Quick Return Motion Mechanism

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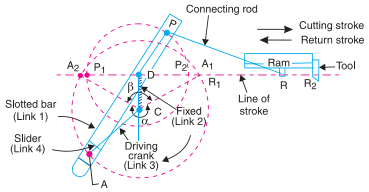

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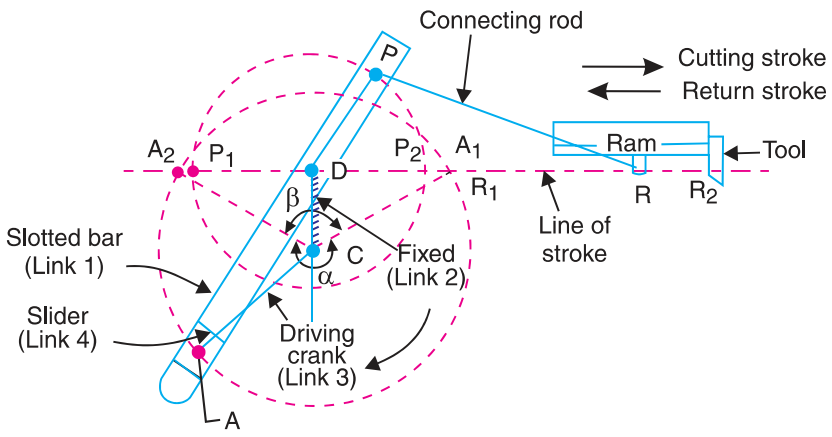
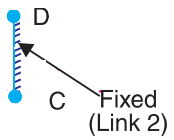
Whitworth Quick Return Motion Mechanism

This mechanism is mostly used in shaping and slotting machines.



Whitworth Quick Return Motion Mechanism

In this mechanism, the link CD (link 2) forming the turning pair is fixed.



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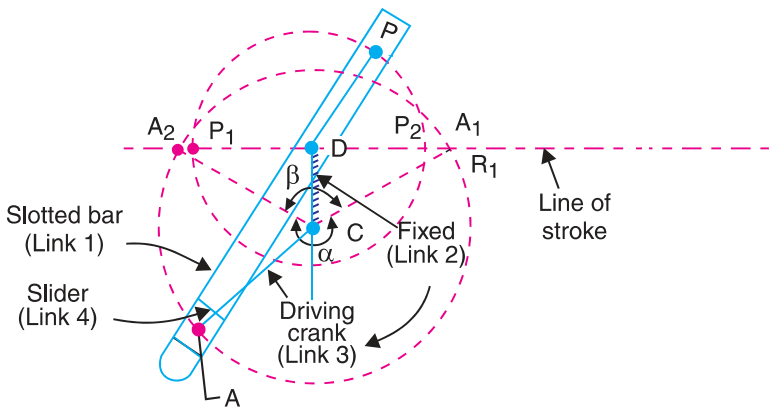
The driving crank CA (link 3) rotates at a uniform angular speed.A slider (link 4) attached to the crank pin at A.



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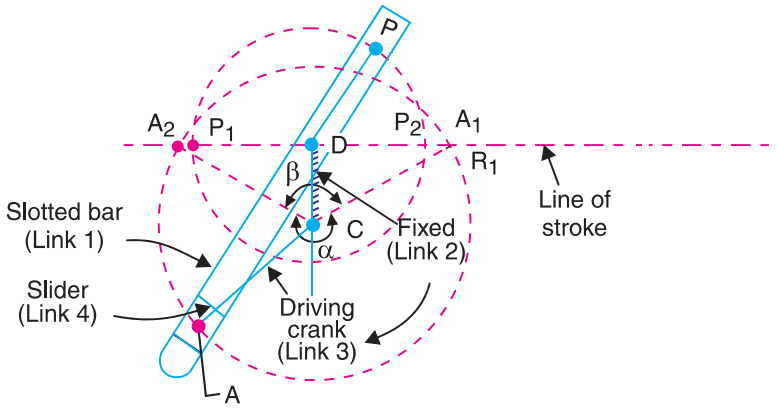
The slider slides along the slotted bar PA (link 1) which oscillates at a pivoted point D.



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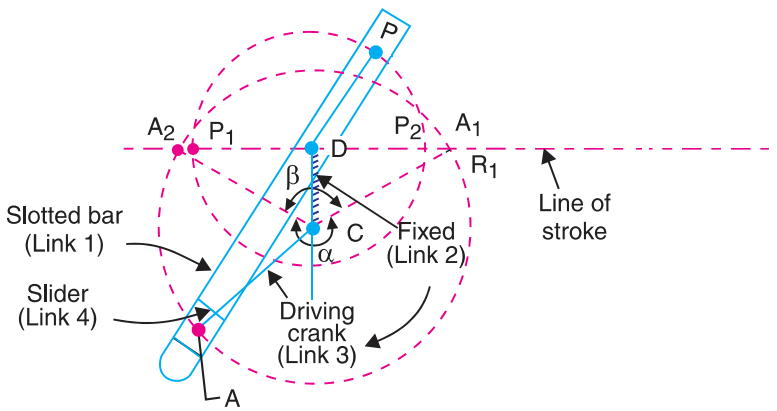
Thus PD portion of link 1 corresponds to a crank in a reciprocating engine.



