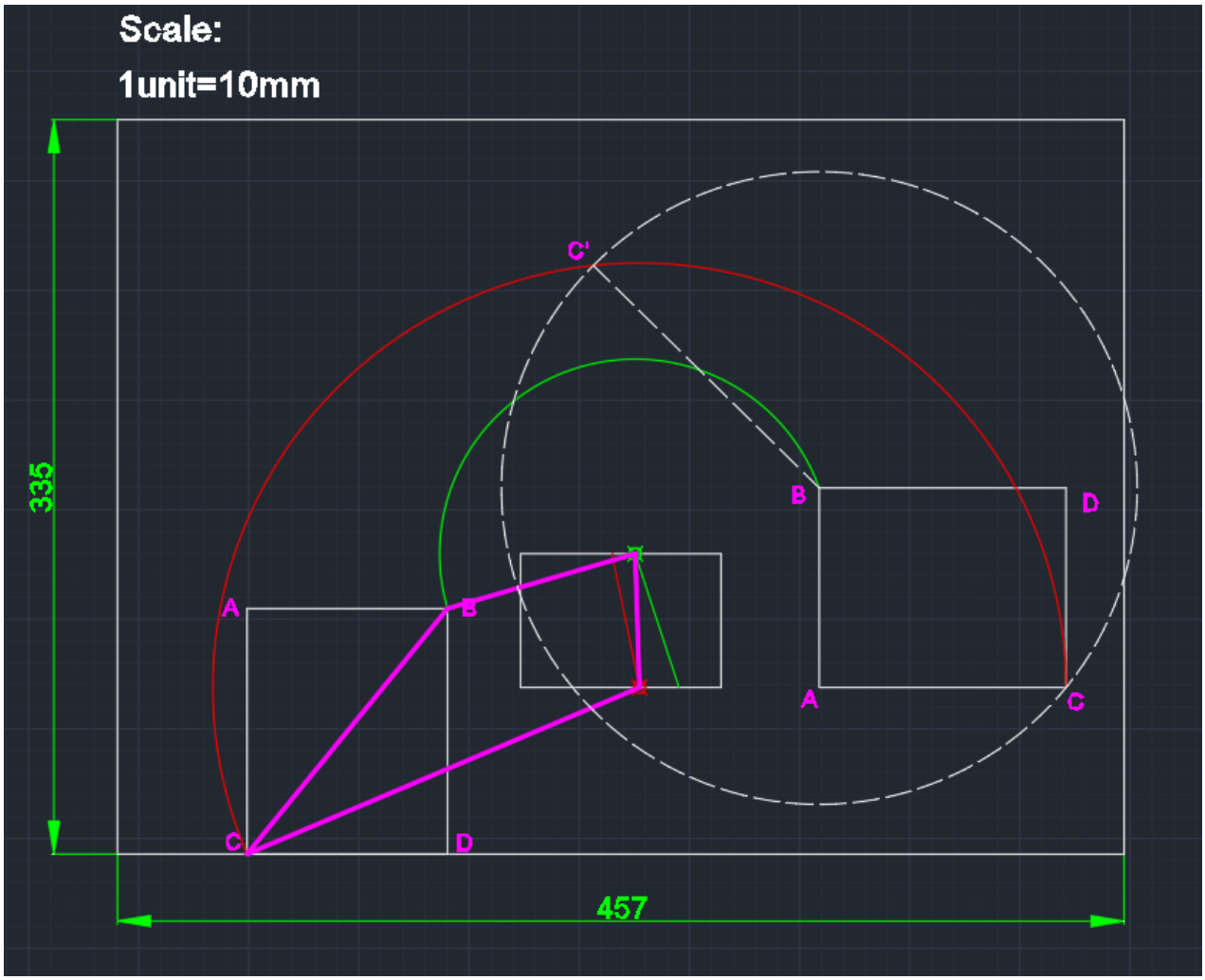
4 BAR MECHANISM FOR LOADING A FLATBED TRUCK

