Mechanical systems and control

Rack and Pinion and worm Gears

2.3 Rack-and-pinion gear system as found on automatic gates and steering racks

A rack is a flat bar with teeth. It always moves in a straight line. It is used to convert rotary motion into linear motion. It can be used in conjunction with **helical worm gears**. **Rack-and-pinion gears** are found in motorised gates, steering mechanisms and cork screws.

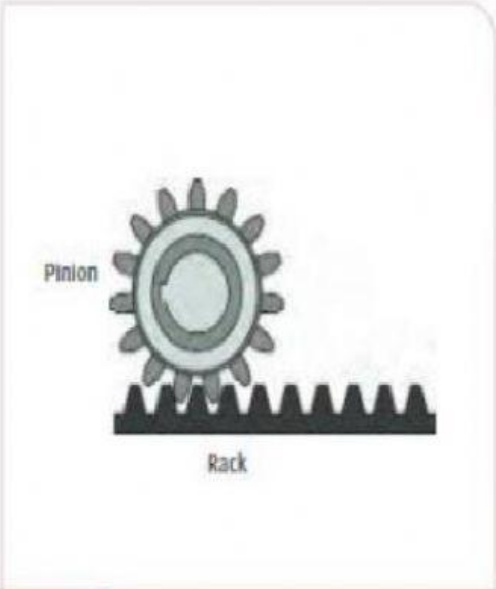

FIGURE 26 A rack-and-pinion gear system

FIGURE 27 An automatic gate uses a rack-and-pinion gear system

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FIGURE 29 Worm gears are used in monkey wrenches

2.4 Worm gear system

Worm gears' teeth are cut in a spiral along a shaft (cylinder). This gear system is used for a large reduction in speed and an increase in force. Worm gears are mostly used to transmit rotary movement from one shaft to another at a 90° angle. This also significantly reduces speed. Worm gears are commonly found in monkey wrenches.

A worm gear is used when a large speed reduction (slower) ratio is required as in the case of a moving (sliding) gate. The slow speed is the result of a large diameter worm wheel. Worm gears can provide a 50 : 1 speed reduction but not a 1 : 50 speed increase.

FIGURE 30 Worm gears are used in many everyday appliances

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Exercise 1

1. Why will the speed ratio (velocity) of unequal gears have more force when they operate?
2. What is the use of adding an idler gear to a gear system?
3. Give two examples where industries use bevel gears.
4. Which of the following two gear types give the strongest output: equal or unequal gears?
5. Name two designs where designers make use of rack-and-pinion gears.
6. What gear system is commonly used in huge sliding gates?

Answers

1.

2.

3.

4.

5.

6.

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