Lecture # 5.4

Cotter Joints - Gib and Cotter

Cotter Joints

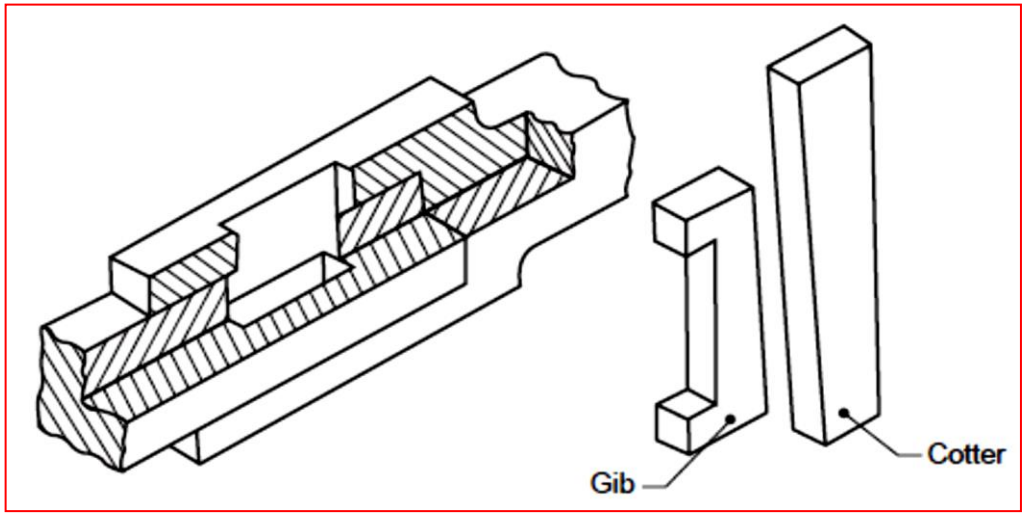
Cotter Joint with Gib:

This joint is generally used to connect two rods of square or rectangular cross-section.

To make the joint, one end of the rod is formed into a U-fork, into which, the end of the other rod fits in.

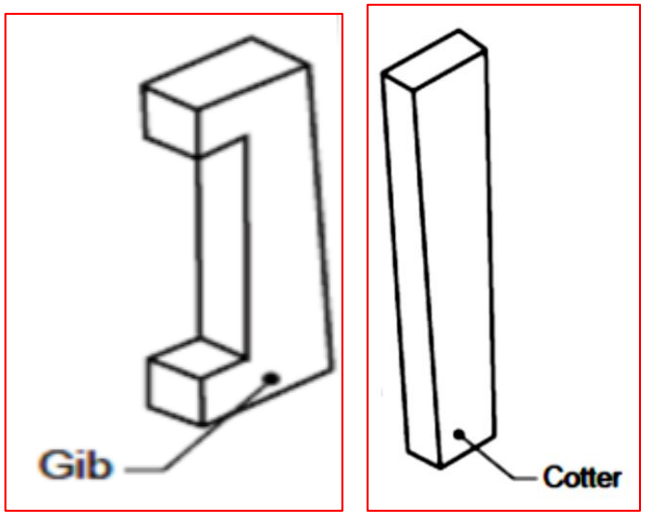
When a cotter is driven-in, the friction between the cotter and straps of the U-fork, causes the straps to open.

This is prevented by the use of a gib.



Cotter Joints

Cotter Joint with Gib:



A gib is also a wedge shaped piece of rectangular cross-section with two rectangular projections called lugs.

One side of the gib is tapered and the other straight.

The tapered side of the gib bears against the tapered side of the cotter such that, the outer edges of the cotter and gib as a unit are parallel.

