

MECH 325

Homework Assignment #1

Due Oct. 8

Problem 1

13–24 A gearbox is to be designed with a compound reverted gear train that transmits 25 horsepower with an input speed of 2500 rev/min. The output should deliver the power at a rotational speed in the range of 280 to 300 rev/min. Spur gears with 20° pressure

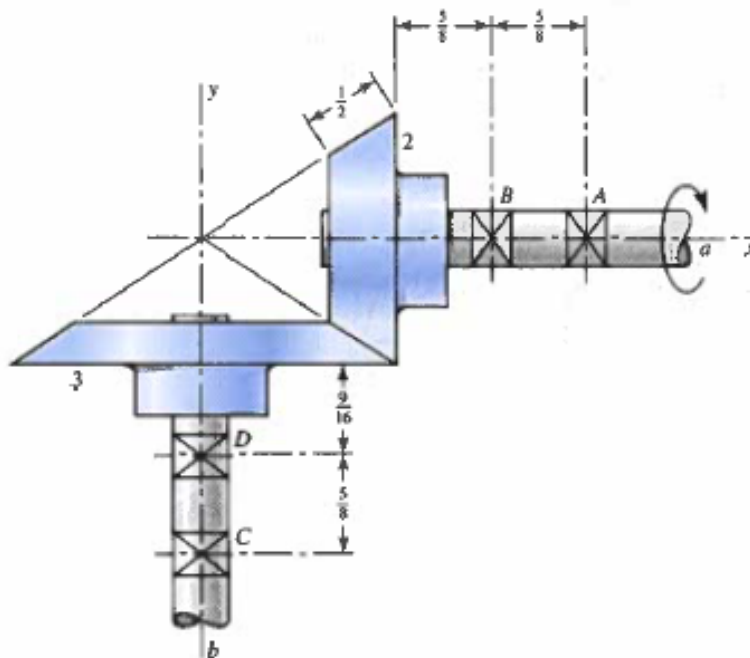
angle are to be used. Determine suitable numbers of teeth for each gear, to minimize the gearbox size while providing an output speed within the specified range. Be sure to avoid an interference problem in the teeth.

13–42 Continue Problem 13–24 by finding the following information, assuming a diametral pitch of 6 teeth/in.

- Determine pitch diameters for each of the gears.
- Determine the pitch line velocities (in ft/min) for each set of gears.
- Determine the magnitudes of the tangential, radial, and total forces transmitted between each set of gears.
- Determine the input torque.
- Determine the output torque, neglecting frictional losses.

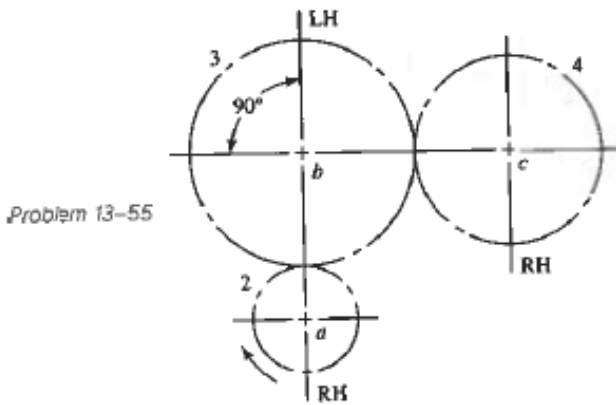
Problem 2

13–50 The figure shows a 10 diametral pitch 18-tooth 20° straight bevel pinion driving a 30-tooth gear. The transmitted load is 25 lbf. Find the bearing reactions at *C* and *D* on the output shaft if *D* is to take both radial and thrust loads.



Problem 3

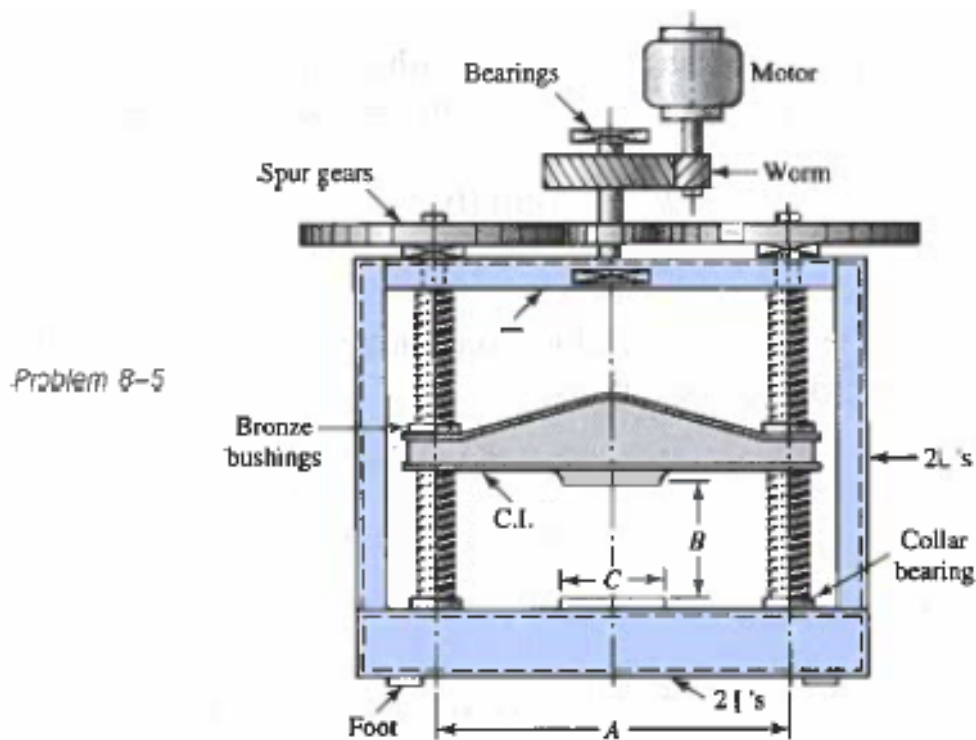
- 13–55** Gear 2, in the figure, has 16 teeth, a 20° transverse pressure angle, a 15° helix angle, and a module of 4 mm. Gear 2 drives the idler on shaft b , which has 36 teeth. The driven gear on shaft c has 28 teeth. If the driver rotates at 1600 rev/min and transmits 6 kW, find the radial and thrust load on each shaft.



Problem 4

- 14–23** A spur gearset has 17 teeth on the pinion and 51 teeth on the gear. The pressure angle is 20° and the overload factor $K_o = 1$. The diametral pitch is 6 teeth/in and the face width is 2 in. The pinion speed is 1120 rev/min and its cycle life is to be 10^8 revolutions at a reliability $R = 0.99$. The quality number is 5. The material is a through-hardened steel, grade 1, with Brinell hardnesses of 232 core and case of both gears. For a design factor of 2, rate the gearset for these conditions using the AGMA method.

Problem 5



8-5 The machine shown in the figure can be used for a tension test but not for a compression test. Why? Can both screws have the same hand?

- 8-6** The press shown for Problem 8-5 has a rated load of 5000 lbf. The twin screws have Acme threads, a diameter of 2 in, and a pitch of $\frac{1}{4}$ in. Coefficients of friction are 0.05 for the threads and 0.08 for the collar bearings. Collar diameters are 3.5 in. The gears have an efficiency of 95 percent and a speed ratio of 60:1. A slip clutch, on the motor shaft, prevents overloading. The full-load motor speed is 1720 rev/min.
- When the motor is turned on, how fast will the press head move?
 - What should be the horsepower rating of the motor?