

Design and Fabrication of Magnet and Spring Suspension in Bicycle

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ABSTRACT: This project deals with the new form of suspension system. This is developed to solve the three problems in existing suspension system. i.e.(life, smooth driving, avoid damage of chassis). The project adding magnetic repulsion method to improve the smooth driving of automobiles. It can be thought of us a spring suspension followed by a magnetic repulsion. The ordinary suspension system is coupled with magnetic repulsion to add more comfortable ride to the rider. Whenever the vehicle undergoes any bumps or imperfection in the road, first the spring compress, the spring is in turn connected with a set of magnet repulsion assembly. The additional magnetic repulsion system provides smooth driving of automobiles both in slow speed, high speed, and all imperfections in road. When the vehicle moving in slow speed it provides suspension in spring movement and magnetic repulsion, but in higher speed the vehicle undergoes any imperfection in road spring compress to maximum extent but the magnetic repulsion system does not compress to that extent. The magnetic repulsion can behave according to the types of imperfection it experience during riding. we done this project in bicycle.

I. INTRODUCTION

The modern motorcycle uses suspension to accomplish several things; it provides a smooth comfortable ride absorbing bumps and imperfections in the road. It also allows the rider to fine tune the machine to give him/her better control over the machine when riding. Whenever the vehicle undergoes any bumps or imperfection in the road, the shock is transferred directly to the vehicle suspension system.

The shock is a vector quantity it have both magnitude and direction, the direction of the shock is perpendicular to the road surface. The magnitude of the shock is directly proportional to speed, that the vehicle hits the bumps. In such a situation, due to the magnitude of shock 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. when we decrease the stiffness of the spring below to minimum value, the magnitude of the shock is maximum there is possible for damage of chassis or other parts of the automobile. In existing condition, whenever the vehicle hits any bumps or imperfection in the obtained shock is transmitted to the conventional system and the spring or conventional system moves up.

Suspension:

Suspension is the term given to the system of springs, shock absorbers and linkages that connects a vehicle to its wheels and allows relative motion between the two. Suspension systems serve a dual purpose contributing to the vehicle's road holding/handling and braking for good active safety and driving pleasure, and keeping vehicle occupants comfortable and reasonably well isolated from road noise, bumps, and vibrations, etc.



These goals are generally at odds, so the tuning of suspensions involves finding the right compromise. It is important for the suspension to keep the road wheel in contact with the road surface as much as possible, because all the road or ground forces acting on the vehicle do so through the contact patches of the tires. The suspension also protects the vehicle itself and any

cargo or luggage from damage and wear. The design of front and rear suspension of a car may be different. But our suspension is used in bicycle.

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If the roads are far from flat, that interact with the wheels of a vehicle, these imperfections apply forces to the wheels. According to Newton's laws of motion, all forces have both magnitude and direction. A bump in the road causes the wheel to move up and down perpendicular to the road surface, then the vertical energy is transferred to the spring. 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.

Bicycle Suspension

Bicycle suspension is the system, or systems, used to suspend the rider and bicycle in order to insulate them from the roughness of the terrain. Bicycle suspension is used primarily on mountain bikes, but is also common on hybrid bicycles. Bicycle suspension can be implemented in a variety of ways, and any combination thereof:

- Front suspension
- Rear suspension
- Suspension saddle
- Suspension stem

Mountain bike suspension technology has made great advances since first appearing in the early 1990s. Early full suspension frames were heavy and tended to bounce up and down while a rider pedaled. This movement was called pedal bob, kickback, or monkey motion and took power out of a rider's pedal stroke especially during climbs up steep hills. Input from hard braking efforts also negatively affected early full suspension designs.

Types of Suspension

A suspension system in which air is the working fluid as well as the shock absorber is called air suspension system. The detection of causes and solutions for the problems with the linked system are discussed here. The front and rear suspension system or the suspension units on the two sides of the vehicle are connected with each other in an interconnected suspension system. They are also termed collectively as linked system. It was very much effective as compared to independent front and rear suspension units and was able to reduce the tendency of a vehicle to bounce, pitch or roll and was able to provide smooth and comfortable drive. Interconnected suspension system is categorized into an air suspension system, hydromantic suspension and hydro gas suspension system. The automatic control devices installed in the vehicle allows making optimum use of the variable space for deflection of wheel. The height of the automobile remains steady and so the changes in the alignment of headlamp due to varying loads are restricted. It helps to reduce the load while the vehicle in motion i.e., the dynamic loading as the spring rate variation between laden and unladen weight is much less. It gives smooth and comfort ride of the vehicle.