Cotter Joints

Cotter Joint with Gib:

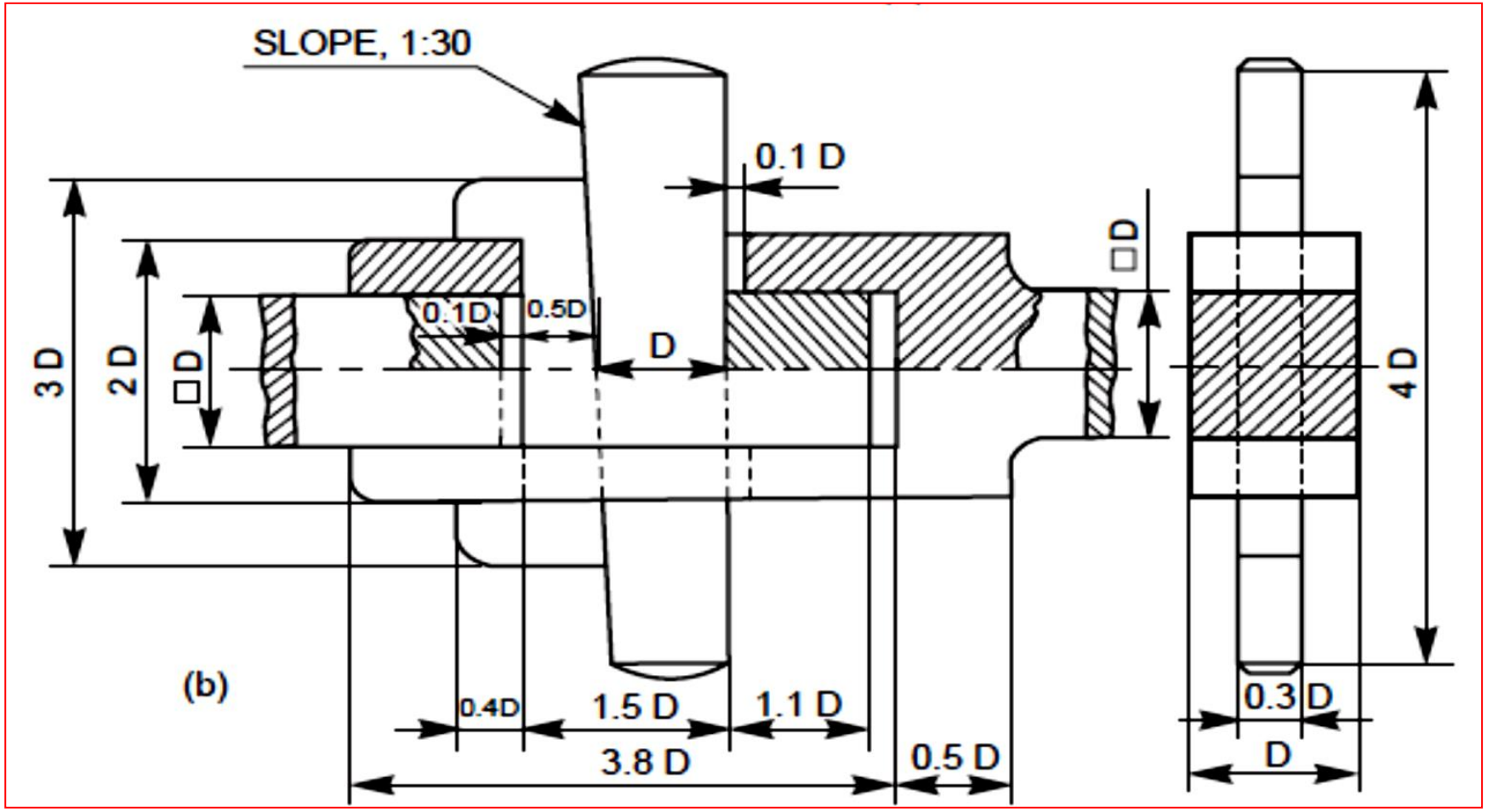
This facilitates making of slots with parallel edges, unlike the tapered edges in case of ordinary cotter joint.

Further, the lugs bearing against the outer surfaces of the fork, prevents the opening tendency of the straps.

For making the joint, first the gib is placed in position and then the cotter is driven-in.

Cotter Joints

Cotter Joint with Gib:



Cotter Joints

Design of Gib and cotter joint

Consider a gib and cotter joint for square rods as shown in Fig.

All components of the joint are assumed to be of the same material.

