

ELECRIC POWER ASSISTED STEERING

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Abstract

Electric Power Steering Systems can become one of the important components of modern cars. It consists of mechanical(steering), electrical(electric motors), electronic(sensors) components. These electro-mechanical components serve a better handling to the driver. This paper present the modeling of EPAS system. Tests were made on the prototype and the prototype was tested for simulation. The system can be used in modern day cars to assist the driver in handling.

Keywords: Electric, component, power, steering

1. Introduction

Steering is one of the important factor of cars. Safe driving of car needs proper operation of steering system, and also the driver to operate it properly.

Electric power steering uses an electric motor to assist the driver in steering. The sensors attached to the steering system helps to detect the position and torque of the steering column. EPAS applies assistive torque with the help of the electric motor. This allows varying assistance applied on driving conditions.

EPAS have a major advantage over fuel efficiency, as there is no belt driven hydraulic pump whether the assistance is required or not.

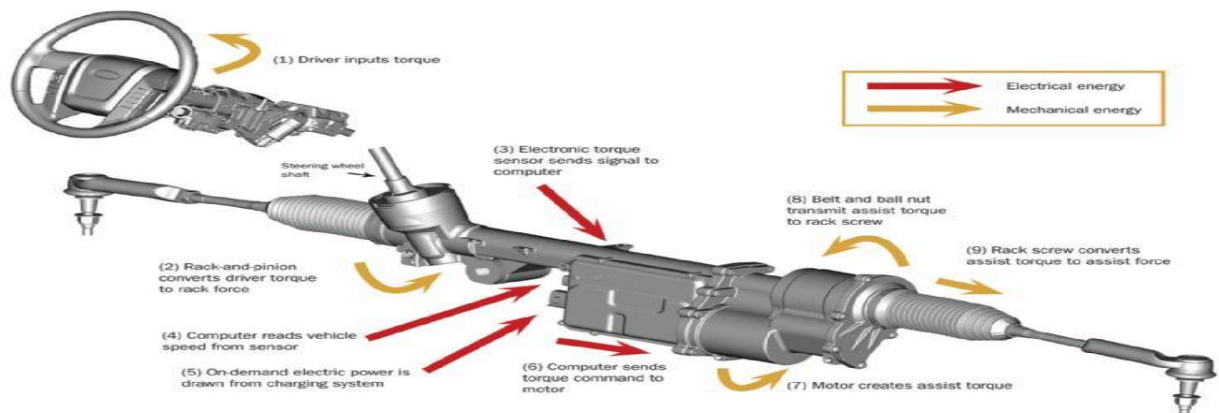


Fig. 1 Electric Power Assisted Steering used in FORD

2. Functions

The primary function of a steering system is to assist a driver in taking a turn by achieving an angular motion of the front wheels. This is done through linkage and steering gear by converting rotary motion of the wheels into angular motion of the road wheels.

Some of the secondary functions of steering systems are as follows:-

- To provide directional stability to the vehicle while moving straight ahead.
- To provide perfect rolling conditions to the wheels at all times.
- To facilitate straight ahead recovery to the vehicle after completing the turn.
- To reduce the driver effort to steer i.e. for steering left and right.
- To minimize wear & tear of wheel tires.