Air springs are classified into two types:

- Bellows type and
- Piston type

Working of Air Suspension System

The air springs shown are mounted on the front and rear axle. The atmospheric air first passes through the filter where the dirt is removed and passed on to the compressor. Air is compressed here and the pressure of air is raised from atmospheric to about 250 M Pa. This pressure is maintained by the accumulator tank. The safety relief valve is provided on the accumulator as a safety device and it opens when the pressure rises above 250 M Pa. This air then moves to lift control valve and through leveling valves to the air springs.



The simple flat plates of optimum thickness that held together by means of two U-bolts and a center clip having a simple construction and design are known as leaf springs. Leaf springs are one of the oldest forms of damping materials ever made. They are very simple in design with a non-complicated construction. They are simple flat plates of optimum thickness held

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together by means of two U-bolts and a center clip. They can be a mono-leaf or a multi-leaf type. In mono-leaf type there is a single leaf whereas in the multi-leaf type there is a layer of springs, one over the other with gradual change in their lengths from the bottom to the top. Rebound clips are provided to keep the leaves in alignment and prevent lateral shifting of the plates during the operation. Multi-leaf springs are widely used for automobile and rail road suspension. It consists of a series of flat plates, usually of semi-elliptical shape. Semi-elliptic leaf springs are almost universally used for suspension in light and heavy commercial vehicles. For cars also, these are widely used for rear suspension. The springs may be either cambered initially or flat. Highly cambered springs provide a soft suspension, but they also increase the tendency to yaw (movement about vertical axis). Flat springs reduce the tendency of the vehicle to dip, i.e. pitching when, braking or accelerating suddenly. Use of longer springs gives a soft suspension. Generally, rear springs are kept longer than the front springs. This causes them to vibrate at different frequencies, which prevents excessive bounce. The springs are provided with metallic or fabric covers to exclude dirt. The covers also serve to contain the lubricant used in between the spring leaves. The leaf springs require lubrication at periodic intervals, after every 1000 km. with SAE 140 oil. No lubrication is required in case of rubber bushings.

Components Used

A spring is an elastic object used to store mechanical energy. Springs are usually made out of spring steel. 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. When a spring is compressed or stretched, the force it exerts is proportional to its change in length. 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 force multiplied by distance divided by angle, such as N·m/red 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. Spring is one of the four conventional temperate seasons, following winter and preceding summer. There are various technical definitions of spring, but local usage of the term varies according to local climate, cultures and customs. When it is spring in the northern hemisphere, it will be autumn in the southern hemisphere. At the spring equinox, days are close to 12 hours long with day length increasing as the season progresses.

II. WORKING PROCEDURE

When the vehicle is driven on the rough surface, a disturbance in the road causes the wheel to move up and down perpendicular to the wheel surface. According to Newton vehicle undergoes any bumps or imperfection in road, it has both magnitude and direction. The direction is perpendicular to the road surface. The magnitude is equal to the speed that he going to hits the bump. Then the vertical energy is transferred to the spring and Magnetic repulsion setup. Whenever the vehicle undergoes any bumps or imperfection in the road, first the spring compress, the inner side of the spring is connected with a push rod. When spring compress push rod connected inside the spring doesn't compress, rather it pushes the magnet against the magnet repulsion. Set of magnet repulsion assembly to compress, that make the rider to ride without jerk. The additional magnetic repulsion system provides smooth driving of automobiles both in slow speed, high speed, and all imperfections in road.

Advantages:

- It give smooth suspension in both in slow and high speed
- Due to good magnetic repulsion setup, it increase the life of the suspension setup
- Due to strong repulsion force, it avoid damaging of chassis in the automobiles
- Low cost

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III. CONCLUSION

By implementing this setup, we can give the smooth and comfortable ride to the rider. When the vehicle is moving in high speed and hits very large bumps in road the magnet compress to the maximum extent and the magnetic power increases and pushes the magnet back to its original position.

When the vehicle is moving in a slow speed and hits a small bumps in the road .The magnitude of the bumps is not having capacity to pushes the spring. Magnetic repulsion compresses and give better control over the vehicle. We can also improve the life & Efficiency of suspension for automobiles we can also avoid the frequent damages of the automobiles. By implementing this setup, we can give luxurious ride to the rider at low cost.

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