

# Unit 8 Automotive Steering System

## 汽车转向系统

## *Passage A Types of Steering System*

### 转向系统的类型

The steering system is a major part of the car. A good steering system makes driving much more pleasurable, comfortable and safer. The steering system, including steering wheel, steering gears, linkages and other components, is used to control the direction of a car' s motion. (转向系统包括方向盘, 转向器, 连杆系和其他部件, 用来控制运动方向) Today, there are two basic types of steering systems: (1) recirculating-ball steering and (2) rack and pinion steering. (转向系统主要有两种基本类型: 循环球式转向器, 齿轮齿条式转向器) The recirculating-ball steering can be either power-assisted or non-power. Rack and pinion is almost always power-assisted. See figure 8-1. (循环球式转向器可以是助力的也可以是非助力的。齿轮齿条式转向器大多数是助力的)

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### Recirculating-ball Steering (循环球式转向器)

Recirculating-ball steering is used on many trucks and SUVs today. **The larger and heavier the automobile is, the more difficult it is to steer. Most large automobiles are equipped with a recirculating-ball steering gear.** (车辆越重, 越难转向, 大多数大型车都装有循环球式转向器) This type of steering gear is very low in friction and provides a good mechanical advantage for a heavy vehicle. (这类转向器摩擦小, 对重型车具有良好的机械效益。) The recirculating-ball steering uses a series of links and arms to ensure both wheels turning in the same direction at the same time. (循环球式转向器用一连串的转向拉杆和转向臂保证两个转向车轮同时向同一方向转动) See figure 8-1.

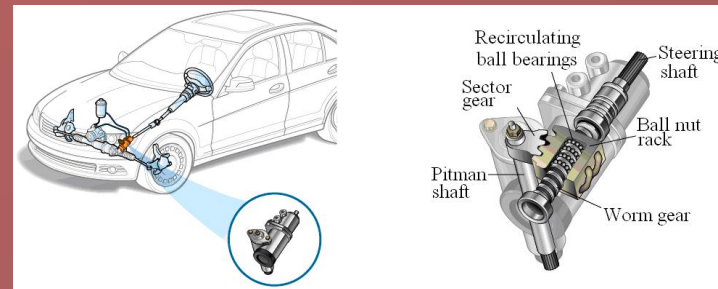


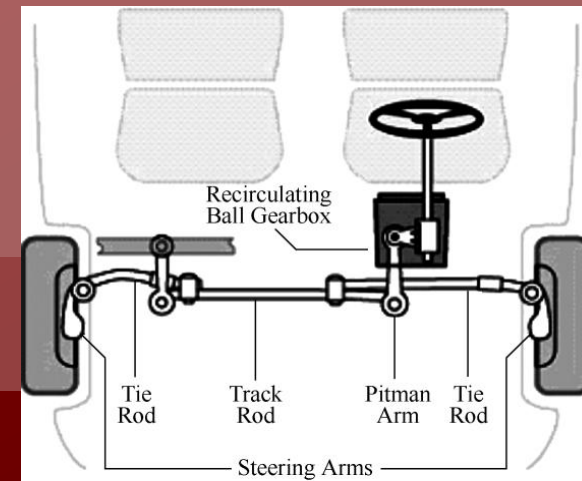
Figure 8-1 Recirculating-ball steering

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The recirculating-ball steering system consists of steering wheel, steering shaft (column), worm gear and sector gear in a steering gear box, pitman arm, track rod, tie rod and steering arm. (循环球式转向器包括转向盘, 转向杆 (转向柱), 蜗杆齿轮和转向齿轮箱里的齿扇, 还有转向摇臂, 横拉杆, 转向横拉杆和转向臂) See figure 8-1. The steering wheel is connected to the steering shaft through the steering shaft. On the end of the steering shaft is a worm gear in the steering box. And a ball nut rides on the worm gear and also engages with the sector gear on the pitman shaft. A pitman shaft is mounted in the box in a position  $90^\circ$  to the worm gear. See figure 8-2. (方向盘通过转向杆与转向箱连接。转向杆末端是转向箱中的一个蜗杆齿轮。循环球螺母依靠在蜗杆齿轮上, 并且与转向摇臂轴的齿扇啮合。转向摇臂安装在装箱中, 与蜗杆齿轮成九十度角)

