

Factors Influencing the Technical Condition of Automobile Steering System and Its Detection Technology Research

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ABSTRACT: With the development of economy, human to the world to further explore and cognitive, people's dependent on cars is becoming more and more obvious, The automobile steering technology system play an important role in the safety and performance of the improved control of the car. At first, this paper summarizes the automotive steering system the research status and development trend, followed by a summary of the automotive steering system development process, on the car steering law were briefly introduced. Finally, further analysis of the steering system is mainly technical condition detection technique.

Keywords: Steering system; Power-assistant; Technical condition Influence factors; Detection

I. INTRODUCTION

As an important part of the car, the car steering system is the key to determine the active safety of the car assembly, the car's steering characteristics of the car has a good maneuverability, its performance is directly related to the comfort of the car, car steering system to ensure traffic Safety, reduce traffic accidents and protect the driver's personal safety, improve the driver's working conditions play an important role.

Electric power steering system after nearly 20 years of development, technology matures, its application range from the initial front axle load smaller steering column power EPS mini-car forward load larger large cars, commercial buses, trucks Direction of the development of the EPS system to help the form of low-speed, steering column to the full-speed, rack-assisted development. Due to technology, manufacturing and maintenance costs and other reasons, the current car steering system is still hydraulically powered HPS (including ECHPS, EHPS) based. EPS with energy saving and environmental protection and many other advantages, EPS to replace HPS is the next period of time the trend of car steering system development.

In addition, the wire-steering system is also a trend in the future development, it is based on the EPS, will shift to the development of the system has taken a step forward, will provide intelligent vehicle driving to provide technical support.

II. TECHNICAL STATUS OF STEERING SYSTEM AND ITS INFLUENCING FACTORS

A. Technical status of steering system

In the process of moving the car in a straight line, the steering wheel in order to eliminate the idle gap and overcome its elastic deformation of the angle turned, said the angle for the steering wheel free travel, also refers to the process of driving the car, the driver to the left Or the right direction, the steering wheel does not occur when the steering wheel can turn the angle, it is called the steering wheel free travel. The presence of the free travel of the steering wheel is beneficial to ease the impact from the road surface, increase the driving comfort of the driver, prevent the driver from becoming tense, but the angle of the steering wheel can not be too large, otherwise it will affect the steering sensitivity. Resulting in the phenomenon of steering swing. The angular ratio of the steering system is the ratio of the angular gain of the steering wheel and the corresponding angular increment corresponding to the ipsilateral knuckle, that is, the result of the ratio of the diverter angular ratio and the angular ratio of the steering mechanism. The size of the steering angle ratio, to a certain extent, will affect the size of the steering wheel in order to overcome the steering torque of the steering wheel, and then the size of the diameter of the steering wheel and the direction of the steering wheel The size of the moment. Mechanical steering system due to the relationship between the components of the assembly gap, it is difficult to ensure the steering sensitivity and portability, so more and more vehicles are using power steering system. When the vehicle is turned, the distance between the wheels on the inside of the vehicle and the outer wheels must be different. The final intersection of the four wheel axes is called the steering center of the car, as shown below. The angle α deflected by the steering wheel on the outside of the vehicle must be smaller than the deflected angle β of the inner wheel when the vehicle is turned. The relationship between α and β should be

$$\cot \alpha = \cot \beta + \frac{B}{L}$$

B - on both sides of the steering wheel of the main pin center distance (can be approximated as the steering wheel wheel); L - car wheelbase. This relationship is guaranteed by the steering trapezoid. The steering trapezium of all cars is only to ensure that the steering wheel on both sides of the steering wheel in the steering angle of deflection is basically consistent with this relationship, and the wheel will be within a certain range of deflection angle. As shown in Figure 2-1.

