Spring less Suspension Car Technology using Bevel Gauge by an Automobiles

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ABSTRACT

This project explores an innovative alternative to conventional suspension systems in automobiles by employing a spring-less suspension mechanism using a **bevel gauge-based geometry**. Traditional suspension systems rely heavily on coil or leaf springs to absorb shocks and provide ride comfort, but they also add to the vehicle's complexity, maintenance needs, and weight. The proposed design replaces these springs with a **mechanical linkage system involving bevel gears and angular displacement gauges** (bevel gauges) to dynamically adjust and distribute loads across the chassis. The bevel gear arrangement converts vertical wheel movements into controlled horizontal displacements, which can be efficiently absorbed and balanced by the structural frame of the vehicle. This system aims to provide improved stability, reduced vehicle weight, and lower maintenance requirements while maintaining or enhancing ride comfort and handling. The design is particularly suitable for off-road or rugged-terrain vehicles where spring fatigue and failure are common. Experimental simulations and prototype models suggest that this method offers promising results in terms of durability, mechanical efficiency, and adaptability.

Keywords : Spring-less Suspension , Bevel Gauge , Bevel Gear Mechanism , Automotive Suspension System.

INTRODUCTION

The suspension system is one of the most critical components in an automobile, responsible for providing stability, handling, and comfort by absorbing shocks from road irregularities. Traditionally, suspension systems use springs—such as coil springs, leaf springs, or air suspensions—to cushion the impact between the vehicle body and wheels. While effective, these spring-based systems come with limitations, including high maintenance, wear and tear, weight addition, and performance degradation over time.

In recent years, there has been a growing interest in alternative suspension mechanisms that reduce complexity and improve durability. One such innovation is the **spring-less suspension system using a bevel gauge and bevel gear mechanism**. This system eliminates conventional springs and instead uses a combination of bevel gears and angular displacement control (bevel gauges) to absorb and redistribute the forces acting on the vehicle during motion.

The bevel gear mechanism allows for smooth transmission of motion between non-parallel shafts, which can be engineered to convert vertical wheel displacement into controlled horizontal or rotational movement. This movement can be dampened mechanically or redirected to enhance vehicle stability. The inclusion of a bevel gauge further assists in monitoring and adjusting angular displacement in real time, improving system responsiveness and control.

This technology holds potential advantages in reducing overall vehicle weight, minimizing component fatigue, and enhancing performance under rough or off-road conditions. This paper explores the concept, design, working principle, advantages, and potential applications of this novel suspension system in modern and future automotive engineering.

Components of the Project

1. Bevel Gears
2. Bevel Gauge (Angular Displacement Gauge)
3. Control Arm or Linkage Mechanism
4. Wheel Assembly
5. Shock Absorber (optional)
6. Chassis/Frame Support
7. Mounting Brackets and Bearings

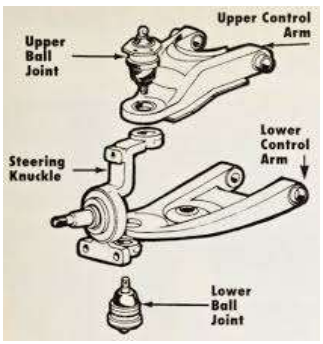
8. Torque Transfer Rods or Shafts
9. Damping Unit or Absorber Plate
10. Sensors (optional)

1.Bevel gears

Bevel gears are a type of gears that have a conical shape and intersecting axes, allowing them to transmit rotational motion between non-parallel shafts. They are used in a wide range of applications, including automotive, aerospace, marine, and industrial machinery. Bevel gears are designed to mesh together at a specific angle, known as the "pitch angle" or "cone angle," which determines the gear ratio and the motion transfer characteristics.

2.Control Arm or Linkage Mechanism

The **control arm or linkage mechanism** is a crucial structural element that connects the vehicle's wheel hub to the chassis and guides the motion of the wheel in response to road conditions. In traditional suspension systems, it works in conjunction with springs and shock absorbers. However, in a **spring-less suspension system**, it serves a more complex role by transferring vertical motion directly into the **bevel gear mechanism**.



3.Wheel Assembly

The **wheel assembly** is the component that directly interacts with the road surface and transfers road forces to the suspension system. In the spring-less suspension model using a bevel gauge, the wheel assembly plays a critical role in initiating the vertical motion that is transmitted through the control arm to the bevel gear mechanism.

4.Shock Absorber

In a traditional suspension system, the **shock absorber** is a hydraulic or pneumatic device used alongside springs to dampen vibrations and control rebound. In a **spring-less suspension system**, although conventional springs are eliminated, a **shock absorber or damping unit** may still be required to reduce oscillations and stabilize the vehicle after the initial impact is transferred through the bevel gear system.

5.Chassis / Frame Support

The **chassis or frame support** is the structural foundation of the vehicle, to which all major components—including the suspension system, drivetrain, and body—are mounted. In a **spring-less suspension system using a bevel gauge**, the chassis plays an even more critical role, as it must bear and redistribute forces transmitted through the bevel gear and control arm mechanism in the absence of traditional spring cushioning.

6.Mounting Brackets and Bearings

Mounting brackets and bearings are essential mechanical components that support and guide the movement of parts in the suspension system. In a spring-less suspension setup using a bevel gauge and bevel gears, these components ensure **secure attachment**, **proper alignment**, and **smooth motion** of rotating or moving elements such as control arms and gear shafts.

7.Torque Transfer Rods or Shafts

Torque transfer rods or shafts are essential components that play a key role in transmitting the rotational motion generated by the bevel gear system to other parts of the suspension system. In a spring-less suspension system, they help redirect

the forces from the wheel to the chassis, ensuring smooth and controlled motion.

8. Damping Unit or Absorber Plate

The **damping unit or absorber plate** plays a crucial role in controlling the motion of the suspension system, specifically in absorbing the energy generated by impacts from the road. In a spring-less suspension system using bevel gears, the damping unit works in conjunction with the torque transfer rods or shafts to absorb the kinetic energy and prevent excessive oscillation, providing a smoother ride and enhanced vehicle stability.

9. Sensors (Optional)

In a **spring-less suspension system using bevel gauges**, **sensors** can be incorporated to enhance the system's performance, diagnostics, and overall efficiency. While not a mandatory component, sensors provide valuable real-time data to monitor and optimize the suspension system's response to varying road conditions.

Construction

The **construction** of the **spring-less suspension system using a bevel gauge** in an automobile involves integrating multiple mechanical and structural components that work together to replace the traditional spring-based suspension with a gear-driven, force-distributing system. The system's primary goal is to absorb road shocks, maintain stability, and ensure smooth vehicle movement without relying on springs.

Advantages

- Lightweight and compact design.
- Longer-lasting, low-maintenance system.
- Improved handling, stability, and ride comfort.
- Optimized space for other vehicle components.
- Smart, adaptive suspension with real-time adjustments.
- Environmental benefits through reduced materials and improved fuel efficiency.

Disadvantages:

- High initial cost.
- Increased,
- Potential for mechanical failure,.
- suitable for heavy-duty vehicles
- high precision.
- tuning flexibility.
- sensors and electronics,.
- weight distribution ,center of gravity.

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