Figure 8-2 Recirculating-ball steering assembly



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The pitman arm is connected to one end of the track rod. In the other end of the track rod is an idler arm. Between the idler and pitman arms, the track rod is supported in the proper position to keep the left and right wheels working together. (转向摇臂与横拉杆一端相连。横拉杆另一端是随动转向轴。在随动转向轴和转向摇臂之间，横拉杆被固定在恰当的位置以保持左右车轮一起工作。)

The inner tie rod ends are attached to either end of the track rod and provide pivot points for the steering gear. From there they go to the outer tie rod ends through an adjustment sleeve. This sleeve joins the inner and outer tie rod ends together and allows for adjustment when the front wheels are aligned. The outer tie rod ends are connected to the steering knuckle arms that actually turn the front wheels. See figure 8-3. (转向横杆内端与横拉杆一端连接，为转向器提供支点。在那里它通过调节套管与转向横拉杆外端连接。该套管将转向横拉杆内端和外端结合在一起，当两个前轮对齐时进行调节。转向拉杆外端与真正控制前轮的转向节臂连接。)

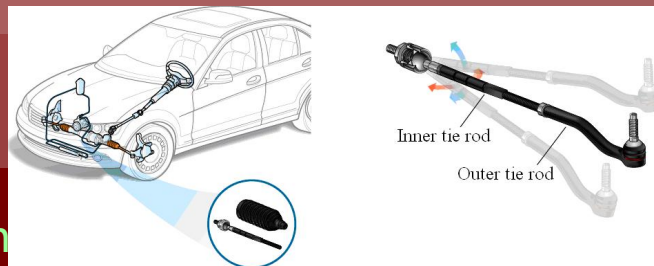


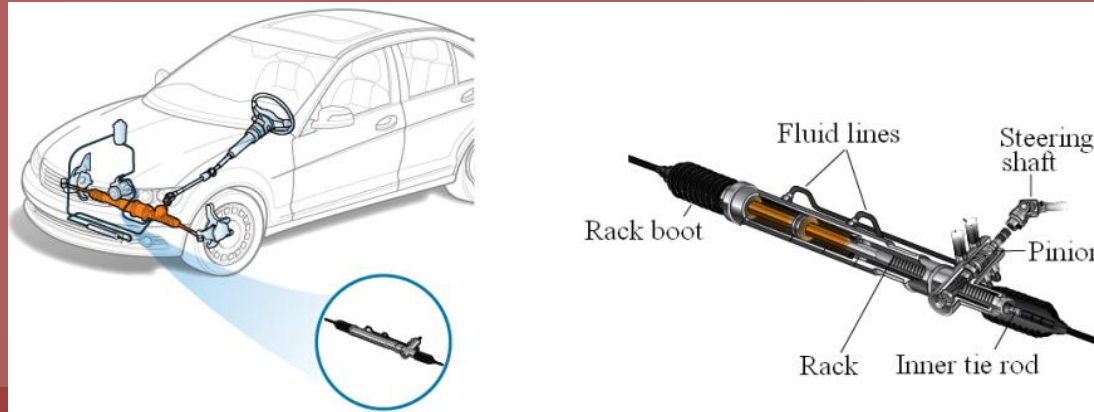
Figure 8-3 Tie rod ends

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## Passage A Types of Steering System

