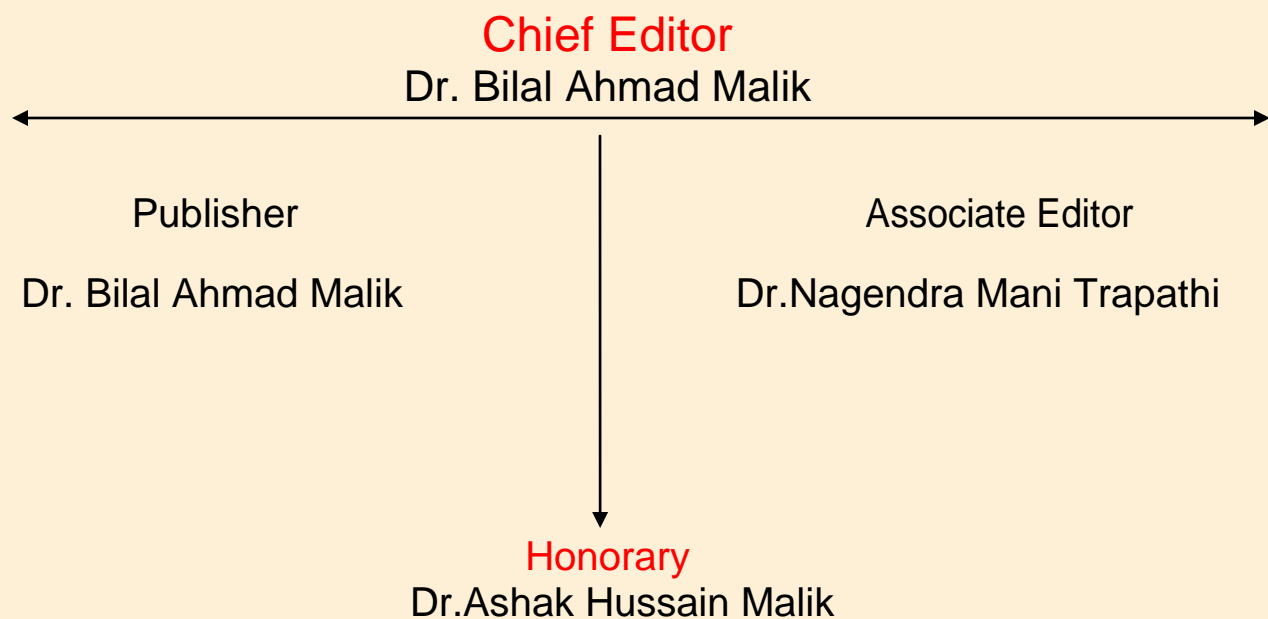


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360 DEGREE ROTATING CAR

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ABSTRACT:-

Nowadays, the every vehicle existed mostly still using the two wheel steering system to control the movement of the vehicle whether it is front wheel drive, rear wheel drive or all wheel drive. But due to the awareness of safety, four wheel steering vehicles are being used increasingly due to high performance and stability that they bring to the vehicles.

In this report, the performance of four wheels steered vehicle model is considered which is optimally controlled during a lane change maneuver in three type of condition which is low speed maneuver, medium speed maneuver and high speed maneuver.

For parking and low-speed maneuvers, the rear Wheel steer in the opposite direction of the front wheels, allowing much sharper turns. At higher speeds, the rest wheels steer in the same direction as the front wheels. The result is more stability and less body lean during fast lane changes and turns because the front wheels don't have to drag non-steering rear wheels onto the path.

KEYWORDS:- Four-Wheel Steering, Rear Wheels Control, Turning radius, turning system, parking problem, lifting of car, back turning.

INTRODUCTION

Steering is the term applied to the collection of components, linkages, etc. which will allow a vessel (ship, boat) or vehicle (car, motorcycle, and bicycle) to follow the desired course. An exception is the case of rail transport by which rail tracks combined together with railroad switches provide the steering function. The most conventional steering arrangement is to turn the front wheels using a hand-operated steering wheel which is positioned in front of the driver, via the steering column, which may contain universal joints, to allow it to deviate somewhat from a straight line. Other arrangements are sometimes found on different types of vehicles, for example, A tiller or rear-wheel steering. Tracked vehicles such as bulldozers and tanks usually employ differential steering that is, the tracks are made to move at different speeds or even in opposite directions, using clutches and brakes, to bring about a change of course or direction.

It is very hard for a medium size sedan to take a U-turn on a busy road with the little space available for the vehicle to actually make the turn. It is also hard for the driver to take the vehicle a little backward and then make the turn as the roads are busy and small. In such a case, if the vehicle is equipped with four wheel steering system, it will be easy for the driver to actually make the turn with ease even in the small space that is available for him. But the main thing is that we have two configurations in four wheel steering systems called

same phase and opposite phase. In order to reduce the turning radius of the vehicle, we need the opposite phase configuration of four wheel steering system.

