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A Literature Review and Study on 4 Wheel Steering Mechanisms

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ABSTRACT

A four wheel steering system also called as Quadra steering system, in which both front wheels and rear wheels can be steered for reducing the turning radius. There are several arrangements available for steer all the wheels. But in the project we will used rack and pinion (spur gear) arrangement. There are two steering rack mounted at front side and rear side on the frame. Both steering racks spindle having pinion which are connected by the rack. The rack is mounted in such a way that it should mesh both front and rear steering racks pinion. This causes transfer of motion from front steering rack to rear steering rack. As a result all wheels are steers simultaneously.

Key words: steering rack, rack, pinion (spur gear)

I. INTRODUCTION

Four wheel steering is a method developed in automobile industry for the effective turning of the vehicle and to increase the maneuverability. In a typical Front wheel steering system the rear wheels do not turn in the direction of the curve and thus curb on the efficiency of the steering. In four wheels steering the rear wheels turn with the front wheels thus increasing the efficiency of the vehicle. The direction of steering the rear wheels relative to the front wheels depends on the operating conditions. At low speed wheel movement is pronounced, so that rear wheels are steered in the opposite direction to that of front wheels. In city driving conditions the vehicle with higher wheelbase and track width face problems of turning as the space is confined, the same problem is faced in low speed cornering. Usually customers pick the vehicle with higher wheelbase and track width for their comforting face these problems, so to Overcome this problem a concept of four wheel steering can be adopted in the vehicle. Four wheel steering reduces the turning radius of the vehicle which is effective in confined space, in this project four wheel steering is adopted for the existing vehicle and turning radius is reduced.

WORKING:

As the steering wheel is rotate to take turning, all wheels are steered. This happen because the motion of steering wheel transfer to steering rack, the steering rack's spindle joint by the pinion called as (spur gear) . There is also another steering rack mounted at the rear side of frame which also

contain the pinion. Both steering pinions are connected by the rack called as design rack. The design rack should mount in such a way that, it should transfer the motion from front pinion to rear pinion. This helps to steer the front wheel and rear wheel in opposite direction. Result in less turning radius. There is also axle available mounted at the rear side of frame to give motion to the vehicle. The system is pedal operated.

Figure .4 wheel steering mechanism referred from the internet source

II. LITERATURE REVIEW

[1] Four wheel steering system for Automobile
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Types of Steering Mechanism:
1 Ackerman's Steering Mechanism
2 Davis Steering Mechanisms

1 Ackerman's Steering Mechanism:
Ackermann steering geometry is a geometric arrangement of linkages in the steering of a car or other vehicle designed to solve the problem of wheels on the inside and outside of a turn needing to trace out circles of different radii. It was invented by the German Carriage Builder "Lankensperger" in 1817, then patented by his agent in England Rudolph Ackermann (1764–1834) in 1818 for horse drawn carriages. Erasmus Darwin may have a prior claim as the inventor Dating from 1758.

The intention of Ackermann geometry is to avoid the need for tires to slip sideways when following the path around a curve. The geometrical solution to this is for all wheels to have their axles arranged as radii of a circle with a common centre point. As the rear wheels are fixed, this centre point must be on a line extended from the rear axle. Intersecting the axes of the front wheels on this line as well requires that the inside front wheel is turned, when steering, through a greater angle than the outside wheel. Rather than the preceding "turntable" steering, where both front wheels turned around a common pivot, each wheel gained its own pivot, close to its own hub. A linkage between these hubs moved the two wheels together, and by careful arrangement of the linkage dimensions the Ackermann geometry could be approximated.

2 Davis Steering Mechanisms:-
The Davis gear mechanism consists of a cross link KL sliding parallel to another link AB and is connected to the stub axles of the two front wheels by means of two similar bell crank levers ACK and DBK pivoted at A and B respectively. The cross link KL slides insides in the bearing and carries pins at its end K and L. The slide blocks are pivoted on these pins and move with the turning of bell crank levers as the steering wheel is when the vehicle is running straight, the gear said to in its mid-position. The short arms AK and BL are inclined an angle 90+α to their stub axles AC and BD. The correct steering depends upon a suitable selection of cross-arm angle.

[2] Four wheel steering system for automobiles. Volume 2 ISSN 2394-3696 [2]

Types of Steering System:[2]

1) CONVENTIONAL STEERING SYSTEM:

In that steering system, only the front wheels are steered towards right or left According to the requirement because of at rear the dead axle is present.

