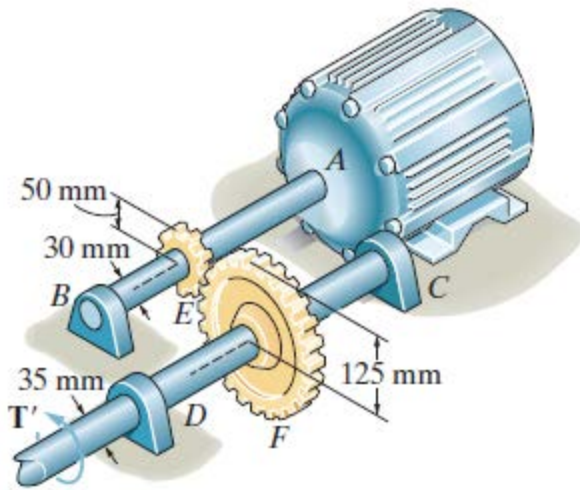


CHAPTER 5- TORSION

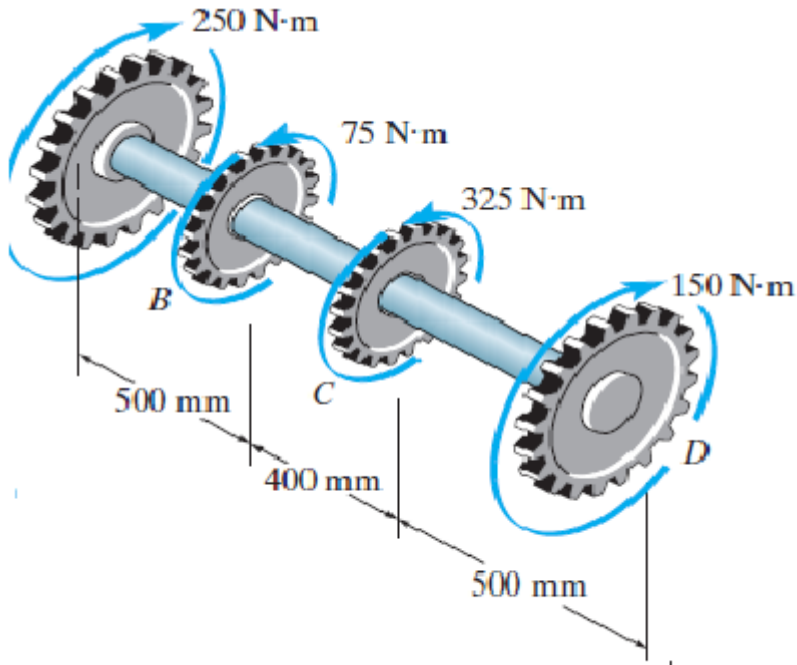
1- The motor delivers a torque of 50 N.m to the shaft AB . This torque is transmitted to shaft CD using the gears at E and F . Determine the equilibrium torque T_C on shaft CD and the maximum shear stress in each shaft. The bearings B , C , and D allow free rotation of the shafts.

(9.43 MPa, 14,8 MPa)



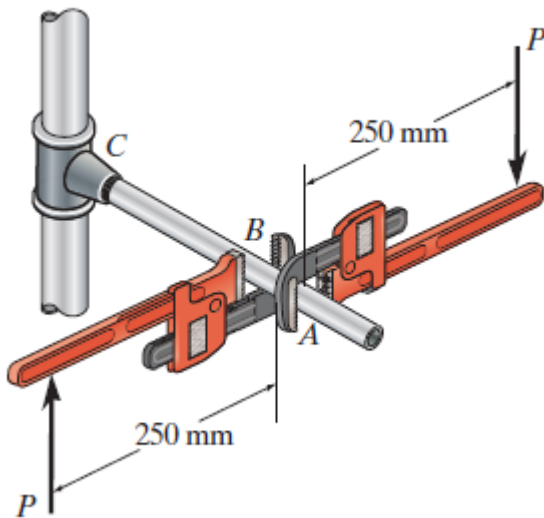
2- The solid 50-mm-diameter shaft is used to transmit the torques applied to the gears. Determine the absolute maximum shear stress in the shaft.

(10.2 MPa)



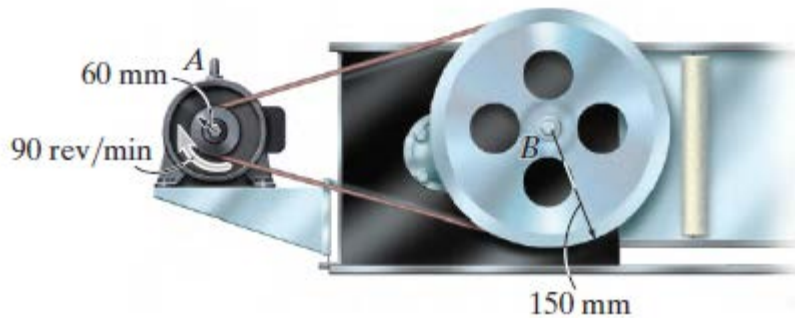
3- Two wrenches are used to tighten the pipe. If the pipe is made from a material having an allowable shear stress of $\tau_{all} = 80$ MPa, determine the allowable maximum force **P** that can be applied to each wrench. The pipe has an outer diameter of 25 mm and inner diameter of 20 mm.

