School of Engineering & Built Environment

African Leadership College Notes

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Module: Engineering Design and Analysis 2

Design of Power Screws: Tutorial

Dr Andrew Cowell CEng MIMechE FIES
Department of Engineering

T: 0141 331 3711
E: aco3@gcu.ac.uk

Original Epicyclic and Power Screw notes prepared by G.K. Vijayaraghavan (2006), Original Clutch, Belt and Brake Systems by Dr M. Macdonald, Updated notes prepared by A. Cowell (2017)

Power Screws Tutorial Sheet

1. The pitch of a square threaded power screw is 4 mm and the major diameter is 24 mm. The load carried by the screw is 6kN and the coefficient of friction for the screw and nut is 0.073 and for the collar bearing it is 0.116 and the thread is double start. The collar bearing has the same mean diameter as the screw. Determine
   (a) the torque required to rotate the screw against the load
   (b) the torque required to rotate the screw with the load
   (c) the overall efficiency
   (d) whether or not the screw is self locking.

   [Ans: 20.22 N-m; 4.86 Nm; 37.79 %; Self-locking]

2. A sluice gate weighing 18 kN is operated by means of square threaded screws as shown in Figure Q2. The power screw is supported in the casing by a plain bearing having an inner and outer diameter of 75 mm and 25 mm respectively with a coefficient of friction of 0.12. The sluice gate is attached to the power screw via nut welded to the gate. The screw thread and nut are double start, 10 mm pitch square thread having an outside diameter of 60mm and a coefficient of friction of 0.1. The frictional force induced by water pressure against the gate when it is in its lowest position is 4000 N. Find
   (a) speed of the hand wheel required to raise the sluice gate 240 mm in 1.2 min;
   (b) the maximum force to be exerted at the ends of the lever to raise the sluice gate;
   (c) Efficiency of the arrangement
   (d) Whether the assembly will be self-reversing

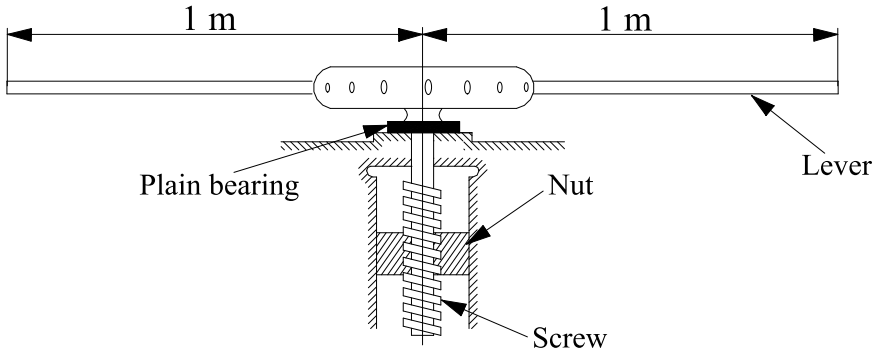

Figure Q2

[Ans: 10 revs/min; 99.03 N; 35%; Not self reversing]

3. The screw of shaft straightener exerts a load of 30 kN as shown in Figure Q3. The screw is square threaded of outside diameter 75 mm and 6 mm pitch. Determine
    (a) force required at the rim of a 300mm diameter hand wheel, assuming the coefficient of friction for the threads as 0.12
    (b) number of threads in contact with the nut
    (c) efficiency of the straightener
    (d) force required at the rim of a 300mm diameter hand wheel, if there is a collar bearing of 50 mm mean diameter provided in the arrangement to exert axial load. Assume the coefficient of friction for the collar as 0.2.

    [Ans: 1058 N; 25 threads; 18%; 2058.4 N]