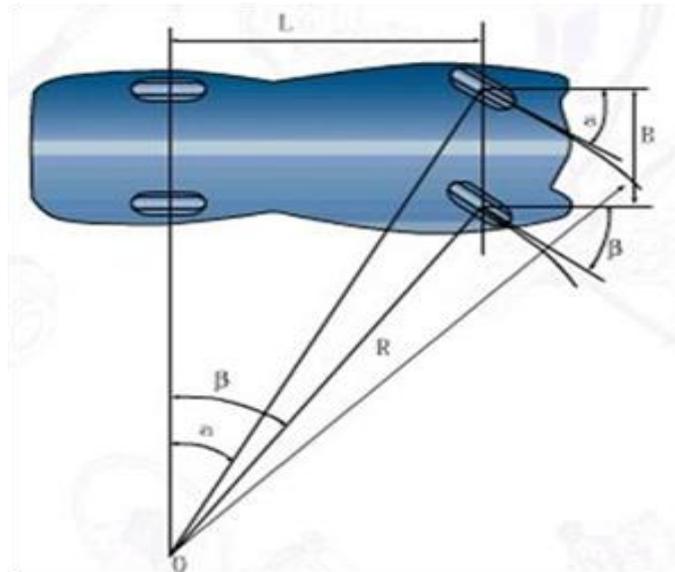


Figure 2-1. Car steering diagram

The radius of the turning of the vehicle is the distance from the steering center O in the figure to the contact point on the outer wheel and the ground. When the turning radius R becomes smaller, the smaller the number of places where the steering of the vehicle is needed, making the flexibility of the motor vehicle better, and only if the deflection angle of the vehicle's outer wheel is maximized, The car's turning radius to achieve the minimum, so that the motor's mobility will be the best.

B. Influencing factors of the technical status of the steering system

The realization of the free travel of the steering wheel is due to the installation of the parts of the system when the assembly between the gap between them and the space required to run. The size of the free travel of the steering wheel will be affected by the change in the assembly relationship between the various parts of the steering system or the wear of the parts. The main factors affecting the assembly and the transmission gap between the steering gear assembly and the steering mechanism situation.

- (1) The influencing factors that exist in the vehicle steering gear assembly are the adjustment condition and the amount of wear of the main drive of the steering gear.
- (2) The influencing factors that exist in the steering section of the vehicle are the gap between the steering pin and the knuckle bushing, the tightening force of the steering arm setting screw wait.

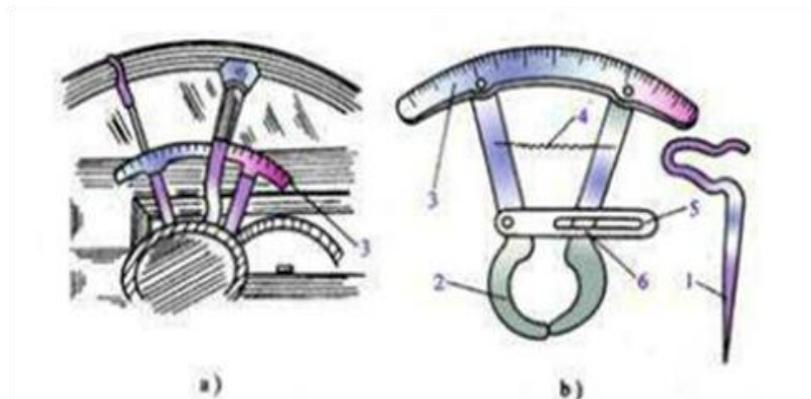
The angular transmission ratio of the steering system is the product of the angular ratio of the steering angle and the angular transmission ratio of the steering transmission mechanism. Therefore, the influence factor of the magnitude of the value is naturally composed of these two parts. First, the steering mechanism is larger than the basic Stable in the 1 or so, in the process of steering will be different with the steering knuckle angle and a series of changes, but the magnitude of the change will not be too large, so the steering angle ratio is mainly driven by the steering angle ratio The size of the steering gear to the impact of the size of some constant (pure mechanical steering system), some are changing. In the car steering movement, the movement of the wheel will be affected by the steering system angle ratio, the wheelbase is the distance between the front and rear axles, steering trapezium, the location of the center of gravity of the vehicle and the soft and hard suspension system. Steering angle ratio and the wheelbase of the car can directly affect the car's minimum turning radius, and the minimum turning radius of the size of the car is to evaluate the performance of important indicators of good steering, but also to reflect the wheel movement of the important parameters of the law.

III. RESEARCH ON TECHNICAL CONDITION PARAMETER DETECTION TECHNOLOGY OF STEERING SYSTEM

C. Detection of free travel of steering wheel

There are many kinds of free travel detection of the steering wheel, the most common instrument is a simple steering wheel free travel detector, as shown in Figure 3-1, it is composed of dial and pointer. The instruments used in the detection of the scale and the pointer are fixed in the steering wheel steering wheel and the steering wheel on the edge. Simple steering wheel free travel detector fixed way there are two, respectively, mechanical and magnetic type.

