Active steering mechanism for automobiles

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ABSTRACT

Steering is the collection of components, linkages etc which allow a vessel (ship, boat) or vehicle (car, motorcycle, and bicycle) to follow the desired course. The basic aim of steering is to ensure that the wheels are pointing in the desired directions. This is generally achieved by a series of linkages, rods, pivots and gears. Many modern cars use rack and pinion steering mechanism, where the steering wheel turns the pinion gear; the pinion moves the rack, which is linear gear that meshes with the pinion, converting circular motion into linear motion along the transverse axis of the car. With the optional Active Steering mode, Steering wheel will offer proactive assistance on every bend and will react flexibly to the current driving situation. At low speeds, such as in the town or when parking, steering becomes more direct. Turning the steering wheel ever so slightly is enough to carry out the tightest maneuvers and park more easily. At high speeds, the required angle increases and the steering becomes more indirect. Now you can control the wheels more precisely with more turns of the steering wheel, and driving stability improves noticeably. The result is improved road holding and a confident steering sensation even at high speeds.

Keywords*: active steering, manual steering, planetary gear*

1. INTRODUCTION

Active Steering offers precision, agility and comfort in every driving situation. Active Steering system consists of a planetary gear set integrated into the steering column. An electric motor in the joint adjusts the front wheels steering angle in proportion to the Sedan's current speed. When driving at lower speeds - such as in city traffic, when parking or on winding mountain roads, Active Steering increases the size of the steering angle. The front wheels respond immediately to small movements of the steering wheel, enabling the driver to maneuvers through tight spaces without needing to make multiple turns of the steering wheel. Parking is easier and agility enhanced. At medium speeds, steering is also easier. And to ensure smoothness at higher speeds, as of around 120 to 140 km/h Active Steering becomes more indirect. Active Steering therefore reduces the amount of change in the steering angle for every movement of the steering wheel. This gives the driver the advantage of more precise steering at higher speeds, and ensures great stability and more comfort. If the vehicle is threatened with instability, such as by over steering or braking on a changeable surface, DSC identifies the problem and can use Active Steering to help overcome it. Active Steering does not interrupt the direct connection between steering wheel and front wheels, so that even in the unlikely event of a complete failure of the electronic systems, the vehicle remains completely controllable at all times. This is because at the first sign of any problems, an adaptation mechanism blocks the Active Steering immediately using a pivot so that the driver is eternally in control of the situation.

2. METHODOLOGY

The heart of the Active Steering system is the planetary gear set that is integrated into the steering column. There is a motor in the joint that adjusts the front wheel's steering angle. This system, part of the optional Sport package, electromechanically adds a positive or negative steering angle to the setting chosen by the driver, via a planetary gear set integrated into the steering column; depending on the situation, the feature varies the angle of steering determined by the user at the wheel (superimposed steering). It increases the steering angle at lower and mid-range speeds; by contrast, at higher speeds (e.g. on motorways), the steering angle is reduced. This reduces steering motion at low speeds (say, while

parking) and when negotiating tight turns on curvy roads, requiring only two turns lock-to-lock rather than three. It also makes the steering much more direct at high speeds.

CONSTRUCTION OF PROJECT MAIN FRAME

Construction of the frame can be completed by following the following procedure which is given in step by step way in this section:

- **Step-1** First construct wheel and tie rod controlling mechanism.