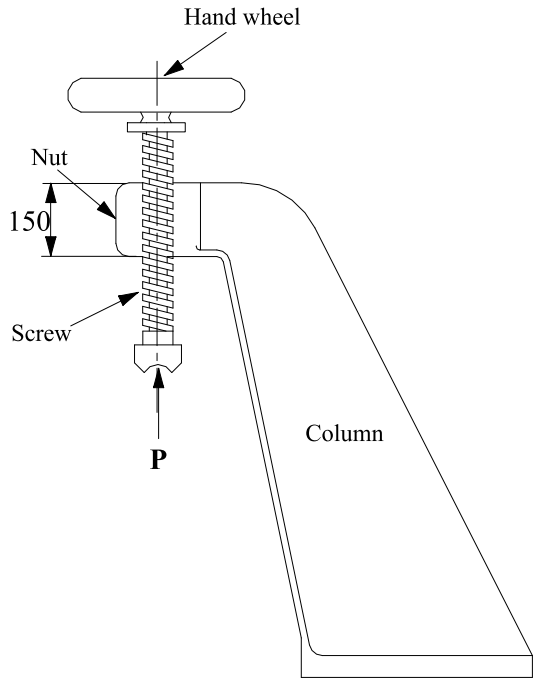

Figure Q3

4. A C-clamp as shown in Figure Q4 has double start square threads of 12 mm outside diameter and 2 mm pitch. The coefficient of friction for the screw threads is 0.15 and for collar is 0.25. The mean diameter of the collar is 12 mm. Determine
    (a) the length of the handle if the force exerted by the operator at the end of the handle is 80 N
    (b) the maximum force that can be exerted by the operator if there is no collar in the above arrangement by assuming the length of the lever as 100 mm
    (c) the efficiency of the arrangement and whether the assembly will be self-reversing if there is no collar bearing

    [Ans: 149.4 mm; 59.48 N; 21.3%; not self-reversing]

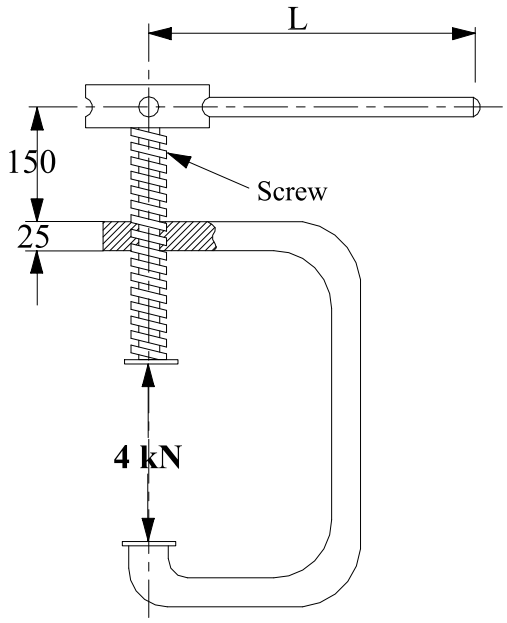

Figure Q4

5. The spindle of the screw jack has a single start square thread with an outside diameter of 45 mm and a pitch of 10 mm. The spindle moves in a nut. The load is carried on a swivel head but is not free to rotate. The bearing surface of the swivel head has a mean diameter of 60 mm. The coefficient of friction between the nut and screw is 0.12 and that between the swivel head and the spindle is 0.10. Calculate the load which can be raised by efforts of 100 N each applied at the end of two levers each of effective length of 350 mm. Also determine the efficiency of the lifting arrangement.

[Ans: 9958.7 N; 22.64%]

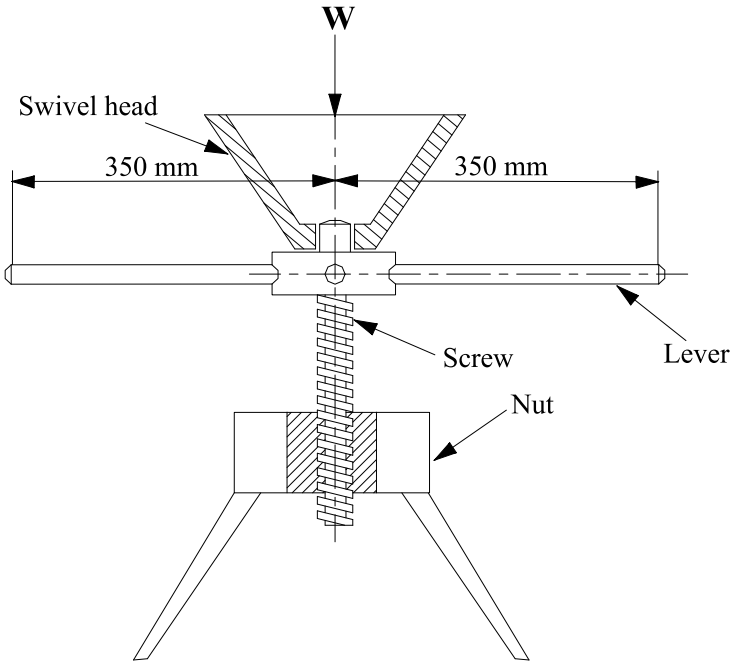

Figure Q5