Ex. 3-1 : Given two rocker outputs, two position Synthesis, design a four-bar crank and rocker mechanism to give 45° of rocker rotation with equal time forward and back, from a constant speed motor input.

$\Delta\theta_4 = 45°$ ↯

1ST step: Draw 45°

2ND step: Choose $L_4 = 6$cm

3RD : Toggles colinear by connecting B_1 to B_2

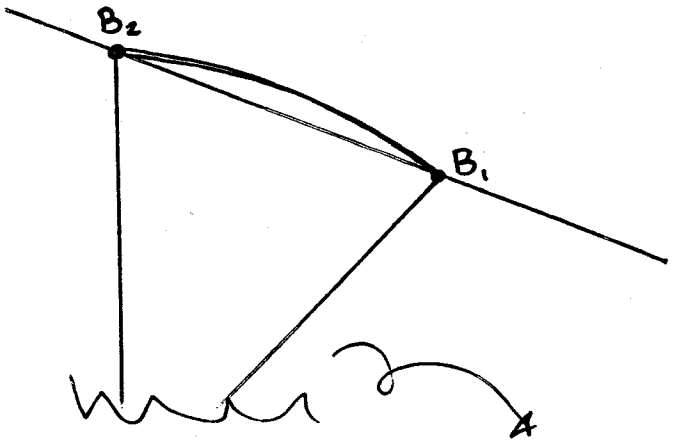
4TH : O_2 is on an extension of $\overline{B_1B_2} = 2L_2$

Choose $L_3 = 10$ cm

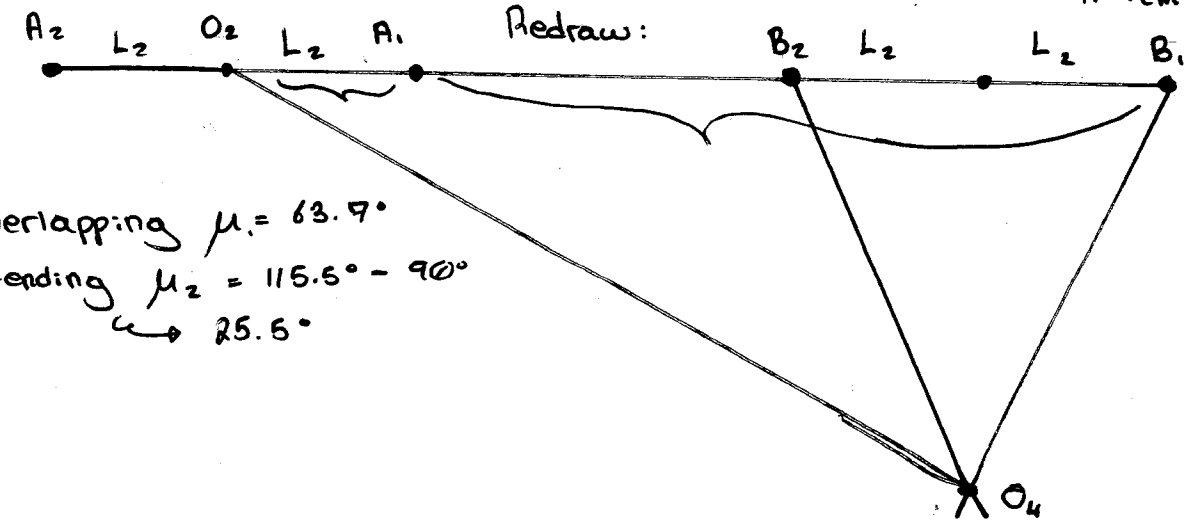
Bisect a line ↳ locate O_2, L_2, L_3

6TH : Check Grasshof condition.

5th Measure $O_2O_4 = L_1 = 11.4$cm



Redraw:



Overlapping $\mu_1 = 63.7°$

extending $\mu_2 = 115.5° - 90°$

↳ 25.5°

Checking:

↳ $L_1 = 11.4$, $L_2 = 2.3$, $L_3 = 10$, $L_4 = 6$

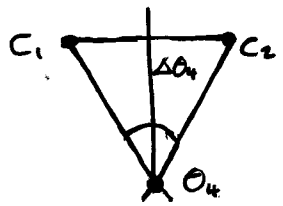
$S + L = 2.3 + 11.4 = 13.7 < P + Q = 6 + 10 = 16$ OK

Crank rocker

7. $\mu_1 = (180 - 45)/2 = 67.5° = \mu_2$

8. μ_{min} occurs when L_2 and L_4 become colinear.

