1. Fig1, Fig2, Fig3 are the original simplest structure for human lower Extremity to support his own body weight. But from Biomechanical point of View, it is more realistic to modify the structure model as Fig4 , Fig5. Explain (a) Why we heed the part A, and Chain a
(b) why we need the part B and chain b,chain c
(c) why the part C is designed to be close to the line of action of the body weight
(d) what musules are simulated by chain a,b,c,d.

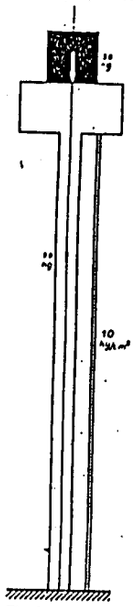


Fig. 1

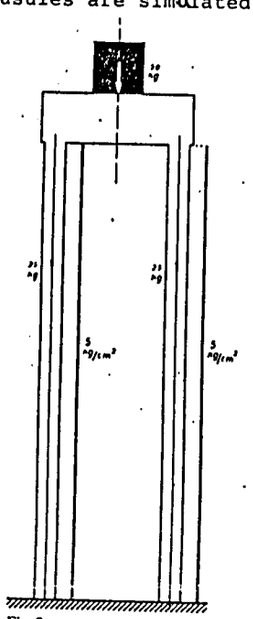


Fig. 2

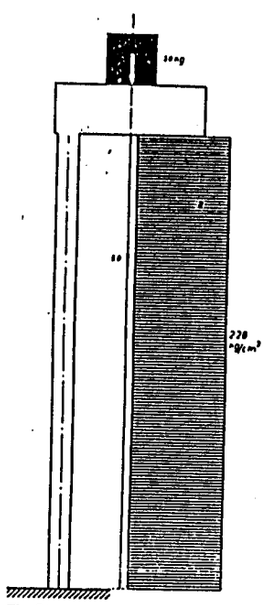


Fig. 3

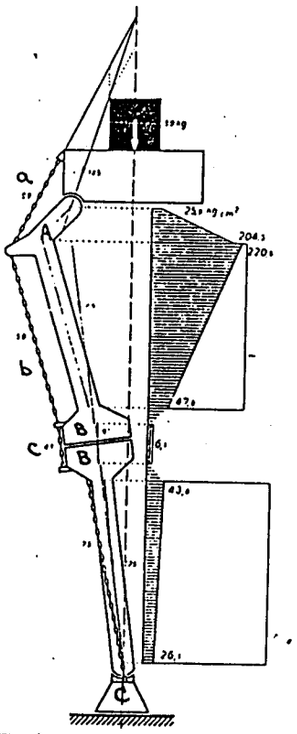


Fig. 4

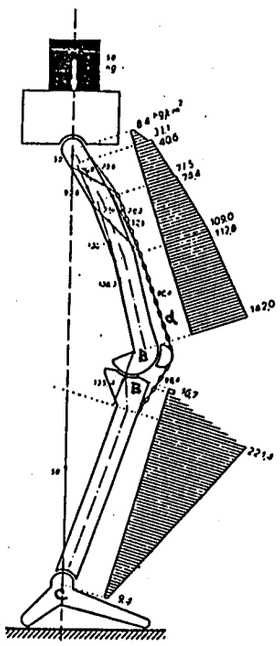
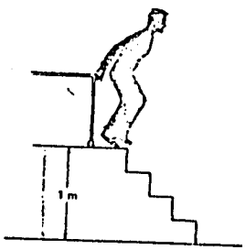
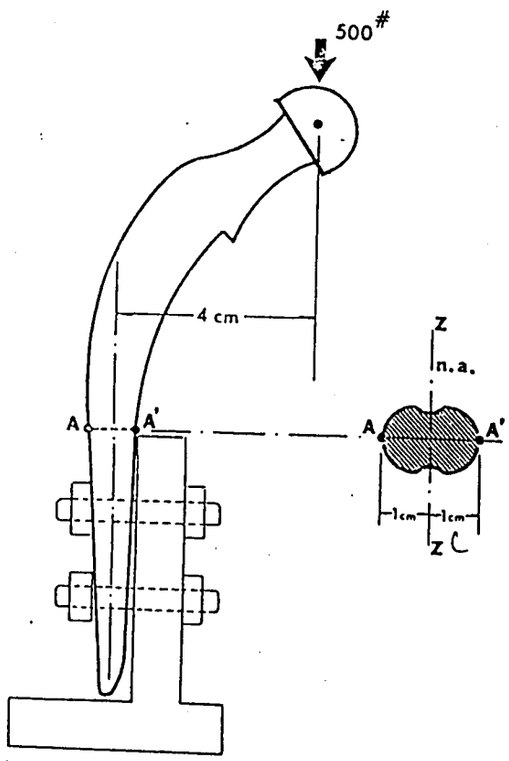


