國立臺灣大學99學年度碩士班招生考試試題

1. (15 %)

A self-locking clamp is designed to hold papers as shown in Fig. 1. Roller *B* is rotated about bearing *C*. The diameter of the roller is *d*, and the distance between the center of the roller and the center of the bearing is *a*. To make a conservative calculation, we assume that the bearing at C and the contact between *A* and the paper are frictionless. However, friction does exist between roller *B* and the paper, and the coefficient of friction is m. Find the largest distance *a* in which the paper can never be pulled out of the self-locking clamp. (m =0.6; d = 30 mm)

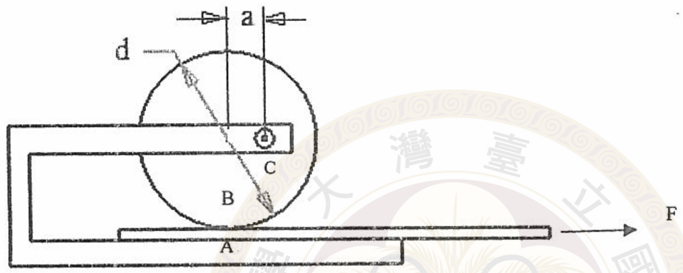

Fig. 1

2. (15 %)

Lever *AC* can rotate about point *A*. The weight of AC can be ignored. When θ is zero, spring *CD* is in a forceless situation (Fig. 2). What is θ when block *B* is hung on *AC* and reaches stable equilibrium? Use potential energy equilibrium to solve the problem.

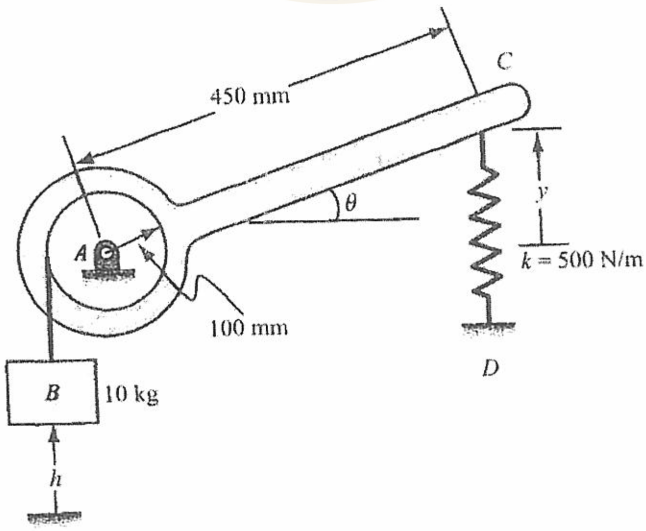

Fig. 2

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3. (20 %)

The bucket and load in Fig. 3 weights 2000 lb. If the weights of other members are neglected, what will be the reaction at pin A and the force in the hydraulic cylinder C?

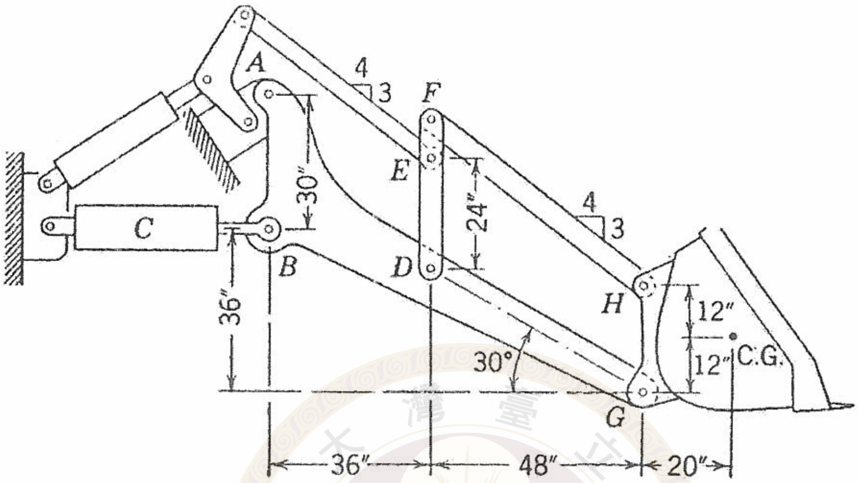

Fig. 3

4. (15 %)

A worm-gear is mounted at the middle of the shaft as shown in Fig. 4. The pitch diameter of the worm-gear is 200 mm. The magnitudes of the forces on the worm-gear are tangential force Wt = 450 Kg, radial force Wr = 160 Kg and axial force Wx = 120 Kg. Direction of the forces on the worm-gear are given in the figure. Two bearing are supported on the ends of shaft. Find the reaction forces on the bearing A and bearing B.

