

A

Seminar report

On

Power Steering

Submitted in partial fulfillment of the requirement for the award of degree
of Bachelor of Technology in Mechanical

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Preface

I have made this report file on the topic **Power Steering**; I have tried my best to elucidate all the relevant detail to the topic to be included in the report. While in the beginning I have tried to give a general view about this topic.

My efforts and wholehearted co-corporation of each and everyone has ended on a successful note. I express my sincere gratitude towho assisting me throughout the preparation of this topic. I thank him for providing me the reinforcement, confidence and most importantly the track for the topic whenever I needed it.

Introduction

In automobiles, **power steering** (also **power-assisted steering (PAS)** or **steering assist system**) helps drivers steer by augmenting steering effort of the steering wheel.

Hydraulic or electric actuators add controlled energy to the steering mechanism, so the driver can provide less effort to turn the steered wheels when driving at typical speeds, and reduce considerably the physical effort necessary to turn the wheels when a vehicle is stopped or moving slowly. Power steering can also be engineered to provide some artificial feedback of forces acting on the steered wheels.

Hydraulic power steering systems for cars augment steering effort via an actuator, a hydraulic cylinder that is part of a servo system. These systems have a direct mechanical connection between the steering wheel and the linkage that steers the wheels. This means that power-steering system failure (to augment effort) still permits the vehicle to be steered using manual effort alone.

Electric power steering systems use electric motors to provide the assistance instead of hydraulic systems. As with hydraulic types, power to the actuator (motor, in this case) is controlled by the rest of the power-steering system.

Other power steering systems (such as those in the largest off-road construction vehicles) have no direct mechanical connection to the steering linkage; they require electrical power. Systems of this kind, with no mechanical connection, are sometimes called "drive by wire" or "steer by wire", by analogy with aviation's "fly-by-wire". In this context, "wire" refers to electrical cables that carry power and data, not thin-wire-rope mechanical control cables.

Some construction vehicles have a two-part frame with a rugged hinge in the middle; this hinge allows the front and rear axles to become non-parallel to steer the vehicle. Opposing hydraulic cylinders move the halves of the frame relative to each other to steer.

History

The first power steering system on an automobile was apparently installed in 1876 by a man with the surname of Fitts, but little else is known about him. The next power steering system was put on a Columbia 5-ton truck in 1903 where a separate electric motor was used to assist the driver in turning the front wheels.

Robert E. Twyford, a resident of Pittsburgh, Pennsylvania, included a mechanical power steering mechanism as part of his patent (U.S. Patent 646,477) issued on April 3, 1900 for the first four-wheel drive system.

Francis W. Davis, an engineer of the truck division of Pierce-Arrow, began exploring how steering could be made easier, and in 1926 invented and demonstrated the first practical power steering system. Davis moved to General Motors and refined the hydraulic-assisted power steering system, but the automaker calculated it would be too expensive to produce. Davis then signed up with Bendix, a parts manufacturer for automakers. Military needs during World War II for easier steering on heavy vehicles boosted the need for power assistance on armored cars and tank-recovery vehicles for the British and American armies.

Chrysler Corporation introduced the first commercially available passenger car power steering system on the 1951 Chrysler Imperial under the name "Hydraguide". The Chrysler system was based on some of Davis' expired patents. General Motors introduced the 1952 Cadillac with a power steering system using the work Davis had done for the company almost twenty years earlier.

Charles F. Hammond from Detroit filed several patents for improvements of power steering with the Canadian Intellectual Property Office in 1958.

Most new vehicles now have power steering, owing to the trends toward front wheel drive, greater vehicle mass, and wider tires, which all increase the required steering effort. Heavier vehicles, as are common in some countries, would be extremely difficult to maneuver at low speeds, while vehicles of lighter weight may not need power assisted steering at all.

