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- (iii) Tensile Failure of Socket Figure 4.14(a)
- shows the weakest section at YY of the socket end,
- which is subjected to tensile stress. The area of this
- section is given by,

$$\text{area} = \left[\frac{\pi}{4}(d_1^2 - d_2^2) - (d_1 - d_2)t\right]$$

The tensile stress at section *YY* is given by,

$$\sigma_t = \frac{P}{\text{area}}$$

$$\text{or} \quad P = \left[\frac{\pi}{4}(d_1^2 - d_2^2) - (d_1 - d_2)t\right]\sigma_t \qquad (4.25\text{d})$$

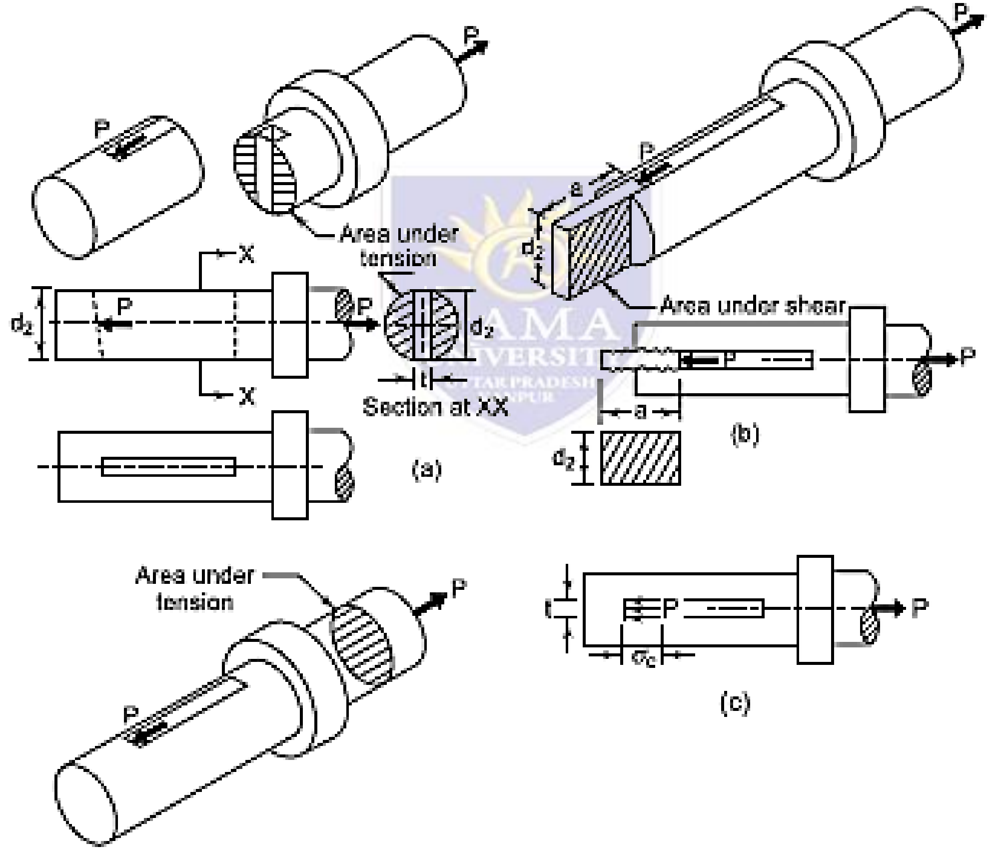

Fig. 4.13 *Stresses in Spigot End (a) Tensile Stress (b) Shear Stress (c) Compressive Stress*

