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SPRINGLESS TYPE MAGNETIC SUSPENSION

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Abstract - *Magnetic suspension is technology for supporting an object without contact by means of a magnetic force. Magnetic suspension system have many advantages like It provides more stable effect, Friction is very Less possibility for direct shock etc. So far, many kinds of magnetic levitation systems have been proposed and developed. These magnetic levitation system use various methods to control the suspension force. Two types of systems are electromagnetic suspension systems which control the coil current so as to vary the suspension force in order to achieve stable suspension. The suspension direction of this system is horizontal (both the suspension device and the permanent magnet are only moving in the horizontal direction).This suspension system has two parts the magnet part including a Permanent magnet and the frame part including the bell crank lever and another two links which makes mechanism connect with the magnetic arrangement with pvc pipe and reducers. This all arrangement is being mounted. In a working model of this suspension PVC pipe carrying 10 magnets floating arround it .Out of 10 magnets 3 magnets fixed in one reducer and a single magnet same in second reducer .other magnets floating on pipe in mode of repulsion .magnets are arrange in such manner that (4,3,2,1). In the frame there are several parts which is square bar.frame is a basic structure to hold the objects like wheel hub, suspension unit, links and more. The frame is joined by welding. The frame is made by M.S material and it support wheel hub very well because the weight of wheel hub is more.*

***Key Words*: Magnets, Frame, Mild steel materials.**

1.INTRODUCTION

Magnetic Suspension is a shock absorbing device. Magnetic suspension is a method by which an object is suspended with no supports other than magnetic fields. Generally the suspensions are used as of spring type. The direct shock on spring is reduced in magnetic suspension. The magnets are arranged in a manner that gives more repulsion. Magnets are of required quality with required magnetic field strength. Magnetic suspension systems have been extensively studied and have found numerous applications. Most magnetic suspension systems are electromagnetic suspension systems (EMS systems) that utilize electromagnets, but here permanent magnets are used instead of that. Various mechanisms are used for various suspensions like wishbone, dual link, multi links, etc. When a lever (Bell crank) used in suspension it consist of lever and two links for horizontal arrangement of suspension.

The levitation directions horizontal, and in the equilibrium position, the magnet's attractive force is equal to the force of the suspended object. Then, based on the principle that the magnetic force is inversely proportional to the square of the gap between the magnet and the ferromagnetic body, the mechanism controls the air gap between the magnet as per load and the object so as to adjust the attractive force.

In the frame there are several parts which is square bar.frame is a basic structure to hold the objects like wheel hub, suspension unit, links and more. The frame is joined by welding. The frame is made by M.S material and it support wheel hub very well because he weight of wheel hub is more. Magnetic suspension can adapt to uneven road surfaces several hundred times per second, in fact it takes only a few milliseconds to adjust any one of the shock absorbers. Magnetic suspension is described as the fastest reacting suspension in the world as sensors monitor the road surface up to 1000 times per second and an ECU can make variations within a few milliseconds resulting in the possibility of multiple damping variations being made in a second.

Magnetic ride control uses a system known as magneto rheological technology for suspension damping. Each absorber is filled with a polymer liquid containing many small magnetic particles. An electrical charge is sent to the liquid in the absorber which immediately changes the position of the particles in the liquid and its viscosity. The viscosity of the polymer liquid can be changed to an almost solid state similar to plastic or rubber in composition. As the viscosity of the liquid changes, it offers a difference in the damping. Each of the four dampers are adjusted individually and independently even when it seems that all of them are doing the same thing. This ensures a comfortable ride along various road surfaces. Magnetic suspension reduces vibrations, bouncing, noise and body roll very effectively on all road surfaces and at any speed that the vehicle could travel. The reduction of body roll may reduce the need for antiroll bars. Another benefit is that these dampers easily offers the best of both worlds in the ride comfort/handling compromise that many other suspension systems are subjected to. Although this type of suspension offers a very comfortable ride, sport settings can be applied or tuned into the system to cater for performance vehicles.

TheCadillac CTS-V uses magnetic suspension/magnetic ride control and has earned the respect of many for its ride comfort/handling compromise as much as its powerful engine. Magnetic dampers are designed with similar dimensions and connection points to other types of dampers so they are usually attached to the chassis of the vehicle

similar to how a coil spring suspension would. Magnetic suspension or magnetic ride control is used by a range of Cadillac vehicles and several other high end vehicles from General Motors (GM) like the Chevrolet Corvette. Other companies, such as Ferrari and Audi are also known to use magnetic suspension in their vehicles. Ferrari uses them in most of their vehicles and Audi uses them in the TT and their supercar, the R8. Whether the magnetic suspension is soft for comfort or firm for performance it maintains the quick reaction time to change the damping immediately when required.