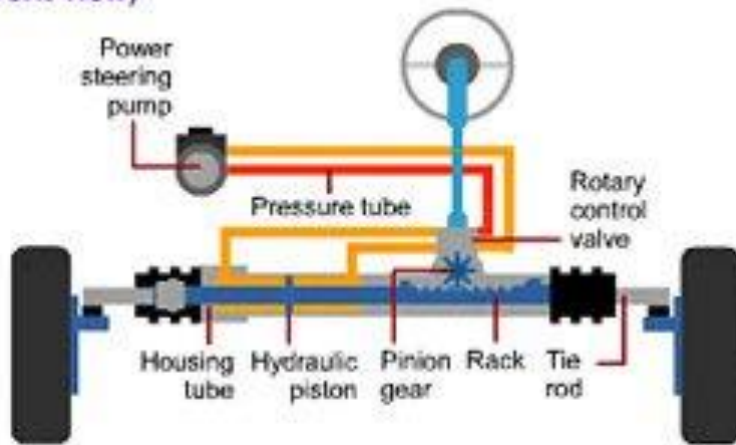
Difference between Power Steering and Normal Steering

Power steering is a system that helps in steering the wheels by using some auxiliary network of power. Normal steering is a steering system in which manual force is used for steering. Normal steering is also known as manual steering or non-power steering.

You want to buy a new car and still thinking about the steering system or you are thinking of converting your steering system, then you must have explored both the systems. However, those who do not know much about the steering systems, this article will clear your doubts or provide you the information regarding the power steering and normal steering.

Power steering is a system that helps in steering the wheels by using some source of power. Steering refers to guiding the wheels towards the intended direction. You must be familiar with the steering systems of cars. The driver uses the steering to control the course taken by wheels. Normal steering is totally different type of steering in which manual force is used for steering. However, today most of the cars have power steering systems. Some people may get confuse between electric and electronic power steering. However, they both refer to the same system. The electric power steering is also known as electronic power steering as it uses the electronic steering control unit.

**Power Steering
(front view)**



When we talk about power steering, than we are either referring to hydraulic power steering or electric power steering. Thus, we can say that electric power steering is a type of power steering and thus has all the features of a power steering. There are two basic steering mechanisms:-

1. Rack and pinion steering- in this system a pinion gear is attached to the steering shaft which means that as the steering wheel is turned it turns the pinion gear(circular) and then moves the rack (linear). It is basically using the rotational motion of steering wheels and then converting this rotational motion into the linear motion. This linear motion is required to turn the wheels.
2. Recirculating ball steering- in this system, a box is fastened over a worm drive that contains many ball bearings. These ball bearings loop around the worm drive and these balls moves out into a recirculation channel and again gets back into the worm drive. When the steering wheel is turned, the worm drive turns and forces the balls to press against the channel inside the nut. Now this forces the nut to move along the worm drive

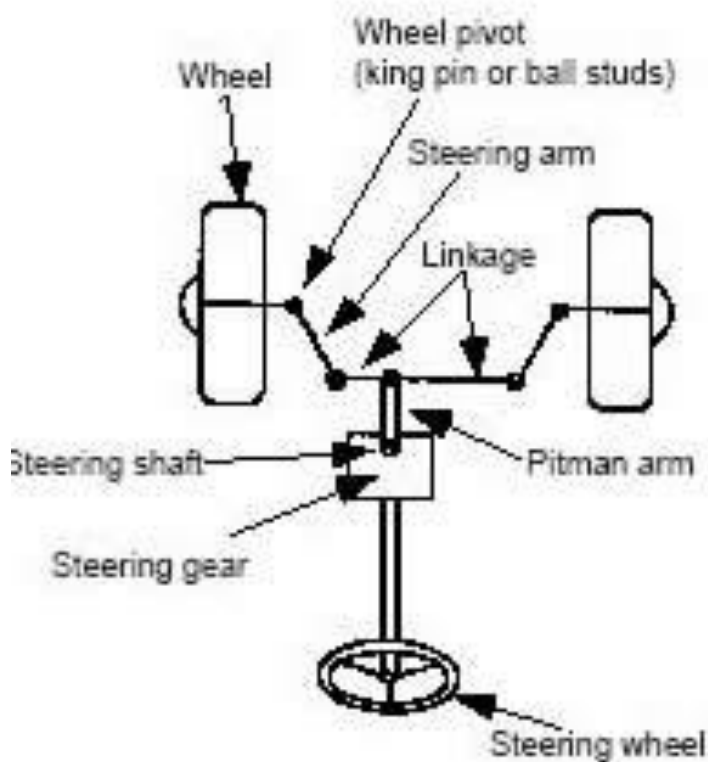
Let us now understand the basic concepts of power steering. Power steering uses hydraulics or fluid pressure in order to help the steering systems. Power steering is preferred when quick turns need to be taken.