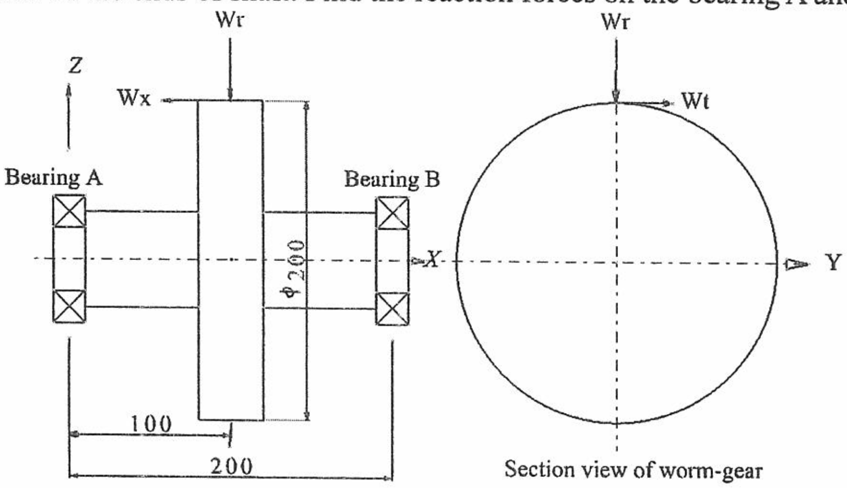

Fig. 4

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5. (15 %)

A uniform bar of weight 2 kg and length 200 mm is hung horizontally by two vertical wires of equal length 300 mm as shown in Fig. 5. The weight of two wires is negligible compared to the weight of the bar. Two opposite horizontal forces of equal magnitude P are applied normal to the bar at ends A and B such that the horizontal rotation angle α of the bar is 4 degrees. Under the force equilibrium, the bar ends are located at positions A' and B'. Find the magnitude of the force P and the tension T in each wire.

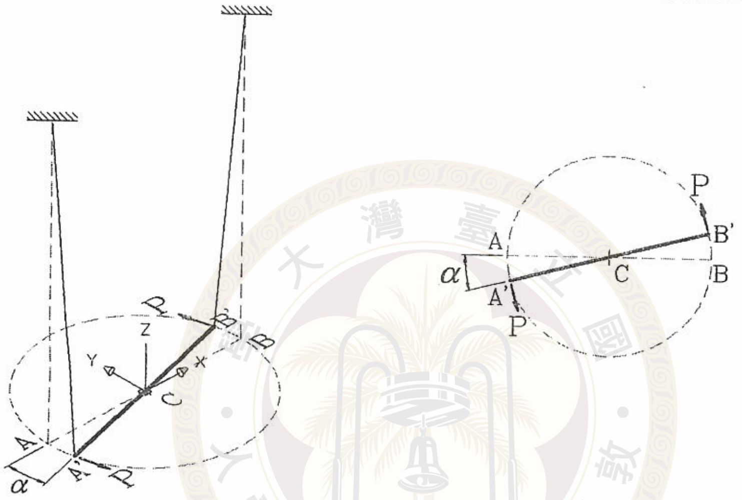

Fig. 5

6. (20 %)

A load 4000N, perpendicular to $\overline{CD}$, is applied to the joint C of a symmetric truss structure as shown in Fig. 6. It is also noted that $\overline{AO}=\overline{ON}=\overline{KJ}=\overline{JI}=0.5\overline{NK}$. Find the forces in members KJ and KL.

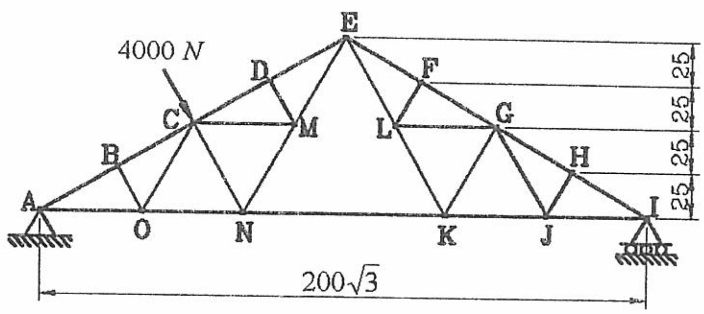

Fig. 6

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