If the allowable stresses in tension, compression and shear for all the components be σ_t, σ_c and τ respectively,

Let P = Load carried by the rods,

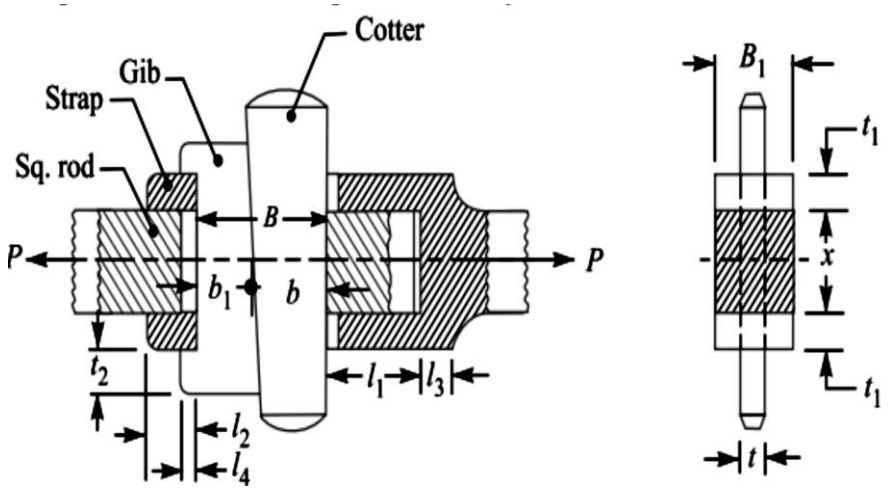
x = Each side of the rod,

B = Total width of gib and cotter,

B_1 = Width of the strap,

t = Thickness of cotter,

t_1 = Thickness of the strap,



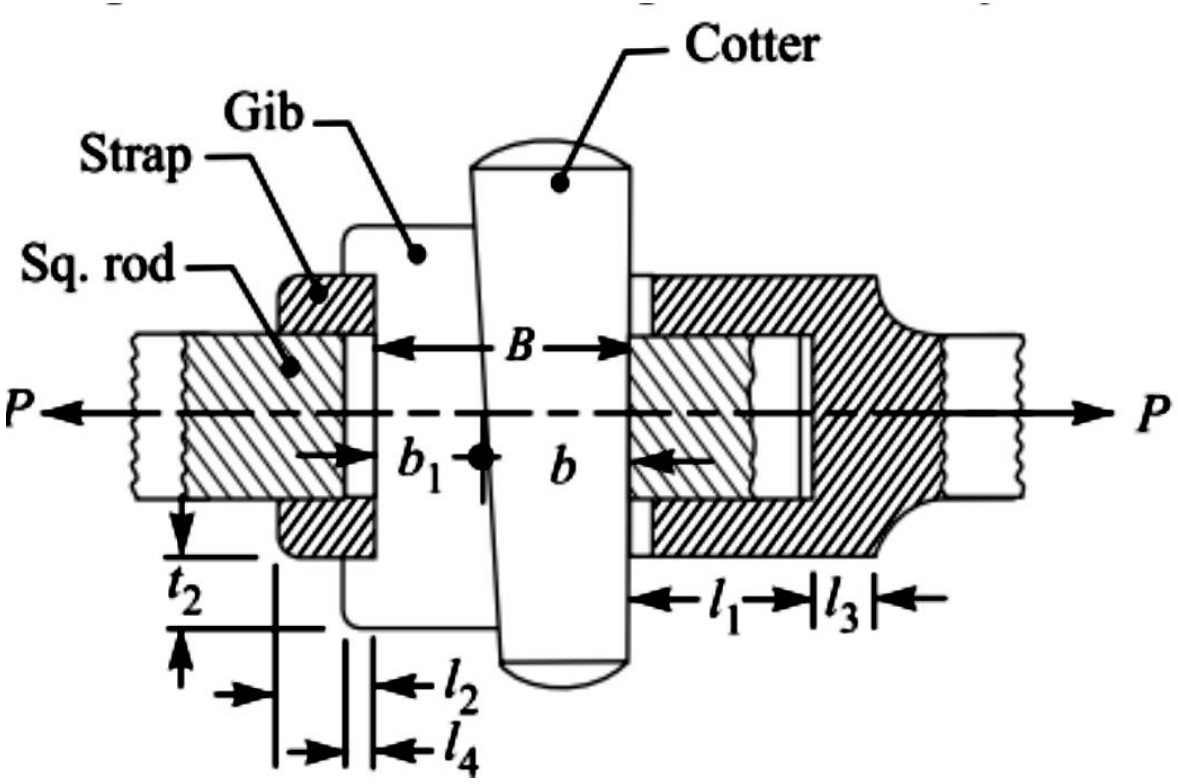
Cotter Joints

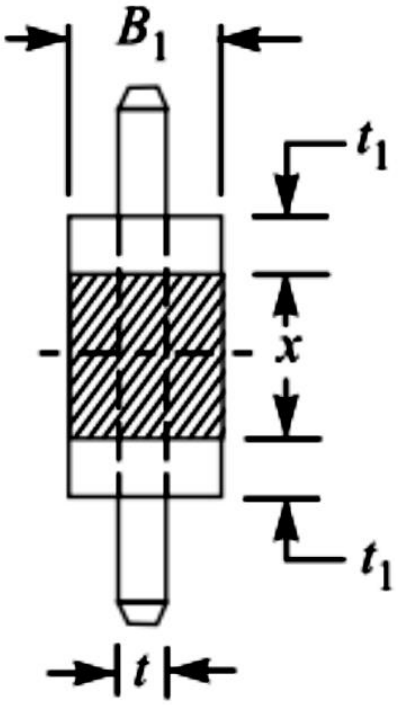
Design of Gib and cotter joint