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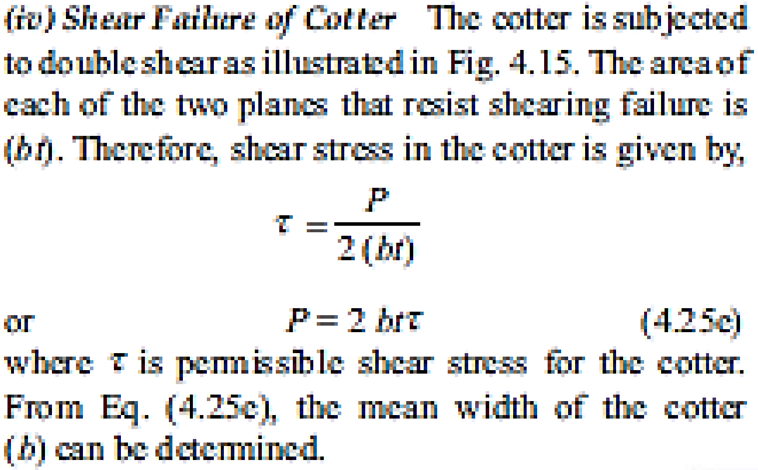
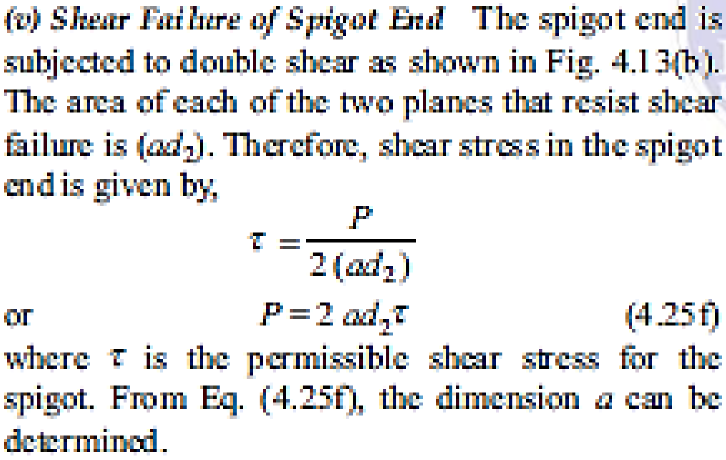


(iv) Shear Failure of Cotter The cotter is subjected to double shear as illustrated in Fig. 4.15. The area of each of the two planes that resist shearing failure is (bt). Therefore, shear stress in the cotter is given by,

$$\tau = \frac{P}{2\,(bt)}$$

or $$P = 2\,bt\tau \qquad (4.25e)$$

where τ is permissible shear stress for the cotter. From Eq. (4.25e), the mean width of the cotter (b) can be determined.



(v) Shear Failure of Spigot End The spigot end is subjected to double shear as shown in Fig. 4.13(b). The area of each of the two planes that resist shear failure is (ad_2). Therefore, shear stress in the spigot end is given by,

$$\tau = \frac{P}{2\,(ad_2)}$$

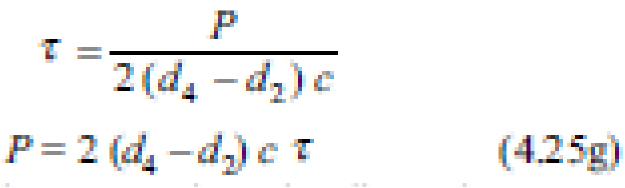
or $$P = 2\,ad_2\tau \qquad (4.25f)$$

where τ is the permissible shear stress for the spigot. From Eq. (4.25f), the dimension a can be determined.

(vi) Shear Failure of Socket End The socket end is also subjected to double shear as shown in Fig. 4.14(b). The area of each of the two planes that resist shear failure is given by,