### Rack and Pinion Steering (齿轮齿条式转向器)

Many modern cars use rack and pinion steering mechanisms. The advantage of rack and pinion steering is relatively simple and the cost is low. And it has **a much better direct steering feel** (直转感觉好) for the driver. By reducing the number of parts and pivot points, it can more accurately control wheel direction, making the steering more responsive. See figure 8-4. (齿轮齿条式转向器通过减少一些部件和支点, 控制车轮方向更准确, 转向更敏感)

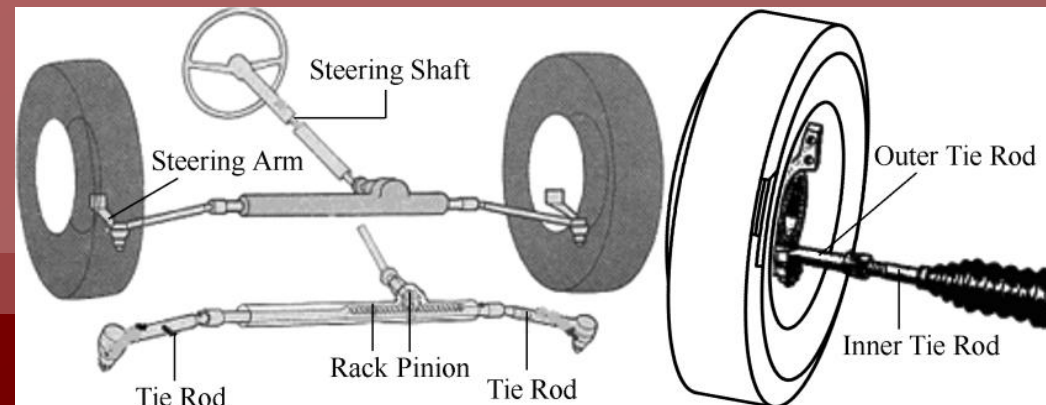




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## Passage A Types of Steering System

The rack and pinion steering system consists of steering wheel, steering shaft, rack and pinion gear, tie rod and steering knuckle arm. (齿轮齿条式转向器包括转向盘, 转向杆, 齿轮齿条传动装置和转向节臂。) In the rack and pinion steering, the steering wheel, through the steering shaft, is directly connected to a pinion gear that is in mesh with the rack. (在齿轮齿条式转向器中。转向盘通过转向杆直接与齿条啮合的齿轮连接。) The rack is a long, toothed bar, which is attached to each end with the inner tie rod ends. The outer tie rod ends are attached to the steering knuckle arms. See figure 8-5. (齿条是一根长长的齿状棒, 它与转向横拉杆内端连接。转向横拉杆外端与转向节臂连接。)