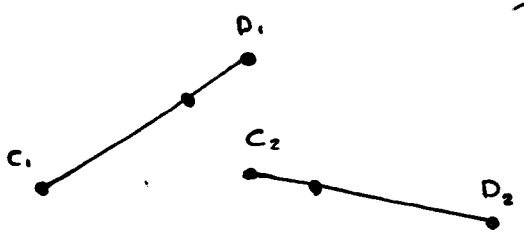
Ex. 3-2 Given two rocker output positions: Design a fourbar linkage to move link CD from position C_1D_1 to C_2D_2, knowing CD is part of rocker.



Bisect C_1, C_2, D_1, D_2 to locate O_4.
Choose L_4 to locate B.

Ex. 3-3 CD = 5 cm

→ 1. Choose C as joint of L_2 and L_3, choose D as joint of C_3 and C_4.



↝ C_1, C_2 path is a piece of arc
D_1, D_2 is the same.

→ 2. Bisect C_1C_2
O_2 is on the bisecting line

→ 3. Bisect D_1D_2
O_4 is on the bisecting line

→ 4. Choose $L_4 = 4.5$ to locate O_4

→ 5. Choose $L_2 = 6$ to locate O_2

→ 6. Measure $O_2O_4 = L_1 = 4.6$

$L_1 = 4.6$, $L_2 = 6$, $L_3 = 5$, $L_4 = 4.5$

$S+L = 10.5 > P+Q = 9.6$

(Class II)

JAN. 23/19

Ex. 3-5

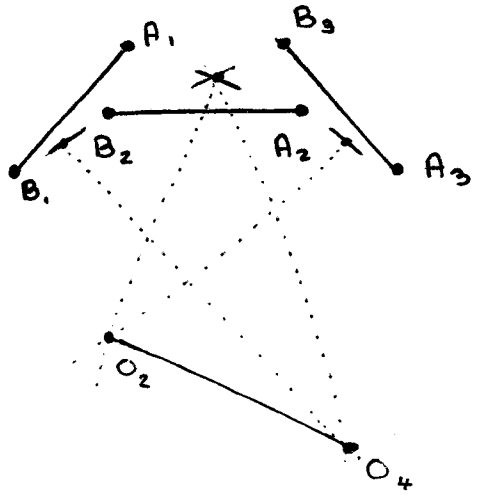
$L_3 = 4$ cm

1. Bisect A_1A_2
2. Bisect A_2A_3
   ↳ to locate O_2
3. Bisect B_1B_2
4. Bisect B_2B_3
   ↳ to locate O_4

$L_1 = 8$

$L_3 = 4$

$L_2 = L_4 = 10$



$L_2 = 9$ cm

$L_4 = 11.5$ cm

$L_1 = O_2O_4 = 9$

$S + L \geq 4 + 11.5 = 15.5$

$P + Q \Rightarrow 9 + 9 = 18$

Class I → double-rocker

Ex. 3-9

T_F = time for Forward (working) stroke

T_b = time for backward (idle) stroke

$T_b < T_F$

Link 2 rotates at a constant speed.

Time ratio $TR = T_b/T_F = \alpha/\beta = 5/7$

$\delta = \beta - 180° = 180° - \alpha$

Power = Force · Velocity

(Power: constant rated)

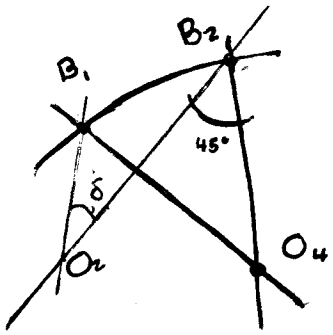
where $\alpha + \beta = 360°$

$5/7\beta + \beta = 360°$

$\beta = 210°$

↳ $\delta = \beta - 180° = 30°$

(Draw Four-bar w/ $\theta_4 = 45°$ and $T_b/T_F = 5/7$)



1. Draw 45°
2. Choose $L_4 = 5\,cm$
3. Specify μ For extended toggle
4. Use $\delta = 30°$ to draw overlapping toggle From B_1 to locate O_2
5. Measure $O_2O_4 = 4.3\,cm = L_1$

$L_1 = 4.3$, $L_4 = 5$

L_2, L_3

$O_2B_2 = 6 = L_2 + L_3$

$O_2B_1 = 2.8 = L_3 - L_2$

$$L_3 = \frac{O_2B_2 + O_2B_1}{2} = \frac{6 + 2.8}{2} = 4.4$$

$$L_2 = \frac{O_2B_2 + O_2B_1}{2} = \frac{6 - 2.8}{2} = 1.0$$

Check:

$S + L = 1.6 + 5 = 6.6 < P + Q = 4.4 + 4.3 = 8.7$

$\theta_2 = 55.1°$

(End Ch. 3)

Start Ch. 4 next week