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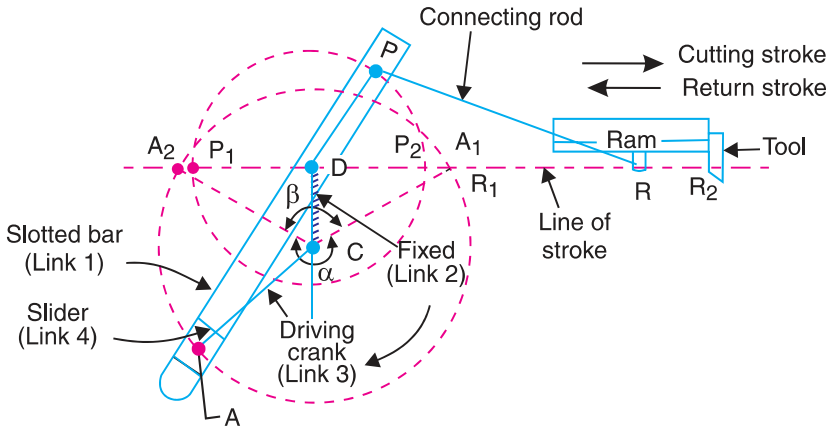
The connecting rod PR carries the ram at R to which a cutting tool is fixed.



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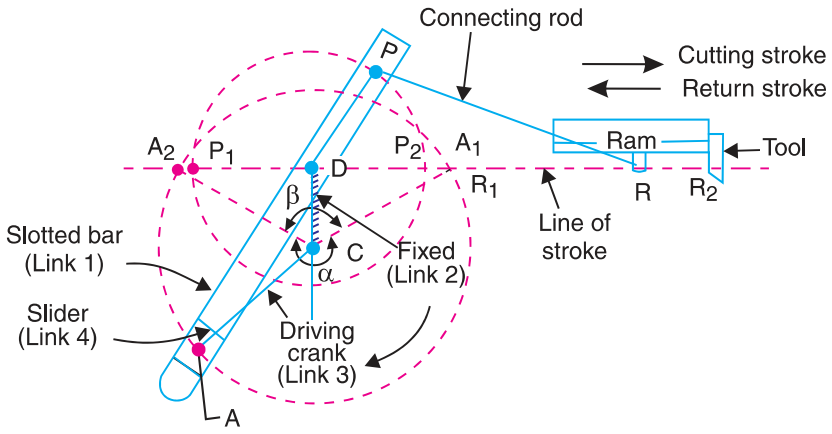
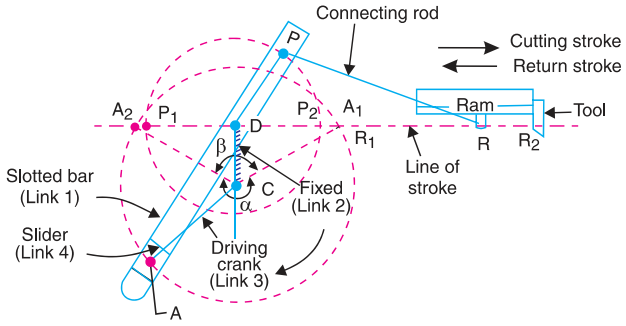
The motion of the tool is constrained along the line RD which is perpendicular to CD.



Whitworth Quick Return Motion Mechanism



When the driving crank CA moves from the position CA_1 to CA_2 (or the link DP from the position DP_1 to DP_2) through an angle α in the clockwise direction, the tool moves from the left hand end of its stroke to the right hand end through a distance 2 PD.

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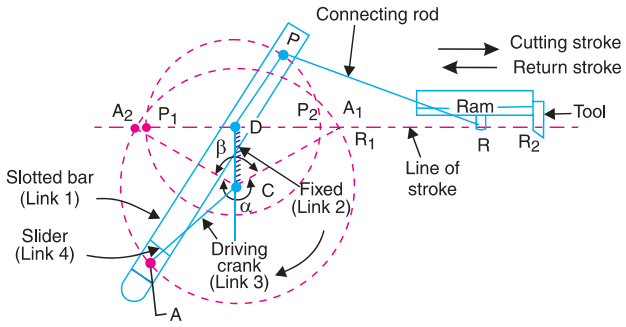

When the driving crank CA moves from the position CA_1 to CA_2 (or the link DP from the position DP_1 to DP_2) through an angle α in the clockwise direction, the tool moves from the left hand end of its stroke to the right hand end through a distance 2 PD.

Now when the driving crank moves from the position CA_2 to CA_1 (or the link DP from DP_2 to DP_1) through an angle β in the clockwise direction, the tool moves back from right hand end of its stroke to the left hand end.

Now, the time taken during the left to right movement of the ram (i.e. during forward or cutting stroke) will be equal to the time taken by the driving crank to move from CA_1 to CA_2. Similarly, the time taken during the right to left movement of the ram (or during the idle or return stroke) will be equal to the time taken by the driving crank to move from CA_2 to CA_1.

Since the crank link CA rotates at uniform angular velocity therefore time taken during the cutting stroke (or forward stroke) is more than the time taken during the return stroke. In other words, the mean speed of the ram during cutting stroke is less than the mean speed during the return stroke.

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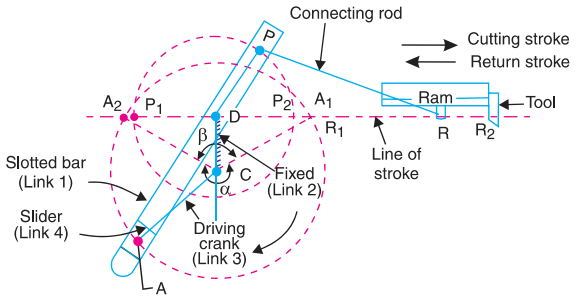

The ratio between the time taken during the cutting and return strokes is given by

$$\frac{\text{Time of cutting stroke}}{\text{Time of return stroke}} = \frac{\alpha}{\beta} = \frac{\alpha}{360^o - \alpha} = \frac{360^o - \beta}{\beta} \qquad (1)$$

In order to find the length of effective stroke R_1R_2, mark $P_1R_1 = P_2R_2 = PR$. The length of effective stroke is equal to 2 PD.