internal components and internal flows had been designed and modelled in the past.

S. Gopinath, R.J. Golden Renjith, J.Dineshkumar: In this project 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. Their 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). When the rod moves inside the piston, movable magnet move 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 non-magnetic material. When the weight of the vehicle increases or vehicle climbs irregular surface, the wheel goes upwards and shock absorber is compressed, at this time the piston moves downwards. The magnets are made closer to each other, due to the increase of weight, the piston rod containing magnet is made to compress to certain extent. At the same time, the stainless steel spring provided is freely inside the shock absorber. The additional support for magnetic shock absorber is provided by a helical coil spring, which was compressed at this stage. So the shocks and vibrations are prevented.

Chandrakant Chavan, G.M.Kakandikar, Swapnil S. Kulkarni: This paper is also based on the principle that like poles of magnet repel each other. This paper gives outlines magnetic suspension where two or more magnets of the same polarity absorb all the bumps. The design and analysis for rear wheel bike magnetic suspension is discussed. This paper

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describes techniques for the design, construction, and testing of a prototype magnetic suspension system. There is one magnet fixed at the top of the inner portion of the cylinder. The second magnet placed at bottom of the inner portion of cylinder that reciprocates up and down due to repulsion. The two magnets fight against each other to achieve the aspect of suspension.

They describe 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.

1) Difference between Magnetic Shock Absorber and Spring Shock Absorber

S.No	Magnetic Shock Absorber	Spring Shock Absorber
1	It has more life	It has less life
2	Life is nearly about approximately 20 years	Life is nearly about approximately 10 years
3	The weight of magnet is more	The weight of spring is low as compared to magnets
4	If the power of magnets decreases then it is possible to recharge and it able to use again and again	Its strength at spring is decreased or loss it is necessary to replace it new one
5	It has very low maintenance	It has more maintenance

IV. VEHICLE SUSPENSION

In a vehicle, it reduces the effect of traveling over rough ground, leading to improved ride quality, and increase in comfort due to substantially reduced amplitude of disturbances. 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. They also, along with hysteresis in the tire itself, damp the motion of the unsprung weight up and down on the springiness of the tire. Since the tire is not as soft as the springs, effective wheel bounce damping may require stiffer shocks than would be ideal for the vehicle motion alone.

1) A Permanent Magnet Shock absorber

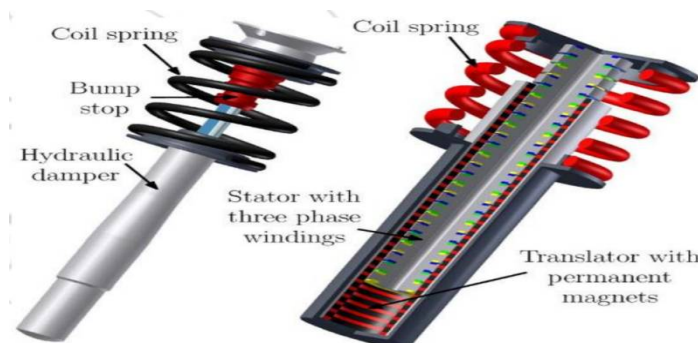


Figure 2: Magnetic shock absorber

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A Permanent Magnetic suspension apparatus for maintaining a spaced relationship between a first movable member and a second fixed member, wherein the motion of the movable member requires dampening, cushioning, stabilizing, harmonic balancing, and/or reflexive re-centering. The suspension apparatus includes a plurality of sets of permanent magnets located within a case, which is coupled to one of the members. The sets of permanent magnets are coupled to an elongated support member, which is couple to the second member. The support member extends within the case, with the support member and the case being adapted for relative axial movement.

2) Electromagnetic Regenerative Suspensions:

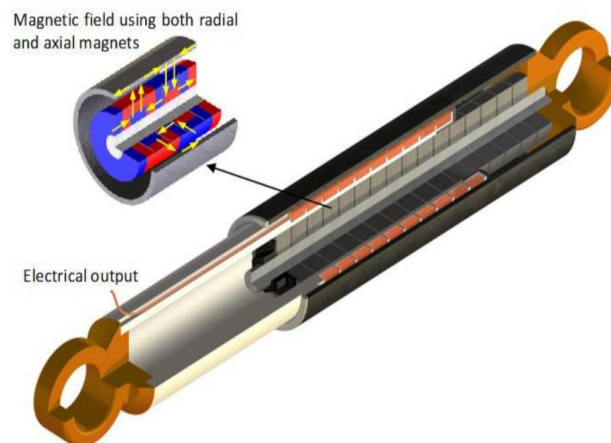


Figure 3: Regenerative Electromagnetic shock absorber

Electromagnetic regenerative suspension transforms the shock energy into electric energy that is more convenient to store and reuse, and has high performance, develop efficiency, little space requirements .Permanent magnet motor is favoured in to Electromagnetic Regenerative Suspensions exerts active force in actuator mode or damping force. The damping force can be easily changed by tuning the shunt resistances.

V. CONCLUSION

1. In conventional system hydraulic damper is used for damping purpose , in this system same magnetic poles follows same function that means here the damper and oil cost is eliminated due to that overall cost of the system is reduced
2. In this work spring is inside the cylinder so that there is no contact with dust particle, moisture of atmosphere, hence corrosion is reduced and spring life is increased.
3. In this study magnetic suspension system and their types are discussed. Some diagrams are given above to clear concept of component of shock absorber. Also some researches on magnetic shock absorbers and suspension system are discussed which are used in shock absorbers to modify and to resist the shocks obtained from bumping action from road. As we have seen the magnetic suspension is a revolutionary idea which will provide a comfortable ride by minimizing the vibrations and other factors .It would also allow to set the suspension stiffness as per requirement. Thereby magnetic suspension will be a best substitute for current problems and providing ultimate vehicle dynamics.

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VI. FUTURE SCOPE

1. If the coils are fitted at the outer side of magnet then it is possible to generate electricity which could be used for charging purposes.
2. Efficiency can be increased by making use of lightweight materials for the production of the suspension.

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