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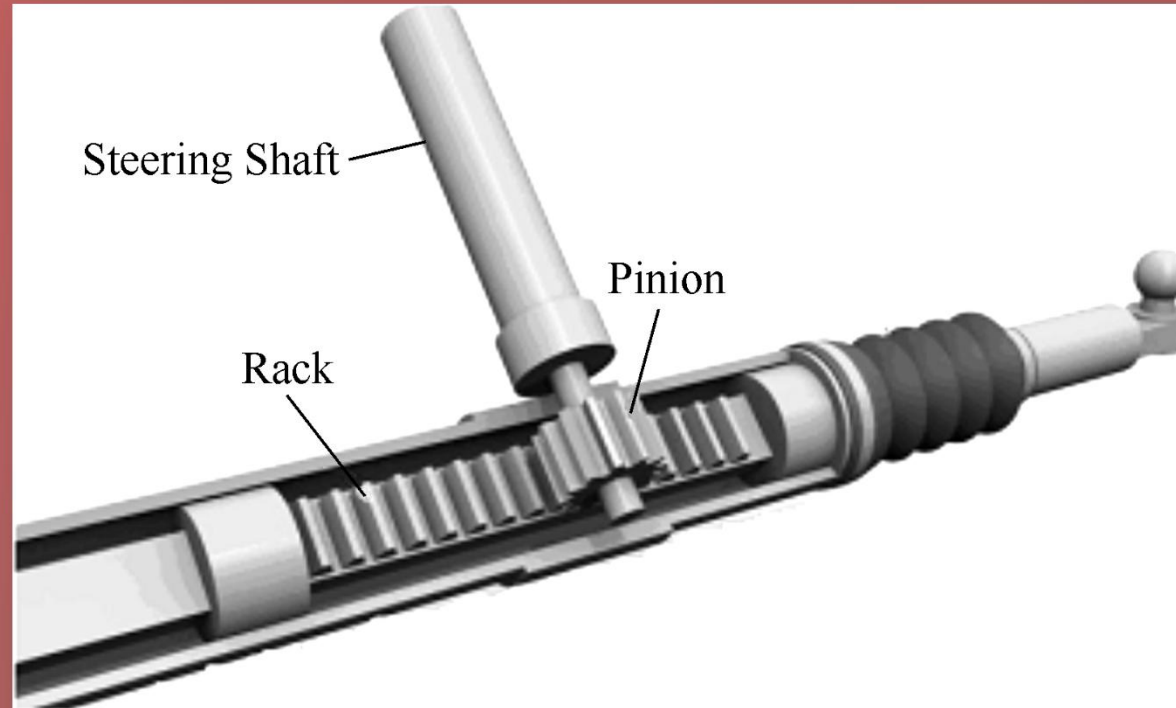
When you turn the steering wheel, the pinion gear turns, causing the rack to move from left to right. This movement, in turn, via tie rods and the steering knuckle arms makes the front wheels steer.

Rack and pinion steering is almost always used with a McPherson strut suspension system. The bottom of the steering knuckle still pivots on a lower ball joint, but the top of the knuckle is connected to the strut assembly. In this system, the outer tie rod end is connected to the steering arm on the strut housing itself. (齿轮齿条式转向器几乎总是与麦弗逊滑柱式悬架系统连用。转向节底部在下球节上转动，而转向节顶部链接到悬架滑柱总成。在该系统中，转向横拉杆外端和内端都连接在悬架滑柱壳上的转向器上)



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*Notes*

1. This type of steering gear is very low in friction and provides a good mechanical advantage for a heavy vehicle. The recirculating-ball steering uses a series of links and arms to ensure both wheels turning in the same direction at the same time. 这类转向机摩擦低，对重型车辆具有良好的机械效益。循环球式转向器用一连串的转向拉杆和转向臂保证两个转向车轮同时向同一方向转动。
2. And a ball nut rides on the worm gear and also engages with the sector gear on the pitman shaft. 循环球螺母依靠在蜗杆齿轮上，并且与转向摇臂轴的齿扇啮合。
3. Between the idler and pitman arms, the track rod is supported in the proper position to keep the left and right wheels working together. 在随动转向臂和转向摇臂之间，将横拉杆固定在恰当的位置以保持左右车轮一起工作。

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*Notes*

4. The inner tie rod ends are attached to either end of the track rod and provides pivot points for the steering gear. 转向横拉杆内端与横拉杆一端连接，为转向器提供支点。
5. This sleeve joins the inner and outer tie rod ends together and allows for adjustment when the front wheels are aligned. 该套管将转向横拉杆内端和外端结合在一起，当两个前轮对齐时进行调节。
6. By reducing the number of parts and pivot points, it can more accurately control wheel direction, making the steering more responsive. 通过减少一些部件和支点，齿轮齿条式转向器能更准确地控制车轮方向，使转向更敏感。
7. The bottom of the steering knuckle still pivots on a lower ball joint, but the top of the knuckle is connected to the strut assembly. In this system, the outer tie rod end is connected to the steering arm on the strut housing itself. 转向节底部在下球节上转动，而转向节顶部链接到悬架滑柱总成。在该系统中，转向横拉杆外端和內端都连接到自己悬架滑柱壳上的转向器上。