area = (d4 – d2) c

Therefore, shear stress in the socket end is given by,



$$\tau = \frac{P}{2\,(d_4 - d_2)\,c}$$

$$P = 2\,(d_4 - d_2)\,c\,\tau \qquad (4.25g)$$

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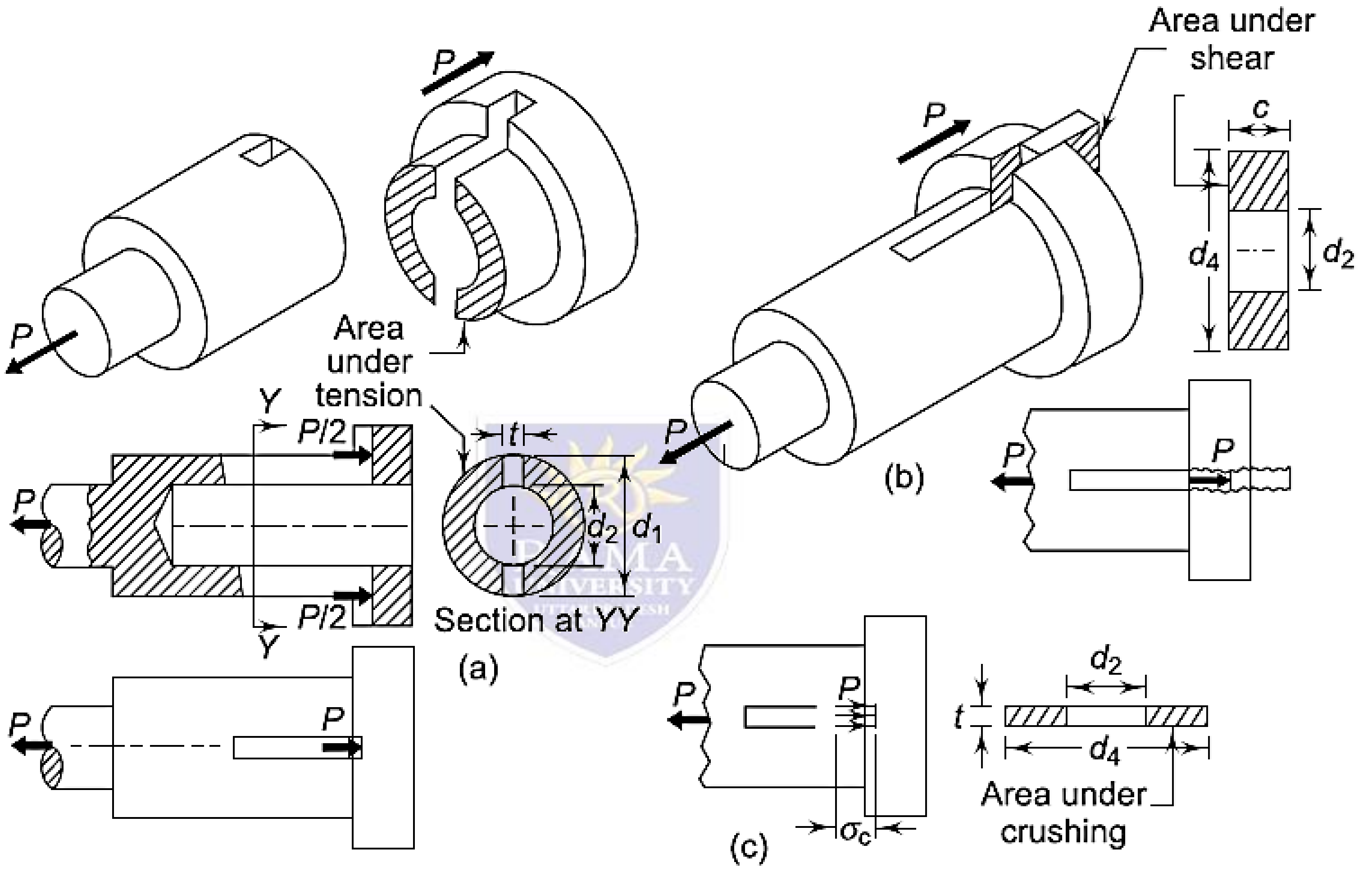

Fig. 4.14 *Stresses in Socket End (a) Tensile Stress (b) Shear stress (c) Compressive Stress*

