Problem of Practices
on
Mechanical Engineering Design
Chapter-12 Worm Gears

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1. Design a high efficiency worm gear speed reducer to transmit continuously the rated power output of 15 kW motor turning at 1750 rpm. The steel worm with BHN 250 is to be integral with the motor shaft and velocity ratio is 10. The phosphor bronze gear should not have less than 40 teeth. Determine pitch, face and diameters of gears.
2. Find the 20° involute worm and gear which will transmit 15 kW between shafts that are 0.30 meter apart, if the speed reduction is to be 10.5 to 1, and the driving shaft is turning at 1200 rpm.
3. Design and determine the input power capacity of a worm gear speed reducer unit composed of a hardened steel worm and phosphor bronze worm wheel having 20° stub involute teeth. The centre distance is to be 200 mm, transmission ratio 10 and worm speed 1450 rpm.
4. A worm gear has 30 teeth of 14.5° and the coefficient of friction for worm gear is 0.05. The worm is triple threaded with a module of 6 mm and pitch circle diameter of 50 mm. Calculate the following:
   (i) Lead angle of worm, (ii) Velocity ratio, (iii) Center distance, (iv) Efficiency of gearing.

5. Design a worm gear set to transmit 12 kW from a shaft rotating at 1400 rpm to another at 75 rpm. Assume normal pressure angle as 20° and centre distance between the shafts is 25 cm.

6. Design a worm gearing to transmit 10 kW from an electric motor running at 1500 rpm to a machine running at 75 rpm. Load is intermittent (< 3 hr. of continuous service) and steady.

7. Design a worm drive for a speed reducer to transmit 3 kW at a worm speed of 600 rpm. The desired velocity ratio is 25:1 and an efficiency of at least 87% desired. Assume the worm and gear are made of hardened steel.

8. Design a worm and worm gear drive for a speed reduction by 25. Worm rotates at 600 rpm and transmits 35 kW. Assume double start thread and gear has 50 full depth 20° involute teeth.

9. For a Worm and worm wheel the centre distance is given as 225 mm. Worm is made of hardened steel and rotates at 1250 rpm. Worm transmits power to a phosphor bronze gear (σ_b = 55 MPa) with a transmission ratio of 15. The teeth on gear are 20° full depth involute (y = 0.125). Determine all the design parameters and recommend the safe power that the drive can transmit.

10. A double threaded worm drive is required for power transmission between two shafts having their axes at right angles to each other. The worm has 14.5° involute teeth. The centre distance is approximately 200 mm. If the axial pitch of the worm is 30 mm and lead angle is 23°, find (i) lead; (ii) Pitch circle diameter of worm and worm gear; (iii) Helix angle of the worm; and (iv) efficiency of the drive if the coefficient of friction is 0.05.

11. A worm drive transmits 15 kW at 2000 r.p.m. to a machine carriage at 75 r.p.m. The worm is triple threaded and has 65 mm pitch diameter. The worm gear has 90 teeth of 6 mm module. The tooth form is to be 20° full depth involute. The coefficient of friction between the mating teeth may be taken as 0.10. Calculate: 1. tangential force acting on the worm; 2. axial thrust and separating force on worm; and 3. efficiency of the worm drive.