There are three main power steering components- power steering pump, power steering fluid reservoir, steering gear box. Power steering can be of three types:-

1. Hydraulic power steering
2. Electric power hydraulic steering (EPHS)
3. fully electric power steering (EPS)

Hydraulic power steering mainly use hydraulic fluid and the pressure that is generated through this hydraulic fluid helps the driver in steering the wheels. In EPHS the customary drive belts and pulleys that drive a power steering pump are replaced by a brushless motor. It is driven by an electric motor and thus also reduces the amount of power that needs to be taken from the engine otherwise. The third category is electric power steering. In this kind of system, an electric motor replaces the hydraulic pump and a fully electric power steering system is established. The electric motor is either attached to the steering rack or to the steering column. The very important component is the electronic control unit that controls the steering dynamics.

Most of the steering systems that are used today are of power steering type. Very few systems use manual steering. EPS are often preferred for the fuel economy and lower emission.



On the other hand, normal steering requires more efforts to steer the vehicles. The only energy source for the manual steering system is the force that the driver applies to her steering wheel. However, power steering always allows normal steering to be available; this may help in case of the problem in engine or in the case of power assist system failure.

There are several types of manual steering systems like

1. Worm and sector
2. Worm and Roller
3. Cam and lever
4. Worm and nut
5. Rack and pinion

Some of the differences are listed in the table below:-

	Power Steering	Normal Steering
Definition	Power steering is a system that helps in steering the wheels using some source of power.	Normal steering is a system in which manual force is used for steering.
Mechanism	Hydraulic : rack and pinion, re-circulating ball and nut, worm and roller, hydrostatic Electrical: Rack and pinion, column driven EPS, pinion driven EPS, Rack driven EPS	Normal steering rack uses a rack and pinion, worm and roller and recirculation ball and nut.
Response	Comparatively quick	Comparatively slow
Resistance to wheel movement	Less	More
Preferred	Comparatively heavy weight vehicles	Low weight vehicles
Elements	A hydraulic pump, fluid reservoir, hoses, lines; and either a power assist unit mounted on, or integral with, a power steering gear assembly	Steering wheel and column, a manual gearbox and pitman arm or a rack and pinion assembly, linkages; steering knuckles and ball joints, and 4. the wheel spindle assemblies
Advantages	Absorbs road shocks, minimum efforts, greater safety and controllability under critical situations	Mechanical connection between the steering wheel and the wheel and all the components continues to be maintained without the help of the auxiliary power

Disadvantages of Electric Power Steering

Electric power steering is a power steering system that uses computers, electronic sensors and a small electric engine to replace traditional, hydraulic power steering. While there are numerous advantages to this system, including increased gas mileage and a less labor intensive fix, there are also certain disadvantages to electric power steering.

Cost

Electric power steering systems improve auto efficiency and safety. However, electric power steering is still relatively new and costly compared with traditional hydraulic steering.

Home Repair

A disadvantage common to electronic car parts is they can't be repaired without specialized diagnostic equipment and advanced tools. Electric power steering is a great boon to a car, but when it fails due to computer failure, sensor damage or just parts wearing out, the owner will be stuck with a significant bill. More traditional systems are friendlier to the DIY owner.

Upgrading

Upgrading a traditional vehicle's hydraulic power steering system to an electric power steering system is a big project with a hefty cost. Newer cars are built with electric power steering systems in mind, whereas hydraulic systems are larger, clunkier and arranged differently.

Reference

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