

**FIGURE P11-11**

Problem 11-18

- †11-18 Figure P11-11 shows a paper roll off-loading station. The paper rolls have a 0.9-m OD, 0.22-m ID, are 3.23 m long, and have a density of  $984 \text{ kg/m}^3$ . The forks that support the roll are 1.2 m long. The motion is slow so inertial loading can be neglected. Find the force required of the air cylinder to rotate the roll through  $90^\circ$ .

† These problems are suited to solution using *Mathcad*, *Matlab*, or *TKSolver* equation solver programs.