By: Abesech Inbasekar

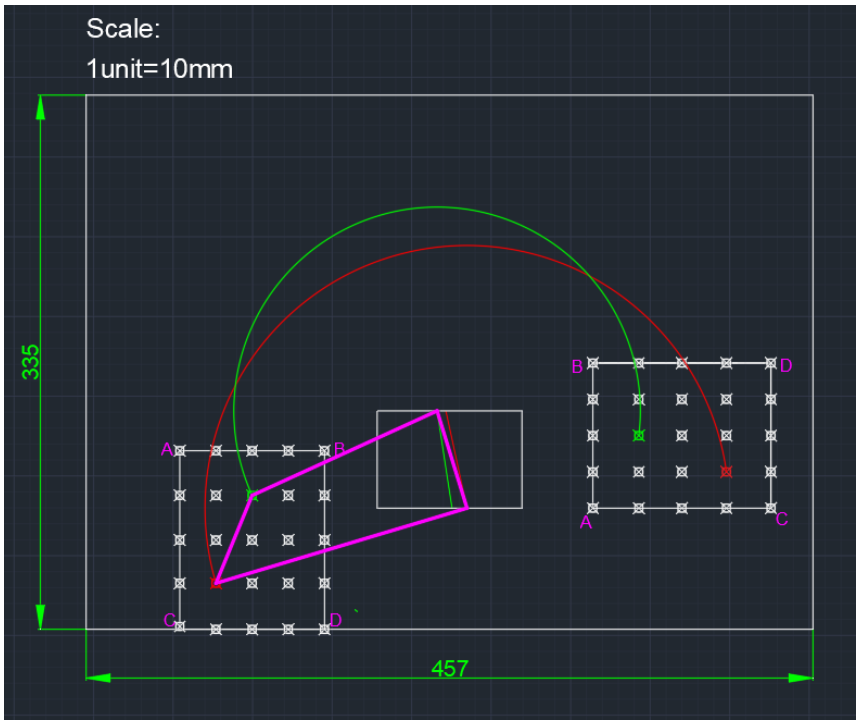
THE DESIGN PROCESS

TRIAL 1: Two-position synthesis with BC(diagonal) as the coupler.



The problem with this configuration is that when the link moving on the green circle reaches B, its destination, the coupler would be along BC' rather than BC as indicated by the dotted circle. Hence we would not arrive at our final desired position.

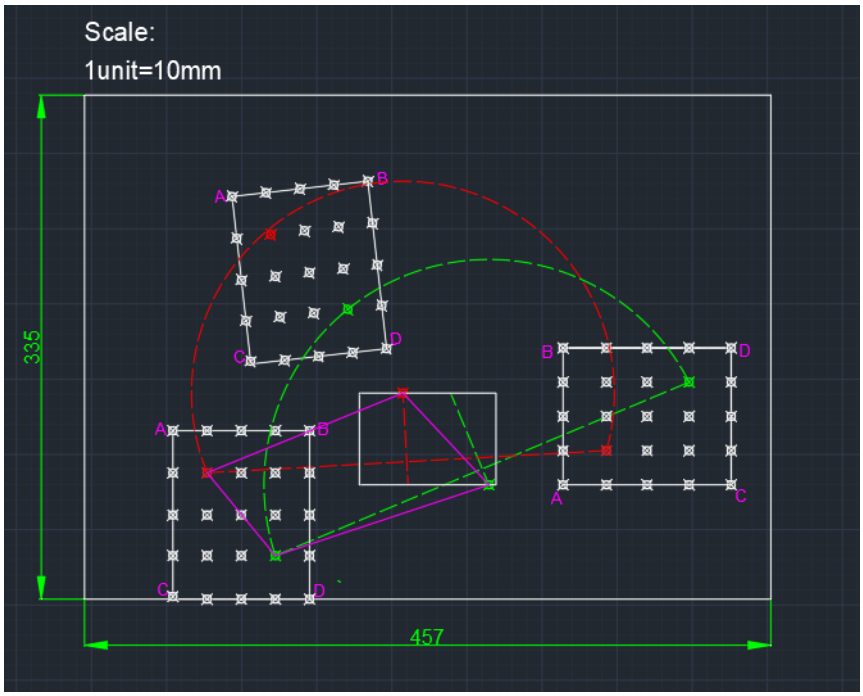
TRIAL 2: Two-position synthesis with coupler along two random points.