In the absence of a dedicated inspection instrument, we can use a wire to complete the simple test, one end of the wire should be fixed on the outer shaft of the steering shaft, the other end to make the way the pointer, and let it point to the steering wheel On the edge, let the steering wheel of the vehicle in a straight line position, start to detect, turn the steering wheel to the left position of a slight resistance, this time, hold down, marked with chalk, then hit the steering wheel to the right, repeat the above action, At the end, measure the size of the arc length twice, and then calculate the angle of the turn according to the radius of the steering wheel.



1-pointer; 2-chuck; 3-dial; 4-spring; 5-connecting plate; 6-fixing screw
Figure 3-1 Simple Steering Wheel Free Travel Detector

D. Detection of steering angle transmission ratio

The steering angle ratio is the product of the angular ratio of the steering gear and the angular transmission ratio of the steering transmission mechanism. Therefore, the influence factor of the size of the steering mechanism is composed of these two parts. The transmission ratio detection system is mainly realized by changing the gear ratio of the gear fan by changing the meshing radius of the tooth fan (changing the modulus and pressure angle of the tooth fan), Grating sensors, interface templates and computer systems and other components. The mechanical drive table is mainly used to achieve the measured components (gear, shown in Figure 3-2) drive, two grating fixed and stepper motor fixed. When the stepping motor drives the rack for linear motion, the rack and the teeth are engaged with each other, thereby driving the teeth to do the rotary motion. During the course of the experiment, the transmission ratio of each point is measured.

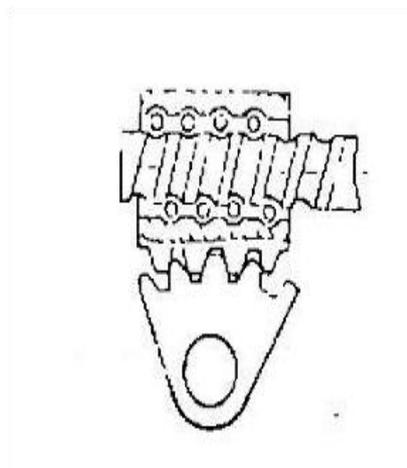


Figure 3-2 Tooth frame structure



Figure 3-3 Steering parameter measuring instrument

Generally, the steering light of the steering wheel is used as the maximum cutting on the outer edge of the steering wheel. The force is the steering force to express. Use the steering parameter meter to detect the corresponding technical condition. Steering parameter measuring instrument shown in Figure 3-3, the basic composition of the steering wheel, the main chassis, connecting fork and positioning rod four parts. This steering parameter measuring instrument is suitable for steering test of automobiles, tractors, construction machinery and other wheeled vehicles. It can measure the steering wheel free corner, in situ steering force, steering wheel torque, corner equivalent, with networking capabilities, with the host computer and other testing equipment together constitute an intelligent test line. Normally, the steering parameter measuring instrument is mounted on the steering wheel and is aligned with the center of the steering wheel, so that the operation panel is fixed on the steering wheel, and the control panel is fixed on the bottom plate, through the torque sensor on the bottom plate and the three connecting fork Connected. The main chassis is also fixed on the floor, there are computers and printers. In addition, the positioning rod protrudes from the bottom plate and is attracted to the instrument panel in the cab by the magnetic force base. The photoelectric device in the positioning rod is installed in the lower part of the main box. Its main function is to protrude from the bottom plate, and the magnetic force is adsorbed on the instrument panel in the cab.

Steering parameter measuring instrument works is relatively simple, when turning the steering wheel, on the one hand the steering force through the floor, torque sensors, connecting fork to the measured steering wheel, the steering wheel to achieve the steering wheel, that is, On the other hand, the torque sensor converts the steering torque into an electrical signal, and the photoelectric device in the positioning rod converts the change of the angle into an electric signal. The two analog electric signals are sent to the microcomputer through the amplification filter circuit and the analog-to-digital converter, By the computer automatically complete the data acquisition, computing, analysis, storage and display, you can measure the actual steering force and steering wheel angle. There are three general methods of detecting the steering force, namely the in situ steering force test, the low speed steering angle test and the cornering force test. However, in the integrated testing station is usually used in situ steering force.

IV. CONCLUSIONS

This paper mainly introduces the development process of automobile steering system, elaborates the working principle of various steering systems, and analyzes the change and influencing factors of steering system technical condition from steering safety and handling stability, The law of a simple discussion, so I have a deeper understanding of the steering system. In addition, the automotive electronics technology is also evolving, domestic automobile electric steering system technology development will also be mature, although in catching up with the international level there is still some distance, but the future in the automotive technology, especially in the car electric turn this A field, our country must occupy a place.

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