we may write the following failure criteria:

1. Tension Failure of rod at square end x

$$x^2 \sigma_t = P$$

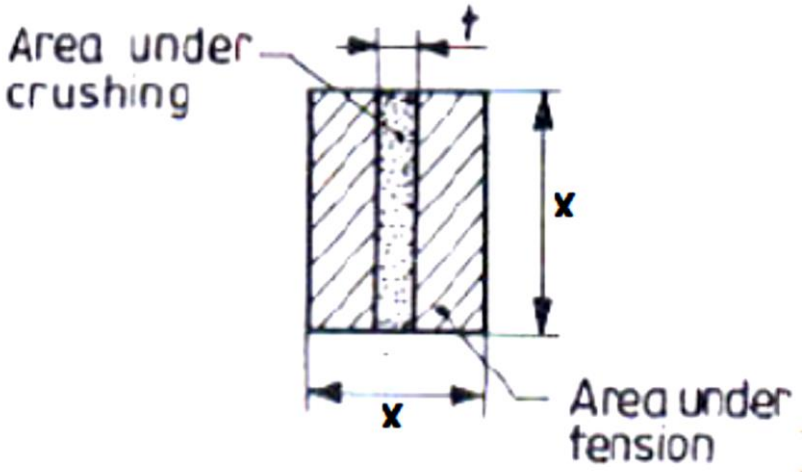




Cotter Joints

2. Tension Failure of rod across slot

$$(x^2 - xt)\sigma_t = P$$



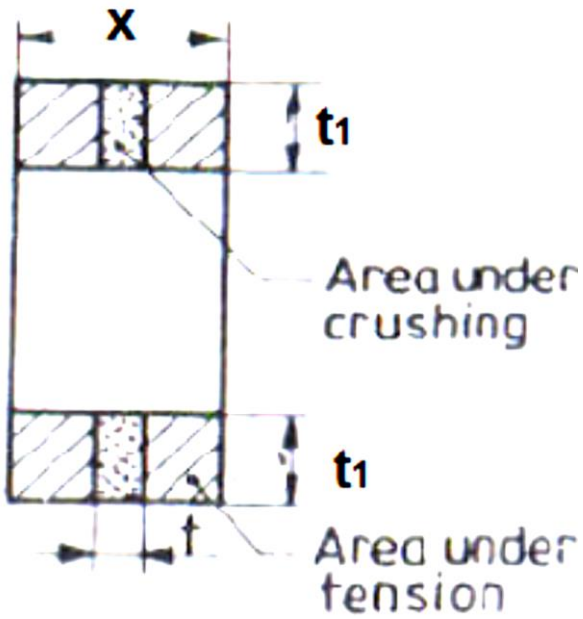
3. Compression / Crushing Failure of rod and Cotter

$$xt\ \sigma_t = P$$

Cotter Joints

4. Tension Failure of Strap/Fork across slot

$$2(xt_1 - tt_1)\sigma_t = \mathrm{P} \quad \text{or} \quad 2t_1(x - t)\sigma_t = \mathrm{P}$$