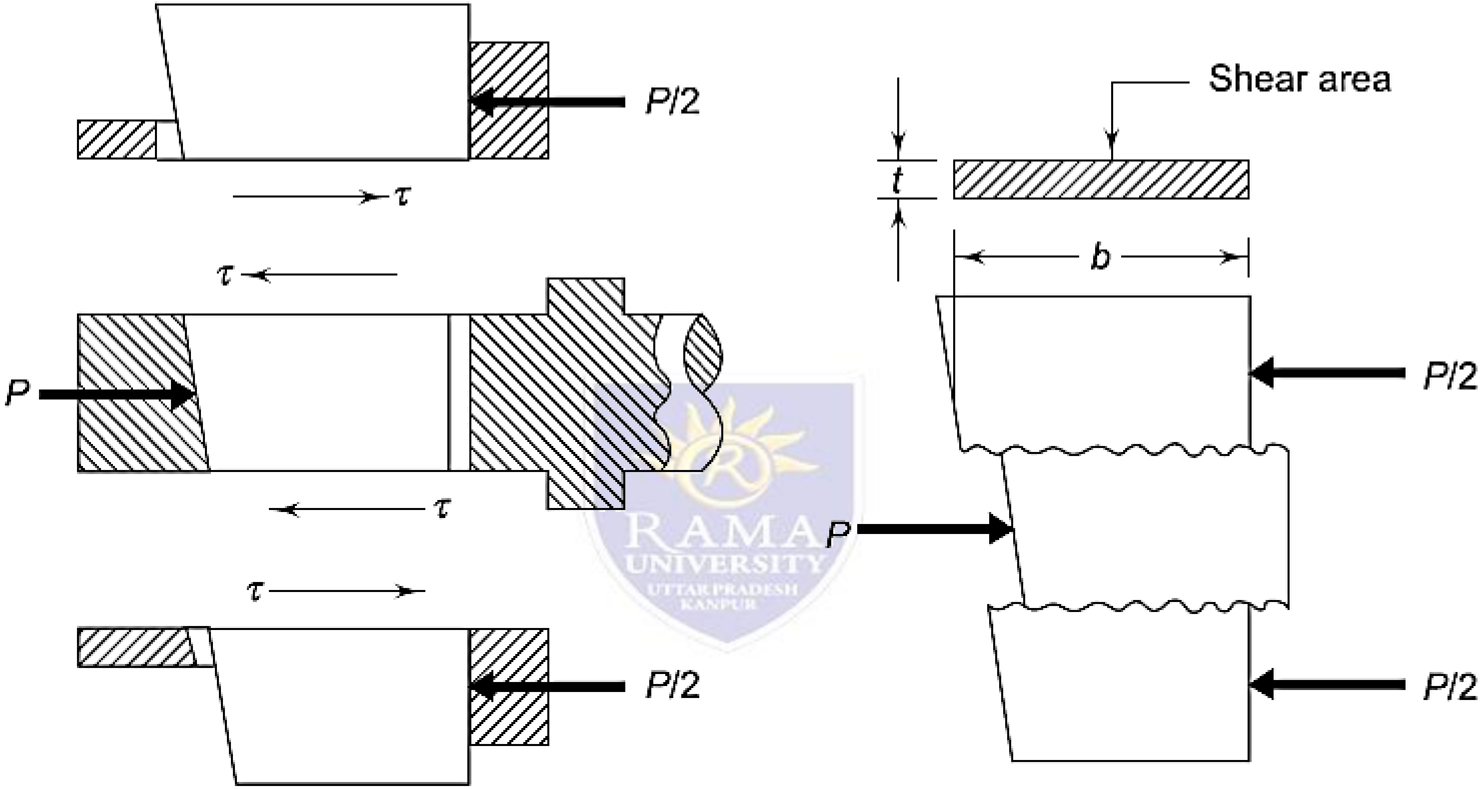

Fig. 4.15 *Shear Failure of Cotter*

- (vii) Crushing Failure of Spigot End As shown in Fig. 4.13(c), the force P causes compressive stress on a narrow rectangular area of thickness t and width d2 perpendicular to the plane of the paper. The compressive stress is given by,

$$\sigma_c = \frac{P}{td_2}$$

- (viii) Crushing Failure of Socket End As shown in Fig. 4.14(c), the force P causes compressive stress on a narrow rectangular area of thickness t. The other dimension of rectangle, perpendicular to the plane of paper is (d4 – d2). Therefore, compressive stress in the socket end is given by,

$$\sigma_c = \frac{P}{(d_4 - d_2)t}$$

- ix) Bending Failure of Cotter When the cotter is tight in the socket and spigot, it is subjected to shear stresses. When it becomes loose, bending occurs. The forces acting on the cotter are shown in Fig. 4.16(a). The force P between the cotter and spigot end is assumed as uniformly distributed over the length d2. The force between the socket end and cotter is assumed to be varying linearly from zero to maximum with triangular distribution. The cotter is treated as beam as shown in Fig. 4.16(b). For triangular distribution,

$$x = \frac{1}{3}y = \frac{1}{3}\left(\frac{d_4 - d_2}{2}\right) = \left(\frac{d_4 - d_2}{6}\right)$$

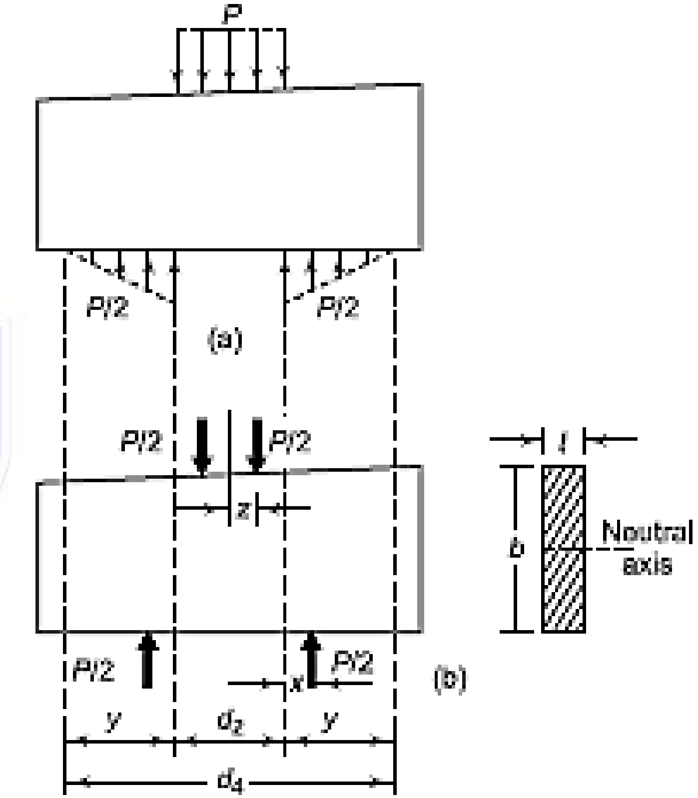

Fig. 4.16 *Cotter Treated as Beam (a) Actual Distribution of Forces (b) Simplified Diagram of Forces*