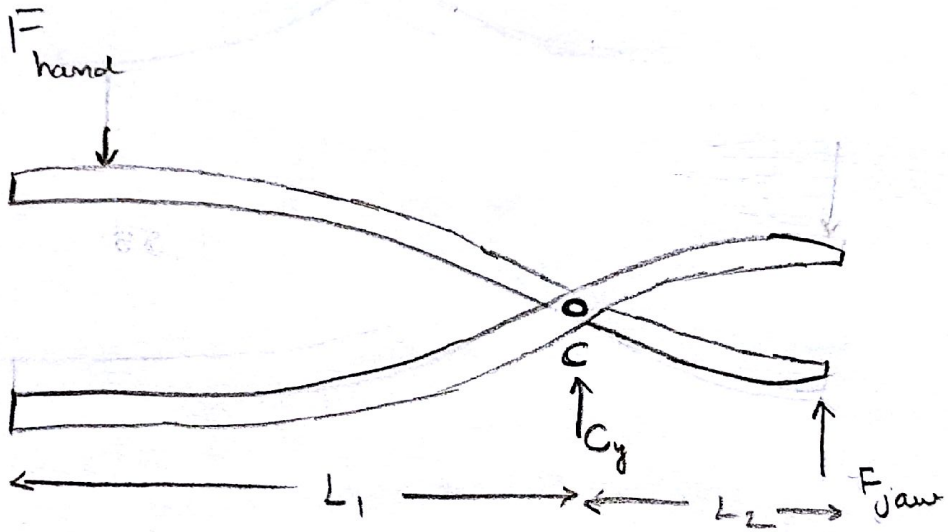
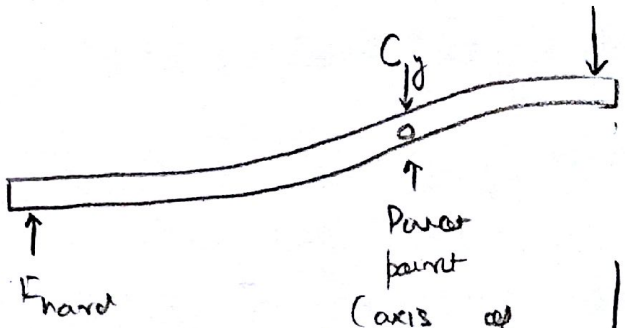
3 Free Body Diagram



Comment added after review:

In Free Body Diagrams, other than the cases of forces such as gravitational, electric etc., the g direction of the arrow doesn't matter since it will be solved for a negative answer on doing the numerics, resolving this ambiguity.

4 Equations



Force on pivot = $(F_{hand} + F_{jaw})$

Moment about pivot = $F_{hand} \times$ dist. (L_1)

Moment about pivot = $F_{jaw} \times$ dist

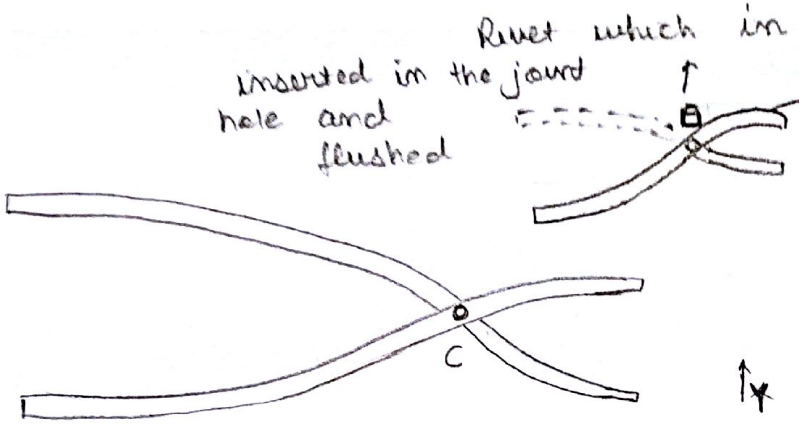
Force summation of equilibrium /

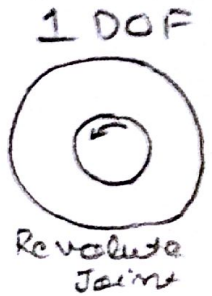
Equilibrium of moments (about pivot point)

$$F_{hand}\ (L_1) = F_{jaw}\ (L_2)$$

$$F_{jaw} = \frac{L_1}{L_2} \times F_{hand}$$

5.





Revolute joint (C) / Rivet

$F_c = F_{jaw} + F_{hand}$

Center pivot receives force equivalent to sum of jaw and hand.

Problems that could arise at pin joint / C || Resolutions

→ Rivet could come lose if huge force is applied (over a long period of time) (wear and tear)

→ Friction b/w two grippers could increase (oiling should be done)

→ Rivet / C / Pin should be flushed during manufacturing along with ensuring no x/z movement while moving grippers.

→ Should be made of strong metal (forged steel / chromium) for the rivet or the gripper arms to not get distorted at the points where force is experienced. 1 DOF movement should be preserved.

6.

→ Inaccurate fit of rivet at the joint will make for wobbly tips that may not align, especially after long use

→ If the grippers are not manufactured with micron accuracy, those might not align after addition of joint.

→ If the gripper / plier joint metal is not strong, it might distort / bend after elongated use (gripper bars might bend) leading to non-alignment.