This configuration too has a similar problem as the previous one where the final position of the coupler is not the desired one.

Looking at these two trials, I got the intuition that a coupler along AD might work, since in this case, we can at least guarantee that the final position will be the desired one.

TRIAL 3 (Almost there): Two position synthesis with coupler as two points along AD.

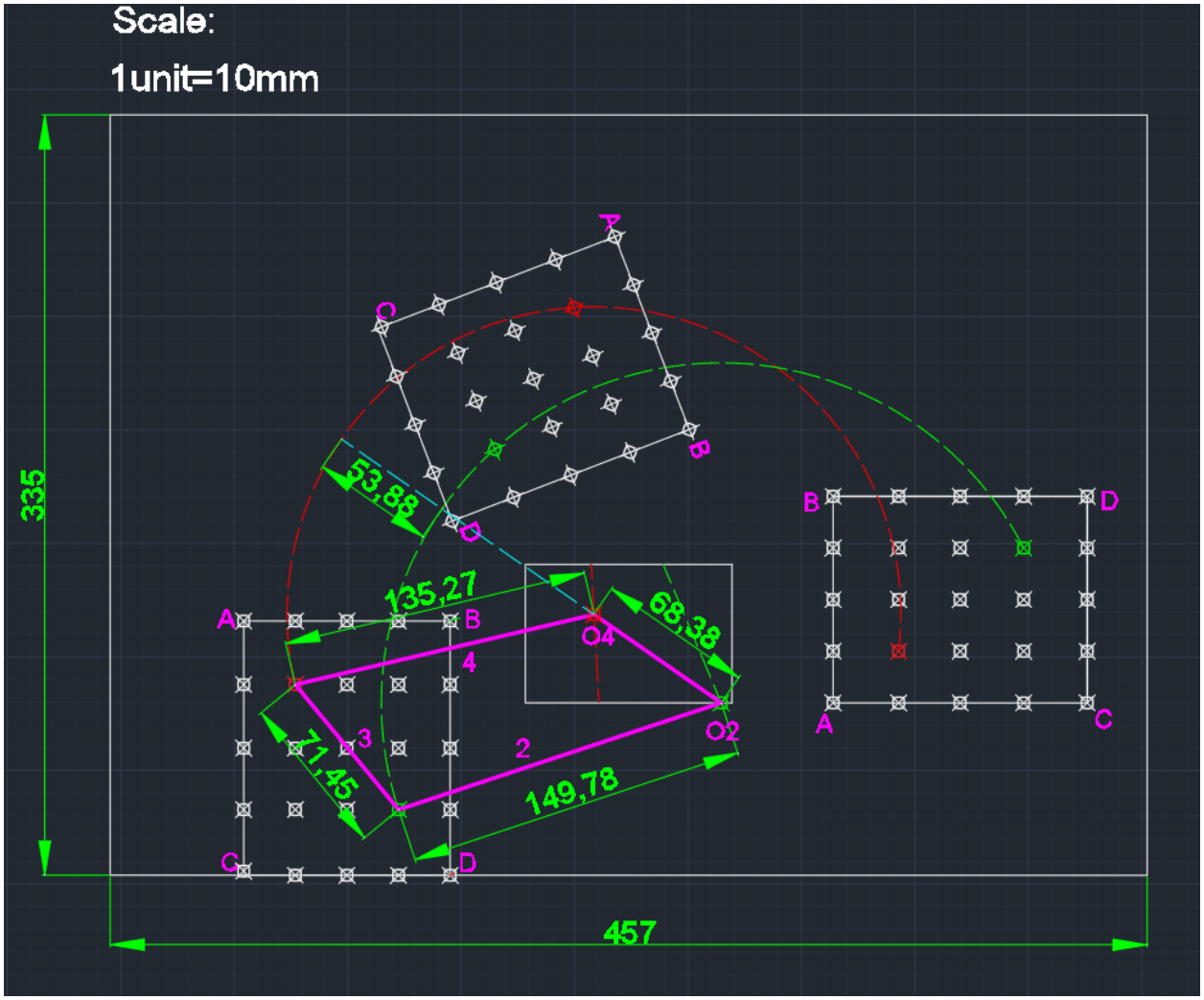


A new problem arises here!

