PROBLEM 6.126

The press shown is used to emboss a small seal at E. Knowing that \( P = 250 \) N, determine (a) the vertical component of the force exerted on the seal, (b) the reaction at A.

SOLUTION

FBD Stamp D:

\[ \Sigma F_y = 0: \quad E - F_{BD} \cos 20^\circ = 0, \quad E = F_{BD} \cos 20^\circ \]

FBD ABC:

\[ \Sigma M_A = 0: \quad (0.2 \text{ m})(\sin 30^\circ)(F_{BD} \cos 20^\circ) + (0.2 \text{ m})(\cos 30^\circ)(F_{BD} \sin 20^\circ) \]
\[ - [(0.2 \text{ m}) \sin 30^\circ + (0.4 \text{ m}) \cos 15^\circ](250 \text{ N}) = 0 \]

\[ F_{BD} = 793.64 \text{ N} \quad C \]

and, from above,

\[ E = (793.64 \text{ N}) \cos 20^\circ \]

\[ \Sigma F_y = 0: \quad A_y - (793.64 \text{ N}) \sin 20^\circ = 0 \]

\[ A_y = 271.44 \text{ N} \quad \rightarrow \]

\[ \Sigma F_x = 0: \quad A_x - (793.64 \text{ N}) \cos 20^\circ - 250 \text{ N} = 0 \]

\[ A_x = 495.78 \text{ N} \quad \uparrow \]

so \( (b) \quad A = 565 \text{ N} \angle 61.3^\circ \)

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PROBLEM 6.143

The tongs shown are used to apply a total upward force of 45 kN on a pipe cap. Determine the forces exerted at D and F on tong ADF.

SOLUTION

FBD whole:

By symmetry \[ A = B = 22.5 \text{ kN} \]

FBD ADF:

\[
\begin{align*}
\sum F_y &= 0: \quad 22.5 \text{ kN} - F_y = 0 \\
F_y &= 22.5 \text{ kN}
\end{align*}
\]

\[
\begin{align*}
\sum M_D &= 0: \quad (75 \text{ mm})CD - (100 \text{ mm})(22.5 \text{ kN}) = 0 \\
CD &= 30.0 \text{ kN}
\end{align*}
\]

\[
\begin{align*}
\sum F_x &= 0: \quad F_x - CD = 0 \\
F_x &= CD = 30 \text{ kN}
\end{align*}
\]

\[
\begin{align*}
F &= 37.5 \text{ kN} \angle 36.9^\circ
\end{align*}
\]
PROBLEM 6.148

Determine the magnitude of the gripping forces produced when two 300-N forces are applied as shown.

SOLUTION

We note that AC is a two-force member

FBD handle CD:

\[ \sum M_D = 0: \quad -(126 \text{ mm})(300 \text{ N}) - (6 \text{ mm}) \frac{2.8}{\sqrt{8.84}} A \]
\[ + (30 \text{ mm}) \left( \frac{1}{\sqrt{8.84}} A \right) = 0 \]
\[ A = 2863.6\sqrt{8.84} \text{ N} \]

FBD handle AB:

\[ \sum M_B = 0: \quad (132 \text{ mm})(300 \text{ N}) - (120 \text{ mm}) \frac{1}{\sqrt{8.84}} (2863.6\sqrt{8.84} \text{ N}) \]
\[ + (36 \text{ mm}) F = 0 \]
\[ F = 8.45 \text{ kN} \]