When people think of automobile performance, they normally think of horse power torque and zero-to-60 acceleration. But all of the power generated by a piston engine is useless if the driver can't control the car. That's why automobile engineers turned their attention to the suspension system almost as soon as they had mastered the four-stroke ic engine.

The job of a car suspension is to maximize the friction between the tries and the road surface, to provide steering stability with good handling and to ensure the comfort of the passengers. In this article, we'll explore how car suspensions work, how they've evolved over the years and where the design of suspensions is headed in the future.

If a road were perfectly flat, with no irregularities, suspensions wouldn't be necessary. But roads are far from flat. Even freshly paved highways have subtle imperfections that can interact with the wheels of a car. It's these imperfections that apply forces to the wheels. According to Newton's laws of motion, all forces have bothmagnitude and direction. A bump in the road causes the wheel to move up and down perpendicular to the road surface. The magnitude, of course, depends on whether the wheel is striking a giant bump or a tiny speck. Either way, the car wheel experiences a vertical acceleration as it passes over an imperfection.Without an intervening structure, all of wheel's vertical energy is transferred to the frame, which moves in the same direction. In such a situation, the wheels can lose contact with the road completely. Then, under the downward force of gravity, the wheels can slam back into the road surface. What you need is a system that will absorb the energy of the vertically accelerated wheel, allowing the frame and body to ride undisturbed while the wheels follow bumps in the road.

2. FRAME INTODUCTION

In the frame there are several parts which is square bar.frame is a basic structure to hold the objects like wheel hub, suspension unit, links and more. The frame is joined by welding. The frame is made by M.S material and it support wheel hub very well because the weight of wheel hub is more.

Fig -2.1: FRAME

2.1 PROBLEM STATEMENT

There are lots of energy, power and force consumption used to move an object with physically contact with the movement elements and it also cause much of energy and power loss especially when dealing with an object with large amount of weight. It may also leads to damage due to friction and pressure occurs in a system that leads to often maintenance routine which needs cost and manpower or skills. Therefore this research is to study about the relationship between the technology of levitation and the reducing of power, energy and force consumption so that this physics technology of levitation can be implemented in a new technology application to reduce power, energy and force and at the same time reduce maintenance cost and avoiding damages.

Even though the stability is a concern but it can be controlled by using servomechanism, use of diamagnetic material or system involving eddy current through which stability can be achieved.

3. OBJECTIVES

Suspension is a mechanical arrangement contributing to vehicle's road handling behaviour. If roads were perfectly flat with no irregularities, suspensions wouldn't be necessary. It's these imperfections that apply force to the wheels .There are many types of suspensions such as double wishbone, trailing arm and air shocks. But these suspensions possess some disadvantages such as vibration, mechanical failure and stiffness variation. So in this paper we have introduced the idea of “MAGNETIC SUSPENSION”.

The basic role of suspension is to isolate the vehicle from the road shocks and vibration so that it could be a comfortable ride for these passenger and goods are in their proper condition too. The suspensions act as a link between vehicle tires and chassis. The vibrations from the wheels are reduced by suspension only. The suspension gives the cushioning effect.

There are mechanical failure, changes in stiffness of springs, change of ride height due to uneven distribution of loads during non-flat tapered road resulting in change in spring stiffness and its arrangement. Some other problems are that the spring cannot be adjusted by the person himself who is driving the car, even though high end car have adjustable ride height but it is not in access to all categories of people of the society.

4. DESIGN AND CALCULATIONS

In the project the 10 magnets are arranged on the pipe. These magnets are in repulsion mode. The two reducers are used. As shown in fig 4.1 in upper reducer the one magnet is fixed by araldite and at lower reducer the four magnets are fixed and inserted. The design of springless type magnetic suspension is in a such a manner that it is in repulsion mode.

The magnetic suspension works on the principle of repulsion.In the magnetic suspension there are 10 magnets and all the magnets are in repulsion mode.the order of magnets are in 4,3,2,1 . the one side of magnetic suspension is fixed and other side of suspension. The one side of suspension is attached to links and lever and other side os suspension is attached with frame . This suspension system has two parts the magnet part including a Permanent magnet and the frame part including the bell crank lever and another two links which makes mechanism connect with the magnetic arrangement with pvc pipe and reducers.