The maximum distance between the two circles (which lies along the line joining the centers) turns out to be more than the coupler length which will indefinitely lead to the failure of the mechanism.

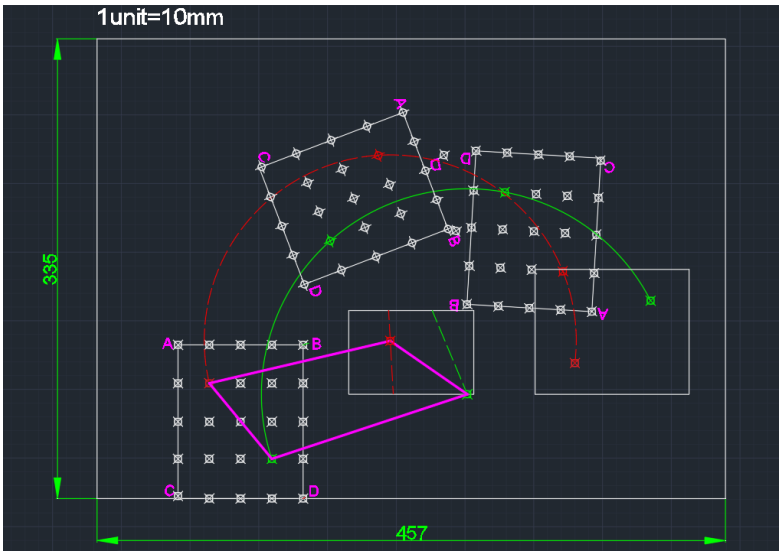
Solution: I moved the location of the red hinge downwards along its locus so as to reduce the maximum distance between the circles.

THE FINAL DESIGN:

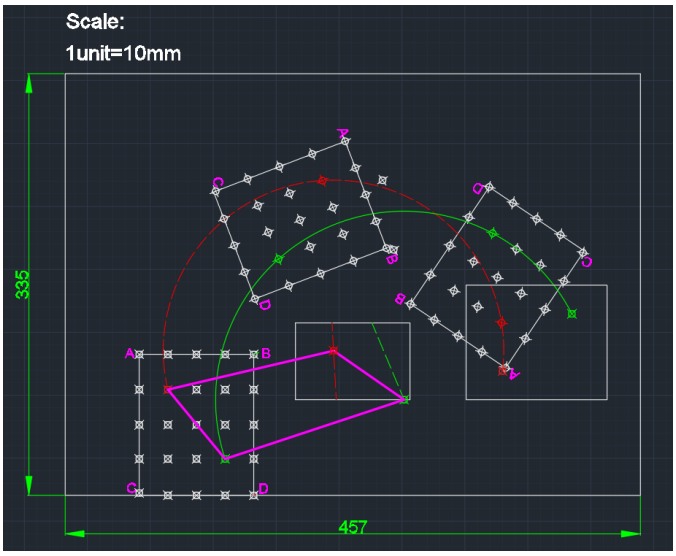


- The coupler length(.71m) is more than the maximum distance between the two circles (.54m) which ensures smooth motion of the coupler.
- Link2 is the input link,which when rotated by an angle of 171 degrees clockwise, the container gets loaded on to the truck as desired.

- The following diagrams display that the container does not extend beyond the walls of the truck during its range of motion, hence the motion of the container does not interfere with that of the truck:



Checking if B crosses the shaded region



Checking if C hits the wall of the truck during its motion

Transmission Angle:

- The transmission angle at the initial position is 64 degrees, now as we rotate the input link (2) the transmission angle reaches a minimum when link2 is aligned along O2O4 and the value comes out to be 29.78 degrees.

Grashof criterion:

- This is a non-grashof 4 bar as sum of lengths of shortest and longest links (2.18m) is more than that of the other two (2.06m) .
- Within the range of motion ,a triple rocker mechanism can also be used to carry out the task , which justifies why grashof condition is not satisfied in this case.

Recommendations for production:

- Redundant linkages can be added between the two parallel 4 bars(in 3D) inorder to strengthen the linkages.
- The input link can be made in such a way that the center of mass is coincidental(or as close as possible) with the hinge O2.