

Review Paper on Steering System of Automobile

Harshal Bhore¹ Shripad Nikam² Shriniwas Nikam³ Shubham Mane⁴ Sourav Desai⁵

¹Assistant Professor ^{2,3,4,5}Student

^{1,2,3,4,5}Department of Mechanical Engineering

^{1,2,3,4,5}AITRC, Vita, India

Abstract— In today's world, safe operation of the vehicle demands that the operator be able to maintain absolute control of the vehicle's critical operating dynamics. Control of the direction of motion of the vehicle (steering). Control of the velocity of the vehicle, i.e., the ability to slow and fully stop the vehicle (braking). This paper provides an overview of electric assisted vehicular steering including brief description of various conventional systems and the basics of steering; particular attention is addressed to Electric Power Assisted Steering (EPAS). Electric power assisted steering has tempted automotive engineer since the 1950. Even so, the promise of smaller, lighter, and more efficient systems never quite matched the low cost and performance of hydraulic power assisted steering (HYPAS) advance in microelectronics; however, have rekindled interest in EPAS. Motor drive stages, electronic control units and torque sensor can now be manufactured relatively cheaply. These components, coupled with complex control algorithms implemented in software can rival or better the performance and functionality of conventional hydraulic steering systems.

Keywords: Steering System, Automobile

I. 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. Near the start of the 18th century, a large number of sea vessels appeared using the ship's wheel design, but historians are unclear when that approach to steering was first used. The first automobiles were steered with a tiller, but in 1894, Alfred Vacheron took part in the Paris Rouen race with a Panhard 4 hp model which he had fitted with a steering wheel. That is believed to be one of the earliest employments of the principle. From 1898, the Panhard et Levassor cars were equipped as standard with steering wheels. Charles Rolls introduced the first car in Britain fitted with a steering wheel when he imported a 6 hp Panhard from France in 1898. Arthur Constantin Krebs replaced the tiller with an inclined steering wheel for the Panhard car he designed for the 1898 Paris Amsterdam Paris race which ran 7–13 July 1898. In 1898, Thomas B. Joffrey and his son, Charles T. Jeffery,

developed two advanced experimental cars featuring a front-mounted engine, as well as a steering wheel that was mounted on the left-hand side. However, the early automaker adopted a more "conventional" rear-engine and tiller-steering layout for its first mass-produced Ramblers in 1902. The following year, the Rambler Model E was largely unchanged, except that it came equipped with a tiller early in the year, but with a steering wheel by the end of 1903. By 1904, all Ramblers featured steering wheels. Within a decade, the steering wheel had entirely replaced the tiller in automobiles. The function of the steering system is to provide directional control to the vehicle. For this a gearbox is used which converts rotational motion of steering wheel into translational motion of tie rod which in turn rotates the tires. For the steering system there are different types of gear box like Rack and Pinion, recirculating ball type, worm and sector etc. The steering system converts the rotation of the steering wheel into a swivelling movement of the road wheels in such a way that the steering-wheel rim turns a long way to move the road wheels a short way. The system allows a driver to use only light forces to steer a heavy car. The rim of a 15 in. (380 mm) diameter steering wheel moving four turns from full left lock to full right lock travels nearly 16 ft (5 m), while the edge of a road wheel moves a distance of only slightly more than 12 in. (300 mm). If the driver swivelled the road wheel directly, he or she would have to push nearly 16 times as hard. The steering effort passes to the wheels through a system of pivoted joints. These are designed to allow the wheels to move up and down with the suspension without changing the steering angle. They also ensure that when cornering, the inner front wheel - which has to travel round a tighter curve than the outer one - becomes more sharply angled. The joints must be adjusted very precisely, and even a little looseness in them makes the steering dangerously sloppy and inaccurate. There are two steering systems in common use - the rack and pinion and the steering box. On large cars, either system may be power assisted to reduce further the effort needed to move it, especially when the car is moving slowly. The wheel is considered as the most important invention made by mankind. It made travel to long-distance possible and allowed us to spread far and wide. To control the wheels and make the travel easier, the steering system was implemented. Today we will explain how a car steering system works and how the simple act of turning your steering wheel makes the car corner. 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 (which may also be part of the collapsible steering column design), 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. Steering wheels are used in most modern land vehicles, including all mass-production automobiles, buses, light and heavy trucks, as well as tractors. The steering wheel is the part of the steering system that is manipulated by the driver; the rest of the steering system responds to such driver inputs.