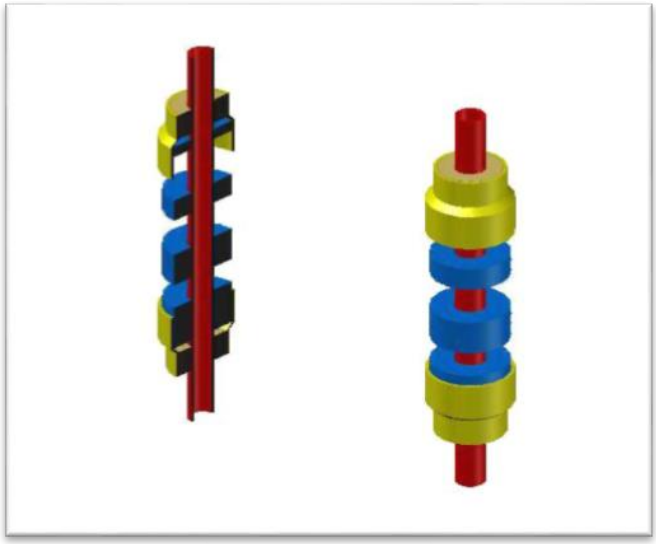

Fig -4.1: DESIGN OF MAGNETIC SUSPENSION IN AUTOCAD

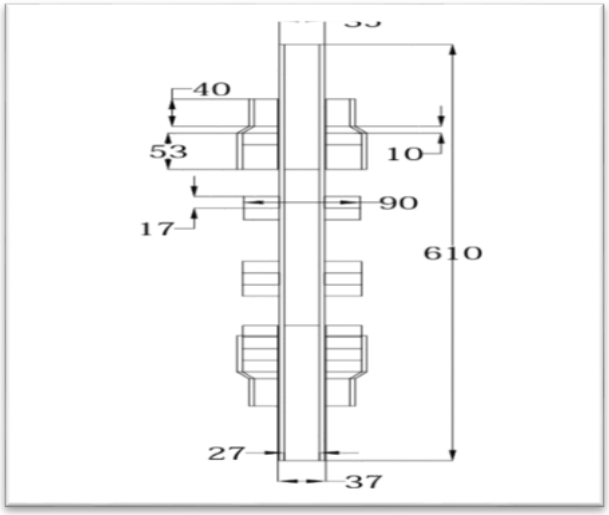

Fig -4.2: DESIGN OF MAGNETIC SUSPENSION IN AUTOCAD 2D (DIMENSIONS)

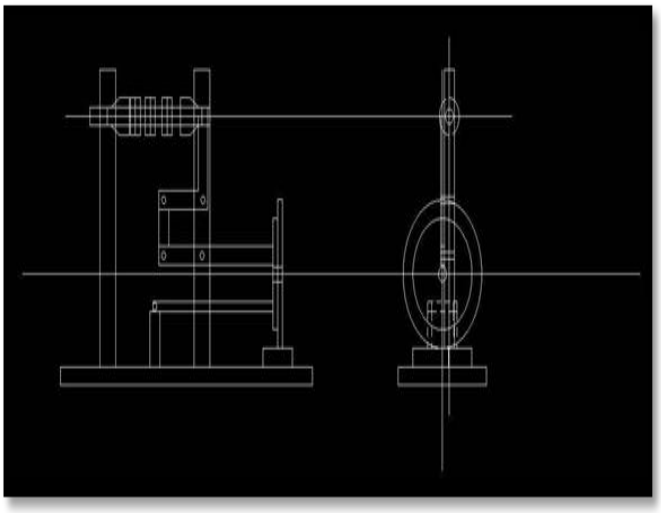

Fig -4.3: DESIGN OF MAGNETIC SUSPENSION WITH FRAME IN AUTOCAD

4. CALCULATIONS

SR.NO	LOAD (N)	DEFLECTION
1	60 N	0
2	65 N	24 to 26 mm
3	70 N	43 to 45 mm
4	75 N	55 to 58 mm
5	80 N	45 to 50 mm

Table -4.1: Calculations Readings

1) When the load is 65 N and deflection is 25 mm

STIFFNESS = $\frac{W}{\delta} = \frac{65}{25} = 2.6$ N/mm

2) When the load is 70 N and deflection is 44 mm

STIFFNESS = $\frac{W}{\delta} = \frac{70}{44}$=1.59 N/mm

3) When the load is 75 N and deflection is 56 mm

STIFFNESS = $\frac{W}{\delta} = \frac{75}{56}$ =1.339 N/mm

4) When the load is 80 N and deflection is 47 mm

STIFFNESS = $\frac{W}{\delta} = \frac{80}{47}$ =1.702 N/mm

5. FUTURE SCOPE

In this type of suspension it can be used Neodium magnets instead of ferrous magnets.To improve the efficiency of whole suspension copper coil also can be used. The aluminum alloy components can be used instead of other material.(because it is rust proof).

6. CONCLUSION

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.

An approach of the magnetic suspension system has been presented. The simplified mathematical model has been developed.

The MSS has the ability to give much smoother ride than any luxury sedan, and less roll and pitch than any sports car.

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