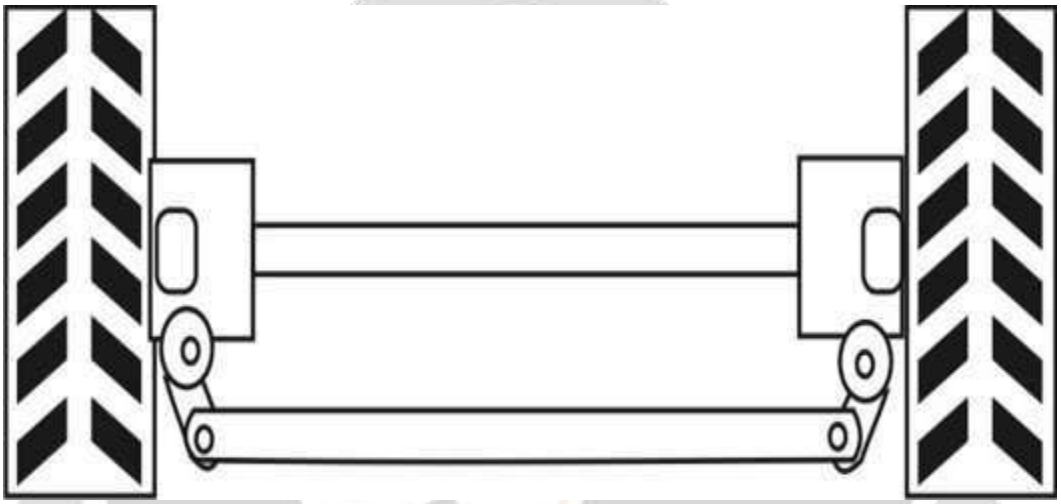

Fig. 1. Construction of Wheel and Tie Rod Mechanism

- **Step-2** Tie rod control mechanism testing.

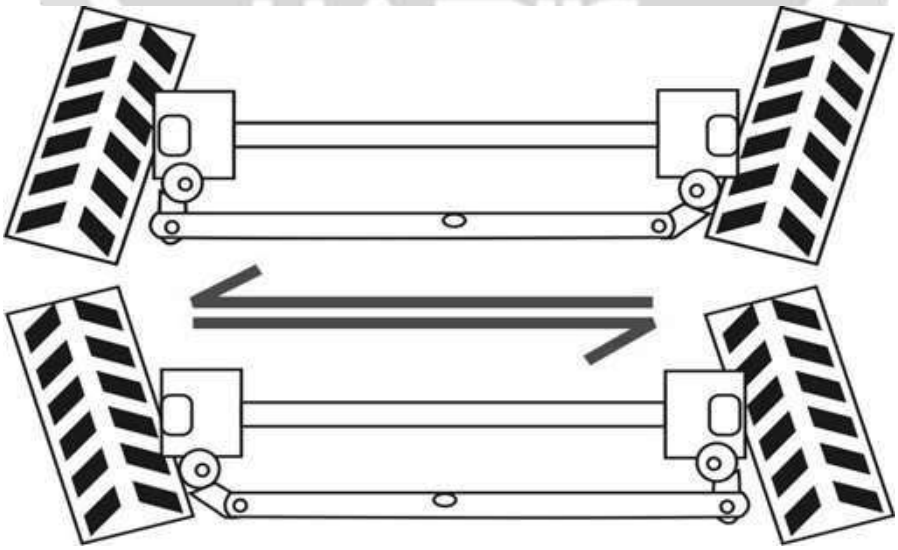

Fig. 2. Testing of Assembly

- **Step-3** Fix one Rack gear on Tie rod and move pinion gear over it as shown in the figure.