Fig. 5

2. A 50 kg person (with a mass of 50 kg) is jumping from a porch 1 m high, how much potential energy does he have before he jumps and what is the K.E. as he is landing on the ground? What is his landing velocity at the time of impact?



3. A femoral component of a total hip prosthesis is under bench test, as shown in the following figure. A vertical load of 500 kg is applied through the head. Calculate the maximum tensile and compressive stresses developed at section A-A'. The cross-sectional geometry and the area moment of inertia of the stem at A-A' is also given as shown. In calculating the stresses, please consider both axial loading and bending conditions.



Area = 4 cm^2

I_{zz} = 1.5 cm^4

<u>In axial loading:</u>

$$\text{stress} = \frac{\text{load}}{\text{area}}$$

<u>In bending:</u>

$$\text{stress} = \frac{MC}{I_{zz}}$$

M = bending moment.

4.

A posture as shown in Fig. and the kinematic and anthropometric data are :

$h = 30\ cm$ $\quad \Theta_H = 30°$ $\quad \alpha = 60°$

$b = 20\ cm$ $\quad \Theta_T = 40°$ $\quad D = 11\ cm$ $\quad E = 5\ cm$

$mg_{BW} = 350\ N$ (above L5/S1 level), $mg_{load} = 450\ N$

The moment at hip for an average anthrometric male in this posture is found to be 200 N m. Abdominal Pressure is empirical predicted by :

$$P_a = 10^{-4}[43 - 0.36(\Theta_H + \Theta_T)][M_H^{1.8}]$$

The diaphram area is assumed to be 465 cm^2

Find F_a, F_{musc} and F_{comp}.

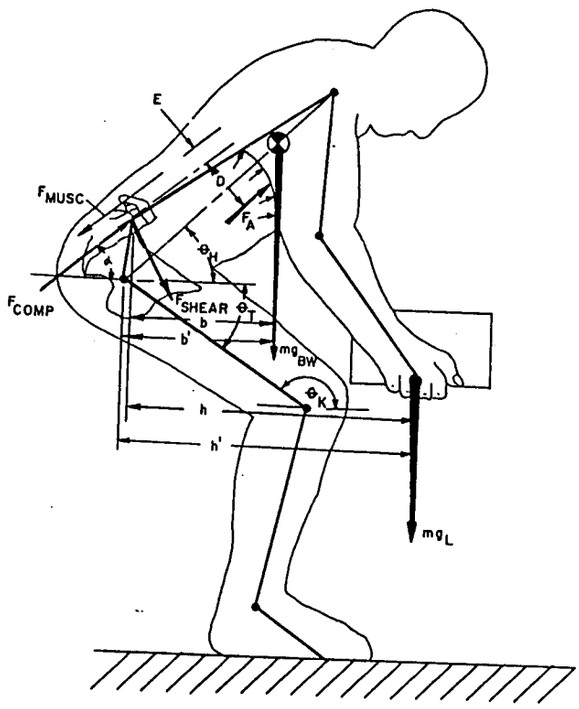


Fig 6

5. Describe the Biomechanics of Ankle Joint.