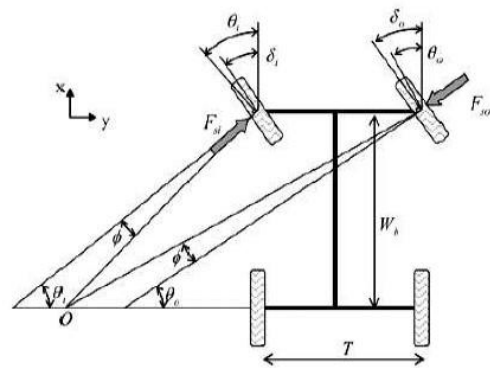
The main intension of this paper is to reduce the turning radius of a vehicle as much as practically possible without crossing the practical limits of design and assembly of the components of the steering system. Based on these requirements, a four wheel symmetric steering system is analyzed using kinematic approach and a conclusion is drawn regarding the geometry of the optimum steering system and the effect of this on the turning radius of the vehicle. This system is seen not to cross any practical limitations of the vehicle in terms of assembly and spacing. Also the wheels are turned to the optimum extent possible and not exceeding this limit.

What Is Zero Degree Turning Mechanism?

It is very hard for a medium size sedan to take a U-turn on a busy road with the little space available for the vehicle to actually make the turn. It is also hard for the driver to take the vehicle a little backward and then make the turn as the roads are busy and small. In such a case, if the vehicle is equipped with four wheel steering system, it will be easy for the driver to actually make the turn with ease even in the small space that is available for him. But the main thing is that we have two configurations in four wheel steering systems called same phase and opposite phase. In order to reduce the turning radius of the vehicle, we need the opposite phase configuration of four wheel steering system.

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Zero Degree Turning Mechanism

LITERATURE REVIEW

Contemporary rear axles allows for coincidental steering through the influence of variation of elasto kinematic steering; rear wheels rotate, due to an influence of variation of vertical load of wheels (tilting), in the same direction as front wheels. Nevertheless, such a turn of rear wheels is very small and driver's will-independent. A disadvantage of this so-called passive steering system is that it operates even when driving in straight direction when single wheel of an axle hits surface irregularity (deterioration of directional stability). New generation of active steering systems distinguishes a need of steering of rear wheels for the reason of directional stability from a need of steering of rear wheels for the reason of cornering at slow speed. Therefore, the active system means that rear

wheels are possible to be turned either coincidentally or non-coincidentally. The increase of the manoeuvrability when parking the vehicle is achieved by means of discordant steering, meanwhile the increase of the driving stability at higher speeds is achieved through concordant.

Dr. N. K. Giri, "Automotive Mechanics"

The basic steering calculations like basic formula for true rolling condition, formula for finding out turning radius of each wheel, etc., are done by referring this book.

Heinz Heisler, "Advanced Vehicle Technology"

The basic constructional details of planetary gear box and stroke rod assembly are being done by referring this book.

"Design data - data book of engineers" PSG college of technology.

Rack construction, formula to find minimum number of teeth to avoid interference, gear materials and basic gear calculations are done by referring this book.

"Theory of machines", S.Rattan

Gear train construction for gear box, speed ratio and the speed of revolutions obtained by each pinion in the gear box are calculated by referring this book.

1. LIST OF COMPONENTS:-

- Screw Jack
- Spur Gears,
- Electric Motor,
- Foot Step Bearing
- Capacitor

2. METHODOLOGY

In order to develop the new system for car, a model of small electric car was used. The selected model was 910 mm long, 360 mm wide and 195 mm height. Some modifications were done in the existing car by incorporating the screw jack, spur gears, electric motor, capacitor etc. The power screws are used to convert rotary motion into translatory motion.

For lifting and turning of car, two methods were proposed, the mechanical system and the hydraulic system. In this model, mechanical system was developed. A screw jack was used to develop the rising mechanism for car. At one end of the screw jack, a gear-1, which acts as the nut of the screw jack and which is free to rotate over the body of screw jack, was placed and meshed with another gear-2, which was placed on the shaft of reversible motor-2. Another end of the screw jack was attached with frame of the car by foot step bearing.

2.1 LIFTING AND TURNING SYSTEM

For the turning mechanism, gear-3 was fixed on the body of screw jack at another end i.e., opposite to that of gear-1. A gear-4, which mounted on the shaft of reversible motor-2, was meshed with the gear-3. The motor-2 is fixed with frame of the car. To drive the mechanism and the car, two electric motors were used.

3. WORKING MECHANISM

In the developed system, as shown in Fig. 7, when the motor-1 rotated the gear-2, meshed with gear-1, then the screw comes out and the car was lifted by 18 cm in 10 seconds. For turning, when the motor-2 was operated, then the gear-4, meshed with gear-3 rotated on its axis and around the gear-3; hence the whole car body was rotated at the required

angle. Again the motor-1 was operated in reverse direction and whole car was lowered in 10 seconds.

