DESIGN AND DEVELOPMENT OF FOUR WHEEL HYDRAULIC STEERING SYSTEM

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ABSTRACT
A Four-wheel steering system also known as Quadra steering system. In this system, both front wheel and rear wheels can be steered according to speed other vehicle and space available for turning. Quadra steer gives full size vehicle greater ease while driving at low speed, improves stability, handling and control at higher speed. Production-built cars tend to under steer or, in few instances, overseer. If a car could automatically compensate for an under steer overseer problem, the driver would enjoy nearly neutral steering under varying conditions. Four wheel systems is a serious effort on the part of automotive design engineers to provide near-neutral steering. This system finds application in off-highway vehicles such as forklifts, agricultural and construction equipment mining machinery also in Heavy Motor Vehicles. It is also useful in passenger cars. It improves handling and helps the vehicle make tighter turns. This system is used to minimize the turning radius.

Our project concept is based on mechanically and hydraulically operated ‘Four wheel steer technology’. So we made combination of mechanical and hydraulic arrangement with using to separate gear box we made physical model for our project. it consist of 2 set (Tata indicia) power steering, 2 set of bevel gear box, rotating shaft, hydraulic pump ,motor and hose pipes.

KEYWORDS: Hydraulic, Rack and Pinion, Rotating Shaft, Steering, Hydraulic Pump, Hose Pipes

INTRODUCTION
What is Steering?
- It provides directional stability of the vehicle when going straight ahead.
- It provides straight ahead recovery after completing a turn.
- It provides perfect rolling motion of the road wheels at all the time. i.e. perfect steering condition
- It helps in controlling wear and tear of tires.

Generally, almost all vehicles are steered by turning the front wheels in the desired direction, with the rear wheels following. However, recently all wheels steering has also been employed in some modern vehicle.
The steering system may be either manual or power assisted when the only energy source of the steering system is the force the driver applies to the steering wheels, the vehicle has manual steering, and power steering uses a hydraulic pump or electric motor to assist the driver’s effort. We made physical model for our project. It consist 2 set of power steering(Tata indicia), Two set of gear box (Bevel gears) , Rotating shaft , Hydraulic Pump , Motor , Hose pipes.

What is four Wheel Steering?
In Four wheel steering system, the all four wheels are to be steered according to the steer 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 manoeuvres. 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. If a car could automatically compensate for an under steer /over steer problem, the driver would enjoy nearly neutral steering under varying conditions. 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 tucks or tractors and vehicles with trailers.

METHODOLOGY:

EXPERIMENTAL
The concept of Hydraulic Steering of all four wheels of the vehicle is wide spread in heavy vehicles in European countries; it is new concept for our country. Most vehicles manufactured in our country do possess front wheel hydraulic steering. As our project, we experimented steering of all 4-wheels of vehicle with combo steering arrangement. The arrangement made such that all 4-wheels can be steered simultaneously with combination of hydraulic and mechanical force.

The reason behind made the combination of mechanical and hydraulic arrangement is for smooth operation and proper control of the system. And also due to this both combination the system is work smoothly and correctly. We can run whole system by only using mechanical arrangement but by only using mechanical arrangement more amount of steering effort is required .as same as we can run whole the system by using only hydraulic system but problem is that we are not able to regulate the movement of piston shaft which is inside the cylinder.

The piston shaft is only regulating by using Rack and pinion steering gear. Due to above all the problem we made combination of hydraulic and mechanical arrangement for our project. While working on the project, we noticed the same direction turn for the rear wheel, which is not desired. To avoid and provide opposite turn to rear wheel a small gearbox attached to
front and rear pinion shaft. we used Bevel gears in gear box. In addition fluid lines are connected to the opposite chamber of the cylinder. The calculation is made such that the rear wheel axle turns only half of the front wheel turn. Mechanically the gearboxes are connected with a intermediate shaft. Now, when the steering wheel is rotate by user or driver the vehicle wheel take turn to the the desired direction. this steering operation is similar to the normal car steering operation. by providing slide motion to the steering wheel the rotary valve will be operated. and fluid will supply in the proper cylinder chamber.

Now, during the right steering operation user or driver rotate steering wheel to the right side this will operate gearbox. gearbox will operate pinion shaft and rotary valve. by operating pinion and rotary valve the rack will slide towards the right side direction and our front wheel move towards the right side. now when the front gearbox is operated it will rotate the rotary shaft which is connect with gear box by means of nut and screw. so now when the rotary shaft rotate it will rotate rear gearbox and this gearbox operate the rear steering gear (pinion) and rack will move towards the left side. during this operation fluid will supply from tank to pump and from pump to power steering cylinder chamber. here rotating shaft in intermediate shaft which is connected between front bevel gear box and rear bevel gear box. Similarly the same operation will be done for a left turn but in opposite manners and the desired turning operation will be completed.
CONCLUSION

In present two wheels steering system there were many problems like grater turning radius, problems during tighter space parking, unstable during cornering and unstable high speed. So after modification of two wheels steering in four wheel hydraulic steering system we can reduce the turning radius, and problems like unstable during cornering and high speed is also solved and also we achieve that the performance and handling of the vehicle is increased.

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