

**FIGURE P4-16**

Problems 4-52 to 4-54 An oil field pump - dimensions in inches

- 4-52 For the linkage in Figure P4-16, what are the angles that link 2 makes with the positive  $X$ -axis when links 2 and 3 are in toggle positions?
- 4-53 The coordinates of the point  $P_1$  on link 4 in Figure P4-16 are (114.68, 33.19) with respect to the  $xy$  coordinate system when link 2 is in the position shown. When link 2 is in another position the coordinates of  $P_2$  with respect to the  $xy$  system are (100.41, 43.78). Calculate the coordinates of  $P_1$  and  $P_2$  in the  $XY$  system for the two positions of link 2. What is the salient feature of the coordinates of  $P_1$  and  $P_2$  in the  $XY$  system?
- 4-54 Write a computer program or use an equation solver such as *Mathcad*, *Matlab*, or *TKSolver* to calculate and plot the angular position of link 4 with respect to the  $XY$  coordinate frame and the transmission angle at point  $B$  of the linkage in Figure P4-16 as a function of the angle of link 2 with respect to the  $XY$  frame.

\* This figure is provided as an animated Working Model file on the CD-ROM. Its filename is the same as that for figure P2-18.