II. LITERATURE REVIEW

Mr. Omkar Diliprao Suryavanshi, et al. [1] presented a paper titled, 'Designing of the rack and pinion gearbox for all terrain vehicle for the competition baja sae india and endure student india'. This paper presents the Design of custom-made RPG gearbox has done with 20% reduction in weight and in less cost than OEM. By using designed RPG gearbox steering geometry selected should produce lock of 48 mm rack shift and thus desired steering angle. All the necessary analysis of component has been done to ensure that design is safe. To reduce equivalent stresses edge fillet should be given where stress concentration is more which reduces weight with increase in strength. From the structural analysis results we can conclude that to avoid failure of material Deformation should be as small as possible. Thus, RPG gearbox is designed with reduction in cost as well as Weight and desired steering ratio can be used for ATV Baja

Akash Patel, et al. [2] presented a paper titled, 'Design Methodology and Manufacturing of Rack and Pinion for All Terrain Vehicle'. This paper presented the manual rack and pinion are only used in light weight vehicles. The values calculated in the paper may differ practically due to improper steering geometry or due to steering linkages errors, so these values are useful to understand the interdependency of the quantities on each other and to design an ideal manual rack and pinion system for the vehicle.

Idil Ilke Gultekin, et al. [3] presented a paper titled, 'Modelling and simulation of power steering system for agricultural tractors' This paper presents in the scope of this study, an integrated hydraulic and mechanical system model for a HPS system is developed using the Flow and SimMechanics toolboxes of the MATLAB/ Simulink platform. The model has been tried by simulating various steering scenarios. The simulation model will be used in further studies such as energy optimization, modifications for improvements in the performance of existing designs, as well as in the development of new designs.

Arun Singh, et al. [4] presented a paper titled, 'Study of 4 Wheel Steering Systems to Reduce Turning Radius and Increase Stability'. This paper presents Four-wheel steering is a relatively new technology, that imposes maneuverability in cars, trucks and trailers. In standard two wheels steering vehicles, the rear set of wheels are always directed forward therefore and do not play an active role in controlling the steering in four-wheel steering system the rear wheel can turn left and right. To keep the driving controls as simple as possible. The aim of 4WS system is a better stability during overtaking maneuver's, reduction of vehicle oscillation around its vertical axis, reduced sensibility to lateral wind, neutral behavior during cornering, etc., i.e., improvement of active safety

Bhushan Akhare, et al. [5] presented a paper titled, 'Performance & Value Analysis of Power Steering System'. This paper presents the value and performance analysis in this paper will help to understand the error as well as this data can be used to increase the efficiency of power steering. There are still lots of possibility to make steering system easier and more effortless and this paper will help to provide a helpful thinking in that way. Power steering systems have been a proven technology for decades; there are still problems to be solved, most concerning quality issues. In this thesis, two predominant problems have been studied, hydraulic lag and the chattering phenomena. Power steering made vehicle driver smooth and effective driving in this paper we consider the part of automobile i.e., steering and how it works in terms of performance and values.

III. STEERING SYSTEM

In most cars, small trucks and SUVs on the road today, there is a rack and pinion steering system. This converts the rotational motion of the steering wheel into the linear motion that turns the wheels and guides your path. The system involves a circular gear (the steering pinion) which locks teeth on a bar (the rack). It also transforms big rotations of the steering wheel into small, accurate turns of the wheels, giving a solid and direct feel to the steering.

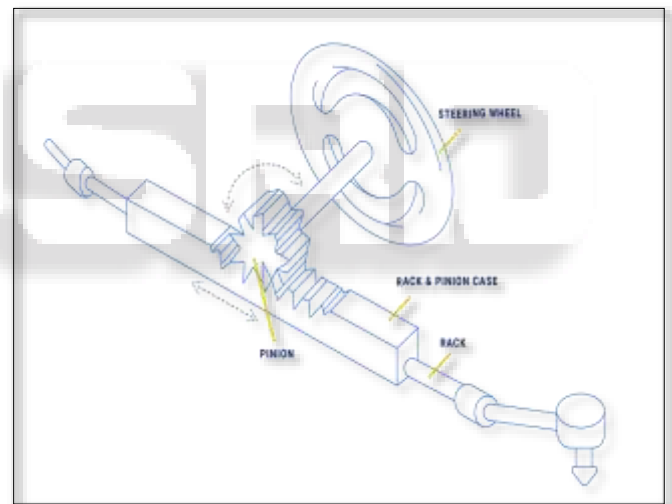


Fig. 1: Rack and Pinion Steering System

IV. CONCLUSION

In a conclusion, steering system is one of the most important features in automobile. This system will control all of the direction and movement of the wheel of our vehicle. Besides, the components that are involved in this system are steering knuckle, centre link, anti-sway bar, upper control arm and adjusting sleeve. This component must always in good condition so that steering system will run smoothly and more efficient to provide the driver with good experience of driving on the road. For this group assignment we are given three different type of car manufacturer such as Cadillac, Subaru, and Citroen. Different type of car manufacturer has different characteristic in technology invented and has their own advantages and disadvantages. This characteristic is very important because when we want to buy a car, we must know

at least how this system works and how this feature can help us to enjoy a good experience of driving in our life.

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