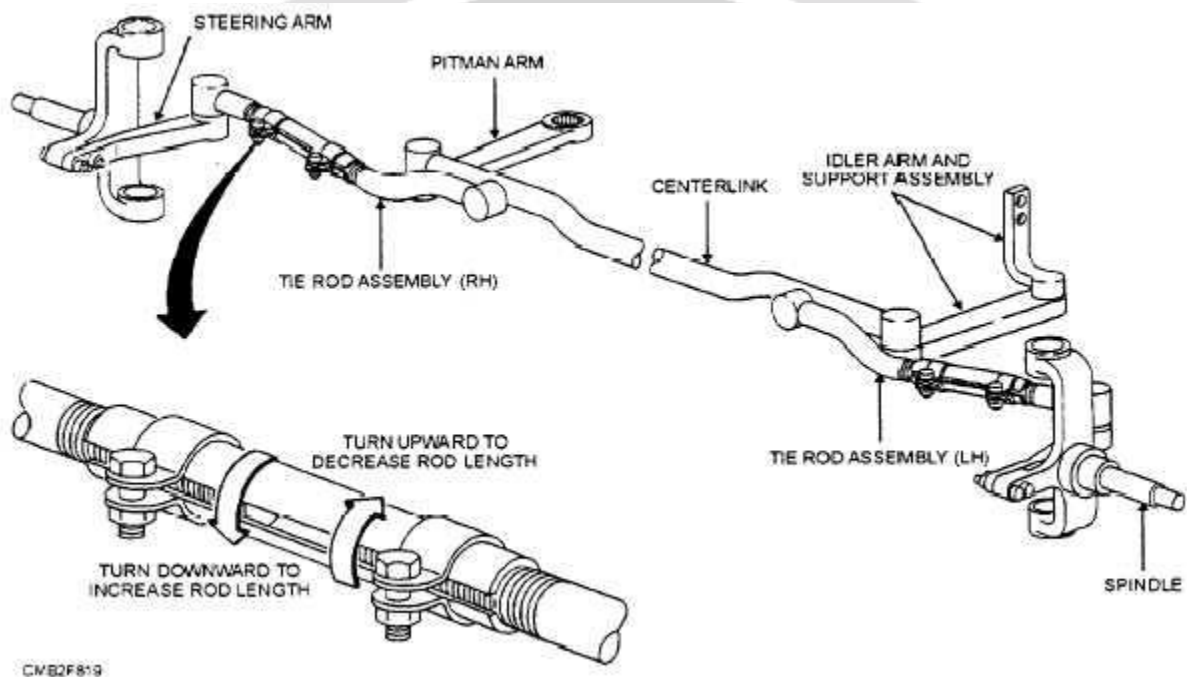


Fig. 2 Steering Linkage

3. Steering Gears

The steering gears convert the rotator motion of the steering wheel into to & fro motion of the link rod. Also it provides necessary leverage so that driver can steer easily without fatigue. There are many type of steering gears in automobiles.

1. Worm & worm wheel steering gear
2. Cam and double roller steering gear
3. Re-circulating ball type steering gear
4. Rack & pinion steering gear

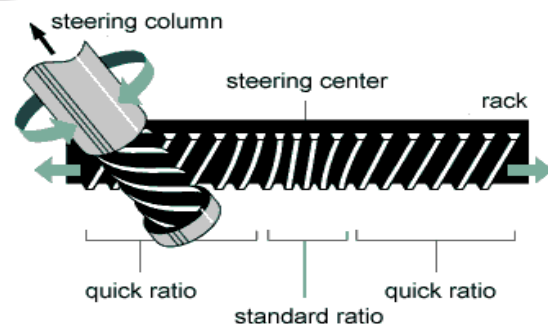


Fig. 3 Steering Gear

4. Need of EPS

The two basic reason for the need of Electric Power Assisted Steering are as follows:-

1. Heavier cars require more power and effort to turn the steering wheel
2. The present generation electric steering system can't deliver the driver's expected feel and handling.

5. System Modeling & Working

5.1. Construction

Currently there are four different types of EPAS, which are all based on rack and pinion steering. Each is different to other, by placement of it's motor.