5. Compression / Crushing Failure of Strap/Fork across slot

$$2tt_1\sigma_t = \mathrm{P}$$

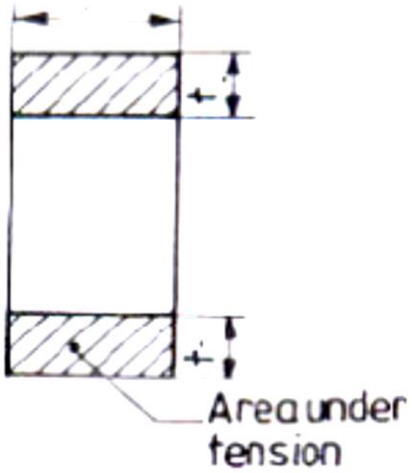
Cotter Joints

6. Shear Failure of Gib and Cotter

$$2Bt\tau = \mathrm{P}$$

7. Tension Failure of Strap/Fork at the weekest section

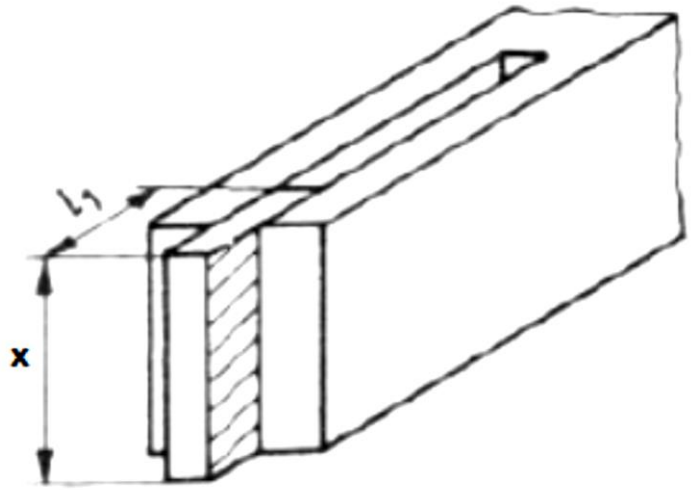
$$2xt_1\sigma_t = \mathrm{P}$$

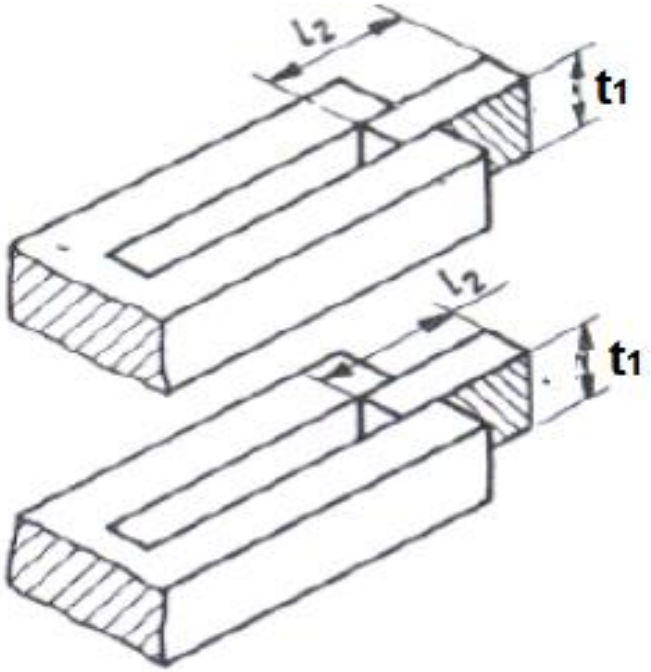


Cotter Joints

8. Shear Failure of rod end

$$2l_1 x\tau = \mathrm{P}$$





9. Shear Failure of Strap/Fork end

$$4l_2 t_1\tau = \mathrm{P}$$

Cotter Joints

Problem 3

Design & Draw a gib & cotter joint to resist a safe tensile load of 50 KN. The material of the gib, cotter & rod is same for which the allowable safe stress are σ_t = 25 N/mm^2, σ_s = 20 N/mm^2 & σ_c = 60 N/mm^2.

References

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V. B. Bhandari, Design of Machine Elements, Third Ed., The McGraw-Hills Companies, New Delhi

R. S. KHURMI and J.K.GUPTA, A Text Book of Machine Design, S.Chand and company ltd., New Delhi, 2000.

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