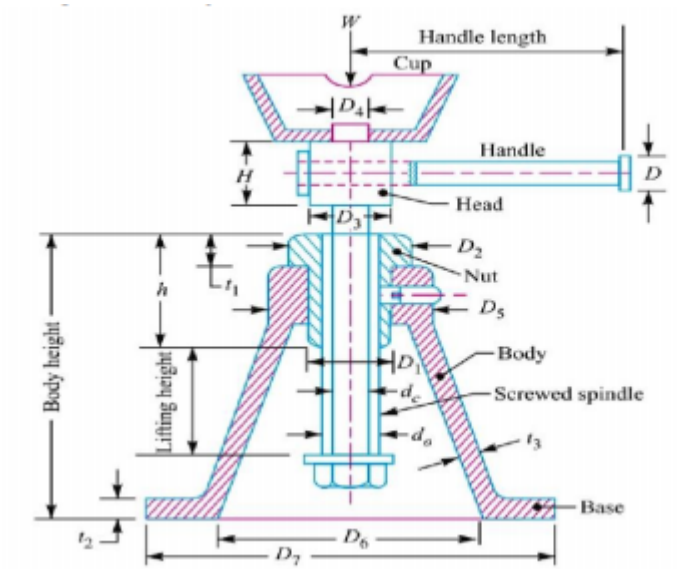

Design of screw jack

Question:

Design of screw jack

Explain with neat sketches and equations. How the screw spindle and nut of a screw jack is designed.

Answer:



Design of Screw:

1)Consider the screw under pure compression to find diameter of screw

$$\sigma c = \frac{W}{\frac{\pi}{4} X (dc)^2}$$

As screw is subjected to twisting moment, higher value of screw is selected .

Select The dimension of d_c w.r.t pitch

Mean diameter d= do- p/2

2) Torque required to overcome the friction (T_1)

Helix angle $\alpha = tan^{-1} \frac{P}{\pi x d}$

$\emptyset = tan^{-1} \mu$

Torque required lifting the load

T1= W. tan ($\alpha + \emptyset$) $\frac{d}{2}$

As collar friction is Neglecting, T_2=0

Total Torque required to lift the load = T_1

For Checking:

Direct compressive stress in screw:

$\sigma c = \frac{W}{\frac{\pi}{4} X (dc)^2}$,

Torsional shear stress τ , $\tau = \frac{16\,T1}{\pi\, X\, (dc)^3}$

According to Maximum shear stress theory, the maximum shear stress in the screw

$\tau_{max} = 1/2\sqrt{\sigma c^2 + 4\,\tau^2}$

Permissible shear stress for a screw $\tau = \sigma c/2$

$\tau_{max} \leq \tau_{allowable}$, So screw is safe

Design of Nut:

The bearing pressure between the thread

$$Pb = \frac{W}{\frac{\pi}{4} X (do^2 - dc^2)\, n}$$, Height of Nut: H= n X P

Check: Shear stress induced in the screw thread

$\tau = \frac{W}{\pi\, X\, (dc) X\, t\ \ n}$ as t= p/2

$\tau_{calculated} \leq \tau_{allowable}$, So screw is safe .