# Unit 8 Automotive Steering System

## *New Words*

pleasurable ['pleɪərəbəl] a. 令人愉快的  
comfortable ['kɒmfətəbl] a. 舒适的, 舒服的  
linkage ['lɪŋki] n. 传动机构  
steer [stiə] v. 驾驶, 航行, 转向  
ensure [ɪn'ʊə] v. 确定, 保证, 确保  
pitman ['pɪtmən] n. 转向摇臂  
sector ['sektə] n. 扇形齿, 齿扇  
nut [nʌt] n. 螺母  
sleeve [sli:v] n. 套筒  
responsive [rɪs'pɒnsɪv] a. 敏感的, 响应度, 响应性  
toothed [tu:θt] a. 有齿的, 锯齿的, 锯齿状的  
pivot ['pɪvət] v. 转动

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## *Phrases and Expressions*

steering system 转向系统, 转向系  
steering gear 转向装置 (转向齿轮机构, 转向器, 操舵装置)  
steering gear box 转向齿轮箱  
steering wheel 转向盘, 驾驶盘  
SUV (Sport Utility Vehicle) 运动型多用途车  
recirculating-ball steering 循环球式转向器  
recirculating-ball steering gear 循环球式转向器  
mechanical advantage 机械利益, 机械增益, 机械效益  
ball nut 转向循环球螺母  
rack-and-pinion steering 齿轮齿条转向器  
steering column 转向柱  
worm gear 蜗杆, 螺杆

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## *Phrases and Expressions*

pitman arm 转向摇臂, 转向臂

track rod 转向直拉杆

steering arm 转向节臂

steering shaft 转向轴

pitman shaft 转向摇臂轴

idler arm 随动臂, 空转轮臂, 空转臂

tie rod 转向横拉杆

inner tie rod end 转向横拉杆内端

outer tie rod end 转向横拉杆外端

steering knuckle arm 转向节臂

pivot point 支点

toothed bar 齿条, 齿杆



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## EXERCISE 1

*Mark the following statements with T (True) or F (False) according to the passage.*

1. The steering system has a great influence on vehicle performance and reliability. **T**
2. There are three basic types of steering systems: (1) recirculating-ball steering (2) rack and pinion steering and (3) lever steering. **F**
3. A pitman shaft is mounted in the box in a position  $60^\circ$  to the worm gear. **F**
4. The advantage of rack and pinion steering is relatively complex and the cost is high. **F**
5. Rack and pinion steering is almost always used with a Cardan's suspension system. **F**

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## EXERCISE 2







*Translate the following phrases into Chinese or English.*

- |                             |         |
|-----------------------------|---------|
| 1. <b>steering system</b>   | 转向系     |
| 2. pitman arm               | 转向摇臂    |
| 3. <b>steering wheel</b>    | 转向盘     |
| 4. rack-and-pinion steering | 齿轮齿条转向器 |
| 5. <b>steering shaft</b>    | 转向轴     |
| 6. steering knuckle arm     | 转向节臂    |
| 7. <b>steering column</b>   | 转向柱     |
| 8. toothed bar              | 齿条      |
| 9. <b>worm gear</b>         | 蜗杆      |
| 10. steering gear box       | 转向齿轮箱   |

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## EXERCISE 3

The following are some expressions for the famous brands. Match the following brands in Column A with their Chinese equivalents in Column B.

A		B
1. 	G	A. BYD 
2. 	E	B. Zhonghua 
3. 	A	C. Chery 



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## EXERCISE 3

4.		<b>F</b>	D. Great Wall	
5.		<b>B</b>	E. Hongqi	
6.		<b>J</b>	F. Gold Cup	
7.		<b>D</b>	G. Dongfeng	

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## EXERCISE 3

8.		C	H. Changan	
9.		H	I. SINOTRUK	
10.		I	J. Lifan	