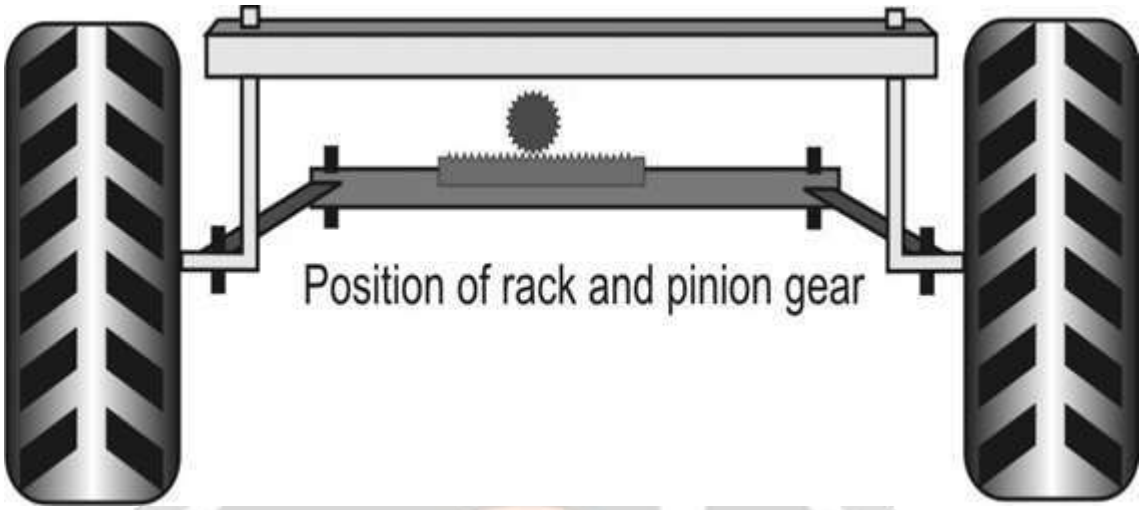

Fig.3. Fixing of Rack Gear on Tie Rod

- **Step-4** Now construct a bevel gear mechanism as a right angle sliding movement provider. This bevel gear assembly is connected with rack and pinion gear assembly as shown below.

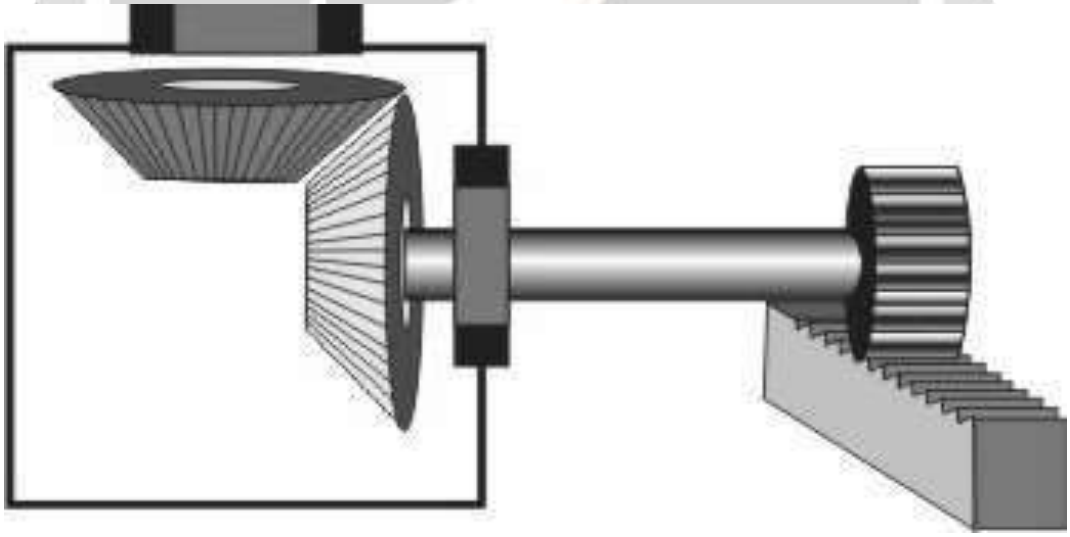

Fig.4. Construction of Bevel Gear Mechanism

 Step-5 Now construct body frame with ½ inch iron pipe and fix whole tie rod and bevel fixture over it.

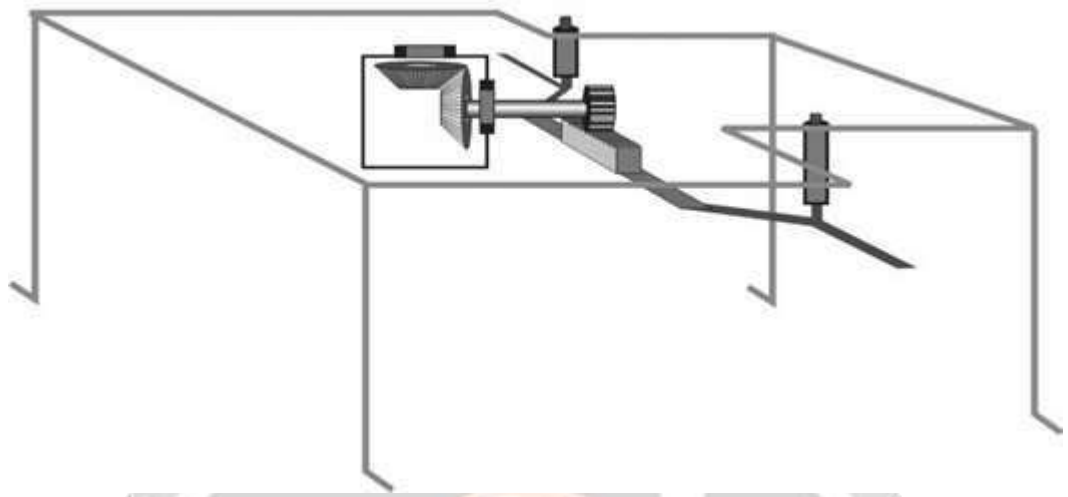

Fig 5. Construction of Body Frame

 Step-6 Connect 16 inch plastic wheel in Tie Rod fixture.

