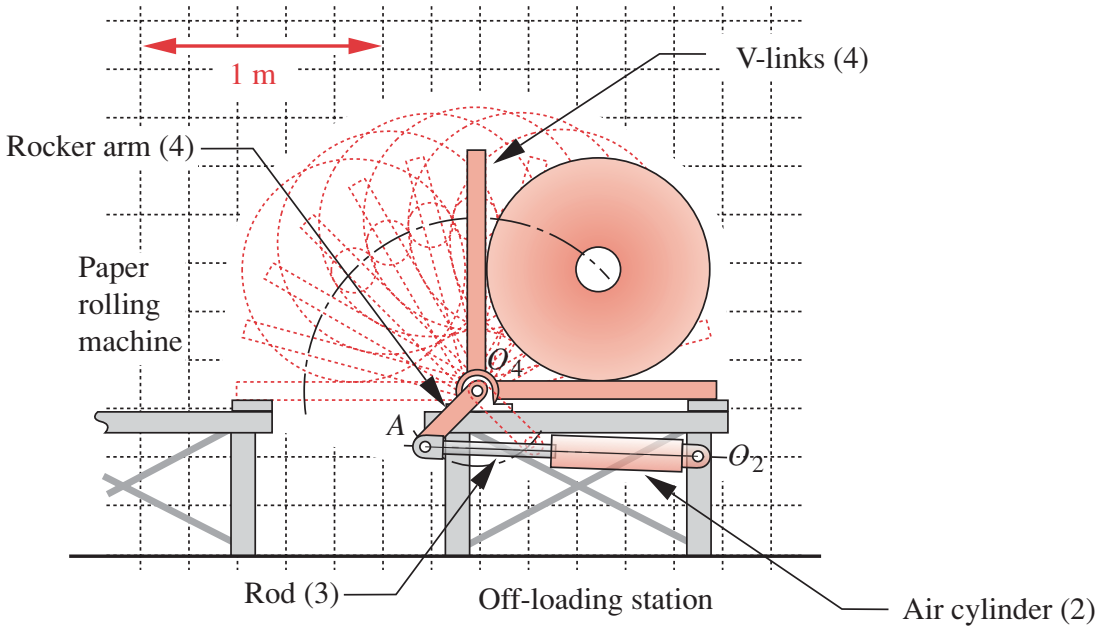

FIGURE P11-11

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 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°.

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