(308 N)



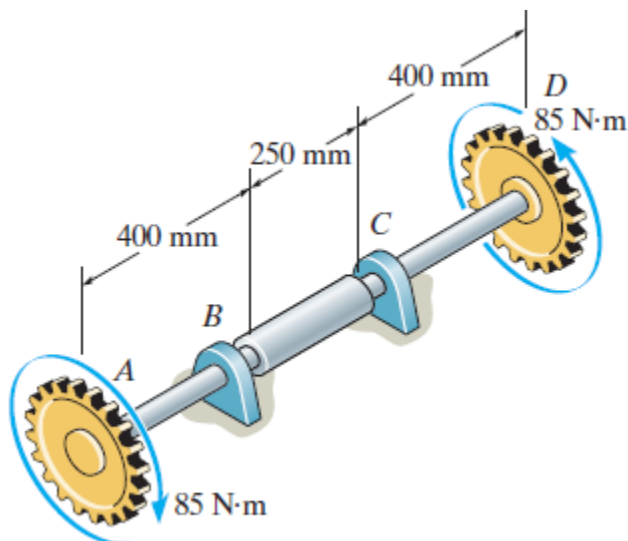
4- The motor A develops a power of 300 W and turns its connected pulley at 90 rev/min. Determine the required diameters of the steel shafts on the pulleys at A and B if the allowable shear stress is $\tau_{all} = 85$ MPa.

(12.4 mm, 16.8 mm)



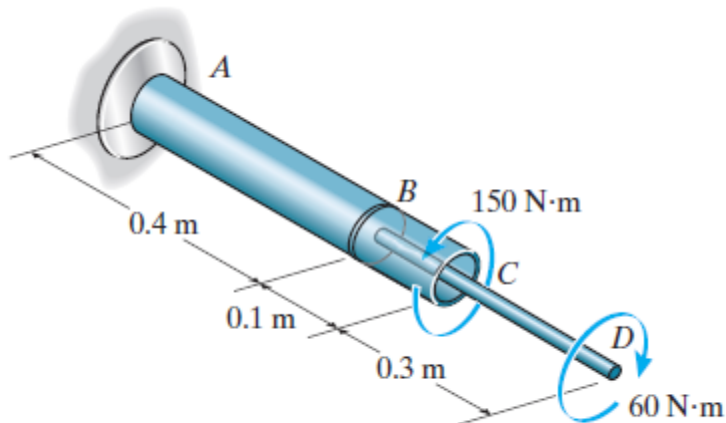
5- The A-36 steel axle is made from tubes AB and CD and a solid section BC . It is supported on smooth bearings that allow it to rotate freely. If the gears, fixed to its ends, are subjected to 85 N·m torques, determine the angle of twist of gear A relative to gear D . The tubes have an outer diameter of 30 mm and an inner diameter of 20 mm. The solid section has a diameter of 40 mm.

(0.01534 rad)



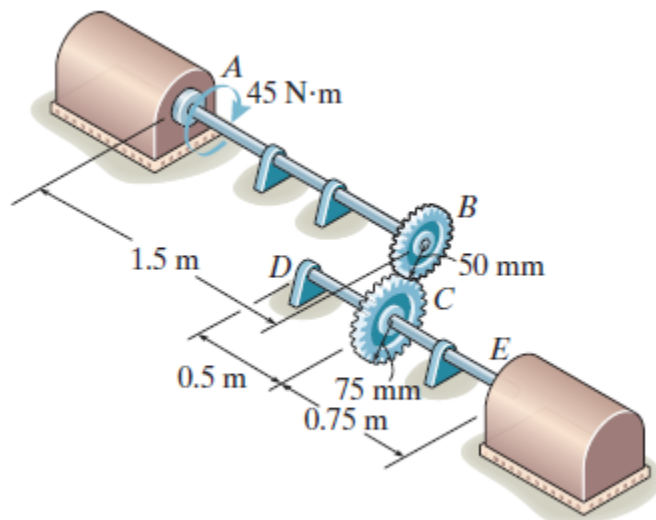
6- The assembly is made of A-36 steel and consists of a solid rod 20 mm in diameter fixed to the inside of a tube using a rigid disk at B . Determine the angle of twist at C . The tube has an outer diameter of 40 mm and wall thickness of 5 mm.

(0.003958 rad)



7- The 30-mm-diameter shafts are made of L2 tool steel and are supported on journal bearings that allow the shaft to rotate freely. If the motor at A develops a torque of $T=45$ N·m on the shaft AB , while the turbine at E is fixed from turning, determine the amount of rotation of gears B and C .

(0.008488 rad)



8- The A-36 steel shaft has a diameter of 60 mm and is fixed at its ends A and B . If it is subjected to the torques shown, determine the absolute maximum shear stress in the shaft.

(9.77 MPa)