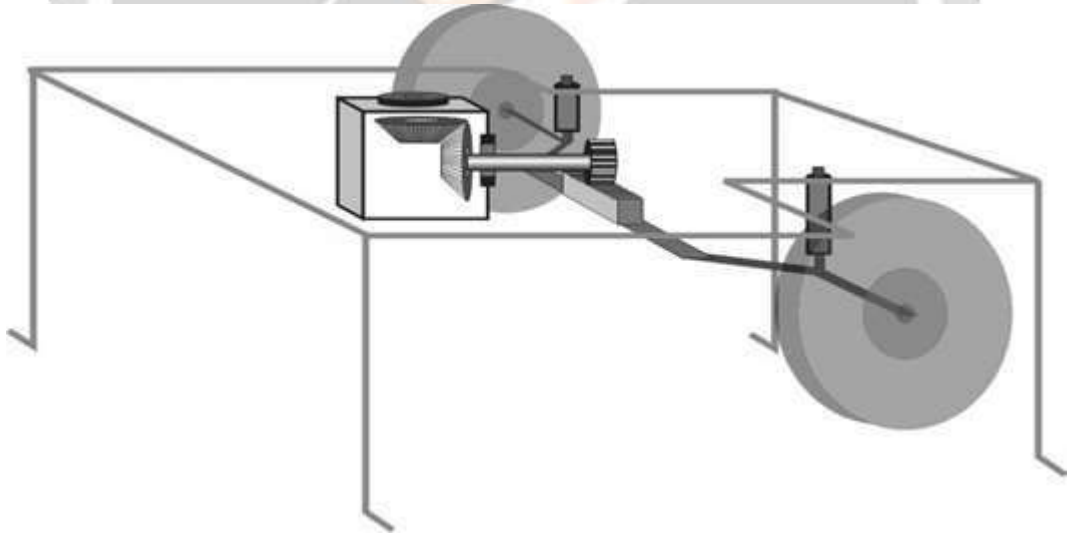

Fig 6. Installation of Plastic wheel on Tie Rod Fixture

- **Step-7** Now insert 8 mm round rod on other end of bevel gear. After that insert 3 different diameter iron gear with fixed electromagnetic clutches in that 8 mm rod as shown below. First two electromagnetic clutches are used for steering drive input as active steering mode and third one is used for line keeping mechanism.