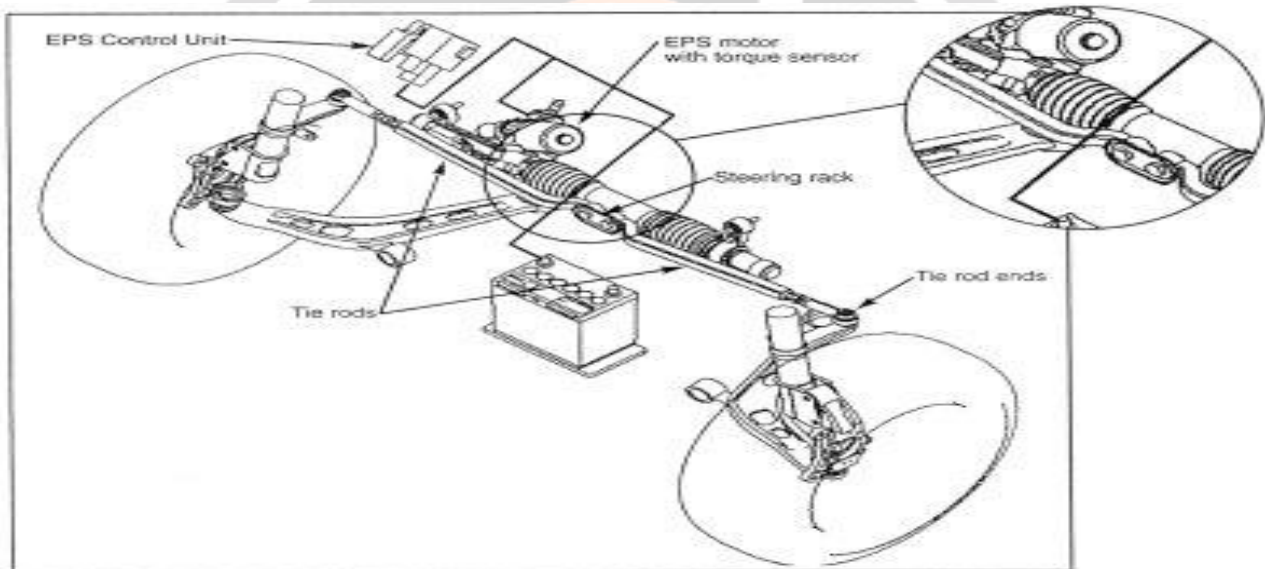


Fig. 4 EPAS Construction

This type of EPAS uses permanent magnet direct current(DC) motor. At one end of the motor, a gear meshes with another gear to turn a ball screw which is parallel to the rack. The steering wheel torque sensor is also fitted with the EPAS motor. An EPAS control Unit is mounted to control the system.

On the whole, the system consists of an electric control unit(ECU), a torque sensor, an electric motor and a rack & pinion gear arrangement.

5.2. Working

The ECU uses the vehicle speed and engine speed to calculate the additional force required by the EPAS to achieve the pre-programmed steering feel. The power required to steer the wheel is then transmitted by the help of interne-

diate gear system.

At low speed, the system offer maximum power to assist the driver in steering, while at high speed when low or no assistance is required, it reduces the amount of power supplied.

Throughout the operation the ECU monitors the system constantly to detect malfunction and disengage the EPAS if required.

6. Conclusion

There are some drawbacks, which are temporary barrier for large scale introduction in today's cars but it can be uniquely stated that EPAS is the future of automobile industry. But the advantages overweigh the disadvantages, soon the EPAS will become more efficient, reliable and safe power steering system.

7. References

- [1] Bleckmann H., Fennel H., Gr"aber J. and Seibert W., "Traction control system with teves abs mark ii," in SAE International Congress and Exposition, no. 860506, Februari 1986.
- [2] Khurmi s., S-chand publication "Theory of Machines" 1st edition Chapter 9.
- [3] Ratan S., Tata Mc-graw Hills publication , "Theory of Machines" Vol 1,
- [4] Magazine "Toyota Technical Training" 2007-8 .
- [5] ZHOA WanZhong, "Control Strategy of Noval Electric Power Steering System Integrated With Active Steering Function" International Journal , June 2011, Vol 54 , No 6: 1515-1520.
- [6] Akhre Bhushan, Chouhan Sanjeev , "Analysis of Power Steering System Assembly", International Journal of Engineering and Innovative Technology Vol. 1, June 6,2012.
- [7] Rosth Marcus , "Hydraulic Power Steering System Design In Road Vehicles" Analysis, Testing, and Enhancement Report (International),2007
- [8] M.F. Rehman, "ELECTRIC POWER ASSISTED STEERING SYSTEM FOR AUTOMOBILES", Electrical Engineering Vol.3.