2) FOUR WHEEL STEERING SYSTEM:

In that steering system, the all four wheels are to be steered according to the steer wheel perform to drive towards left or right. Four-wheel steering, 4WS, also called rear-wheel steering or all-wheel steering, provides a means to actively steer the rear wheels during turning maneuvers. It should not be confused with four-wheel drive in which all four wheels of a vehicle are powered. It improves handling and helps the vehicle make tighter turns. Production-built cars tend to under steer or, in few instances, over steer. In most active four wheel steering system.

The rear wheels are steered by a computer and actuators, the rear wheels generally cannot turn as far as the front wheels. Some systems including Delphi's Quadra steer and the system in Honda's Prelude line allow the rear wheels to be steered in the opposite direction as the front wheels during low speeds. This allows the Vehicle to turn in a significantly smaller radius sometimes critical for large trucks or tractors and vehicles with trailers.

[3] Prototype of four wheel steering system volume 4 issue 10 ISSN 2277-8179[3]

4 wheel steering types based on phase
there are mainly 2 types of 4WS based on phase.
a). In Phase Steering.
b). Counter Phase Steering.

a) In Phase Steering

In phase steering system the rear 2 wheels direction and front 2 wheels direction are same way. This produces a kind of sideways movement of the car at low speeds.

b) Counter Phase Steering

In this phase steering system the rear 2 wheels direction is opposite of the front 2 wheels direction. It produces a sharper, tighter turn.

4] Unknown, Four wheel steering, http://whatwhenhow.com/automobile/four-wheel-steering-4wsautomobile/, retrieved on 14th Sep 2012 [4]

The company **Honda Prelude [4]** manufactures the first four wheel steering car and it defines four wheel steering as the effect of the 4WS mechanism acting in this way was non-linear steering. That is, the Effective steering ratio varied from a low ratio at small steering angles, to high ratio at large angles. This means more steering angle input is required to perform a gradual turn, making the car less twitchy and more relaxed to drive at high speed, without requiring constant corrections; while less steering angle is required to perform a tight-radius turn, giving the car a go-kart like feel during tight maneuvers. The observed effect while driving might be best imagined as a variable effective wheelbase, from a long wheelbase at small steering angles, to very short wheelbase at large angles.

[5] Optimizing the turning radius of a vehicle using symmetric four wheel steering system Volume 4, Issue 12, December-2013 2177 ISSN 2229-5518 [5]

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.

[6] Optimizing the turning radius of a vehicle using symmetric four wheel steering system Volume 4, Issue 12, December-2013 2177 ISSN 2229-5518 [5].

STEERING MECHANISM

The basic and widely used steering mechanism is the rack and pinion mechanism. If is suitable for all types of vehicles with different wheel track and wheel bases. The functioning of this mechanism is also quite simple to understand and use. The pinion part of the steering system rotates with the steering wheel operated by the driver. The pinion is a circular gear which meshes with the gears on the rack, which is a longitudinal bar with gear teeth on it. As the pinion rotates, the rotary motion of it is transmitted as longitudinal motion on to the rack. The ends of the rack are usually connected to the kingpins of both wheels at either side by means of a drag link. This translational motion of the rack pushes or pulls the wheels about their kingpin axis, thus rotating the wheels in the desired direction.

PROBLEM DEFINATION:-

Nowadays all vehicles uses two wheel steering system, but the efficiency of the two wheel steering (2WS) vehicle is proven that it is still low compared to the four wheel steering (4WS) system car. So, this project is base on how to prove that the 4WS is better than 2WS in terms of turning radius. A vehicle with higher turning radius face difficulty in parking and low speed cornering due to its higher wheelbase and track width, but the passenger prefer the vehicle to be higher wheelbase and track width as it gives good comfort while travelling. In this scenario four wheel steering will be effective as the turning radius will be decreased for the same vehicle of higher Wheel base.

III. CUNCLUSION

By collecting the details we have researched and study number of literature available from the internet sources. About 4 wheel steering mechanism the above discussed literature reviews are helpful. By applying the rack and pinion arrangement we will minimize the turning radius up to 40-50% approximately.

IV. REFERENCES

[1]. Four wheel steering system for Automobile ISSN: 2394-3696 VOLUME 2, ISSUE 4APR.-2015

[2]. Four wheel steering system for automobiles. Volume 2 ISSN 2394-3696 [2]

[3]. Prototype of four wheel steering system volume 4 issue 10 ISSN 2277-8179[3]

[4]. Unknown, Four wheel steering, http://whatwhenhow.com/automobile/four-wheel-steering-4wsautomobile/, Retrieved on 14th Sep 2012[4]

[5]. Optimizing the turning radius of a vehicle using symmetric four wheel steering system Volume 4, Issue 12, December-2013 2177 ISSN 2229-5518

[6]. Maruti 800 specification chart.