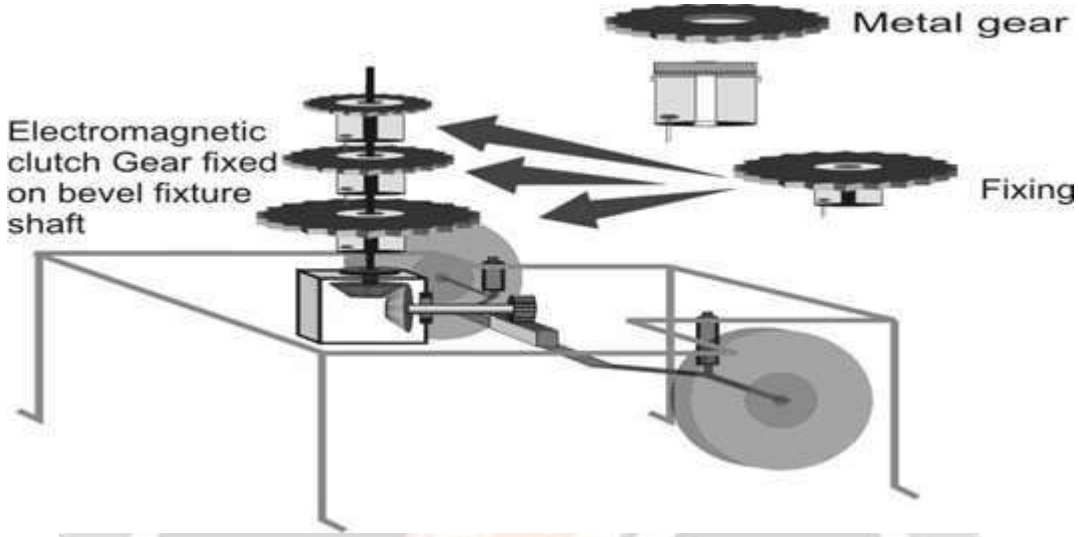

Fig 7. Installation of Electromagnetic Clutch and Gears

- **Step-8** Now connect two opposite diameter gears with active steering gears. These gears are power by steering control gearbox. Steering control gear box is only used to increase steering rotations only; its ratio is 4:1.

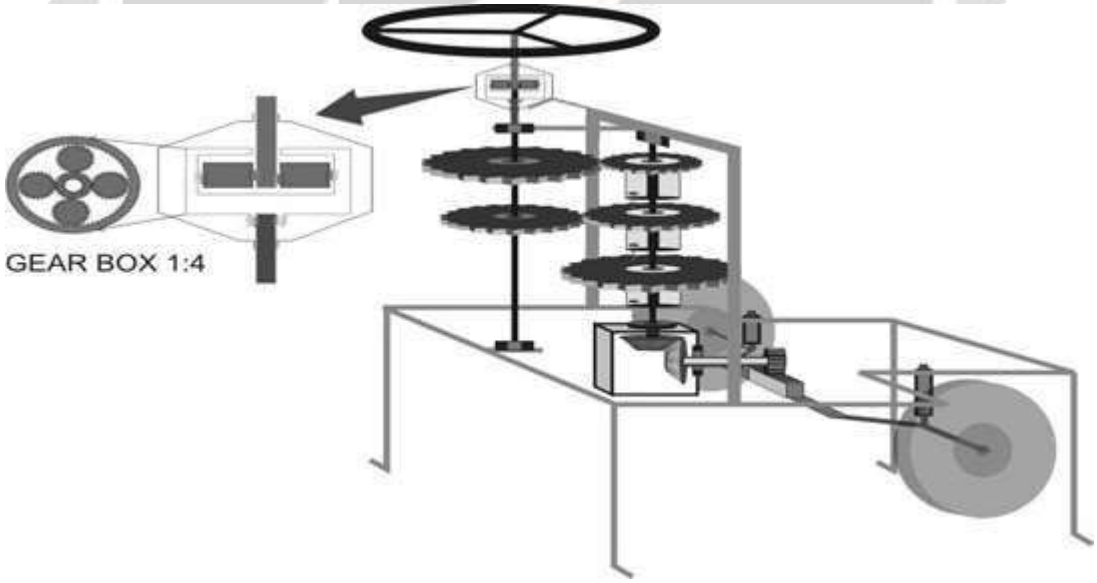

Fig 8. Installation of Gear with Active Steering

3. CONCLUSION

In conclusion, over the course of the research, we designed, built, and tested Active Steering, it can play a vital role in improving the stability, comfort, and vehicle dynamics, also in preventing accidents. The present steering ratio (ratio of rotation of the wheels to rotation of steering wheel) is 8:1 for almost all the basic car models. But this project can be able to have the steering ratio of 4:1, which is much more convenient and efficient than the present type of steering

mechanism. This ensures that the automobiles are more mobile and agile even on twisting roads and enable the driver have more control over the steering than never before. While doing this research, we learned about steering, electromagnetic clutches, DC gear motors, infrared sensor, IC LM567 & other electronic and mechanical components and how to connect them. Also, we learned the skills of planning, procurement which is vital to ensure that a project is completed within time and there is time left to improve the design or to troubleshoot as is normally needed. The future work could be to implement the active steering system in an experimental car. Most suitable would be a car with steer-by-wire. Implementation in a car is a only true way to examine the perception of the feeling of the driver. An implementation a real car demands changes in the system so that for example speed variations are considered. Since the transfer function of the vehicle is dependent of the velocity. How the extra steering angle should be delivered is also an important problem to solve.

4. REFERENCE

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