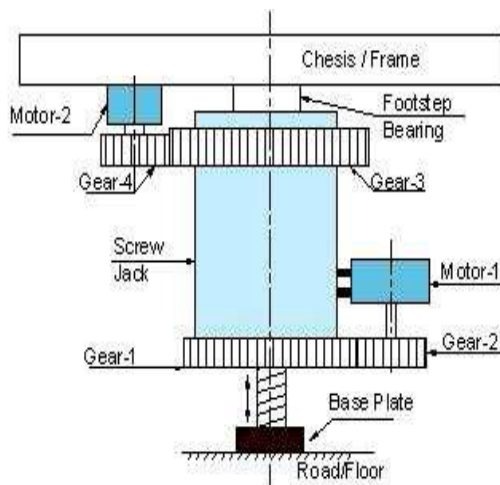


Fig 3.5 Lifting Mechanism

3.1 Balancing Mechanism:-

During the lifting and turning, balancing of the car is required. There are two methods for the balancing of the car. In first method base plate is made sufficient larger for the balancing and in another method two balancing wheels are provided which are attached with the levers, operated by power of the car and balance the car. In the present work, former was used.

4. ADVANTAGES& DISADVANTAGES

4.1 ADVANTAGES:-

- Superior cornering stability: The vehicle cornering behavior becomes more stable and controllable at high speed as well as on wet slipping road surfaces.

- Improved steering response and precision: The vehicle response to steering input becomes quicker and more precise throughout the vehicle enter speed range.
- High speed straight line stability: The vehicle's straight –line stability at high speed is improved. Negative effects of road irregularities and crosswinds on the vehicles stability are minimized.
- Improved rapid lane-changing maneuvers: This is stability in lane changing at high speed is improved. In high speed type operation become easier. The vehicle is less likely to go into a spin even in situations in which the driver must make a sudden and relatively large change of direction.
- Smaller turning radius: By steering the rear wheels in the duration opposite the front wheels at low speed, the vehicle's turning circle is greatly reduced. Therefore, vehicle maneuvering on narrow roads and during parking become easier.
- Controlling: Computer-controlled Quadra steer can be switched on and off and has an effective trailer towing mode.

4.2 DISADVANTAGES

- The Four-Wheel Steering, due to construction of many new components, the system becomes more expensive.
- The system includes as many components (especially electronically) there is always a chance to get any of the part inactive, thus the system become in operative.

4.3 APPLICATION

- Parking: During a parking a vehicles driver typically turns the steering wheels through a large angle to achieve a small tuning radius. By counter phase steering of the rear wheels,

4ws system realizes a smaller turning radius than is possible with 2ws system. As a result vehicle is turned in small radius at parking.

- Junctions: On a cross roads or other junction where roads intersect at 90 degrees or tighter angles, counter phase steering of the rear wheels causes the front and rear wheels to follow more or less path. As a result the vehicle can be turned easily at a junction.
- Slippery road surfaces: During steering operation on low friction surfaces, steering of the rear wheels suppress sideways drift of the vehicle's rear end. As a result the vehicles direction is easier to control.
- High speed straight line operation: When travelling in a straight line at high speed, a vehicle's driver frequently needs to make small steering correction to maintain the desired direction; in phase steering of the rear wheels minimizes these corrective steering inputs.
- Narrow roads: On narrow roads with tight bends, counter-phase steering of the rear wheels minimizes the vehicle's turning radius, thereby reducing side-to-side rotation of the steering wheels and making the vehicle easier to turn.
- U-Turns: By minimizing the vehicle's turning radius, counter-phase steering of the rear wheels enables U-turns to be performed easily on narrow roads.

RESULT AND DISCUSSION

The developed model of car was tested in various conditions for different applications. It was lifted by 18 cm in 10 seconds, turned back in 20 seconds and lowered in 10 seconds. So in all, it required 40 seconds in lifting, turning back and lowering. The developed system is most suitable in parking at home and multiplexes. Car can be easily

removed from the tight parking of the vehicles, on the crowded roadside and in the traffic jams

The automatic lifting system of the car is very helpful in changing the punctured wheel of car on road, as shown in Fig. 10. In hilly areas, where roads are very narrow and reversing of the vehicle is very dangerous, so it can be turned back using the developed system. In the developed system, lifting and lowering time is fixed, while turning time depends on the angle of turning.

CONCLUSION

Automobile industry is very fast growing industry and day-by-days developing the new technologies/systems that are mainly related to safety, ergonomics and efficient drive. The developed model was tested in various conditions and effectively reduced the turning radius to its minimum in the developed model. The reduced turning circle diameter (nearly about zero) has lots of advantages in daily life, such as-

- Better parking at home in narrow space and at multiplexes
- Easy removal of vehicle from the traffic jams
- Easy changing the punctured tyre,
- Turning back at narrow roads
- Use in service and maintenance etc.

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