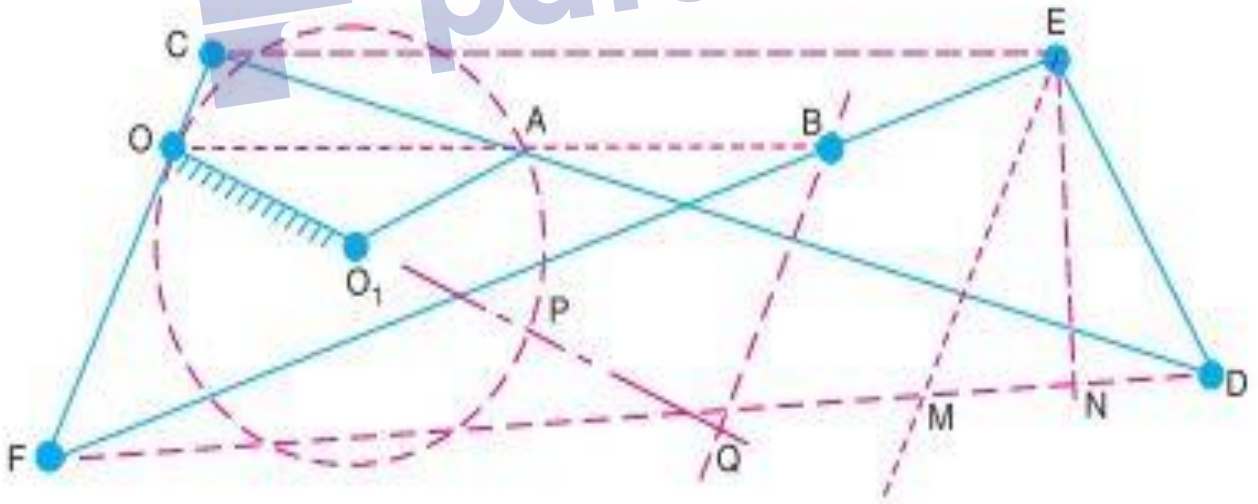
From similar triangles CFE and OFB,

$$\frac{CE}{FC} = \frac{OB}{OF} \quad \text{or} \quad OB = \frac{CE \times OF}{FC} \qquad \ldots(i)$$

d from similar triangles FCD and OCA

$$\frac{FD}{FC} = \frac{OA}{OC} \quad \text{or} \quad OA = \frac{FD \times OC}{FC} \qquad \ldots(ii)$$



Exact Straight Line Motion Consisting of One Sliding Pair-Scott Russell's Mechanism

It consists of a fixed member and moving member P of a sliding pair as shown

The straight link PA Q is connected by turning pairs to the link OA and the link P.

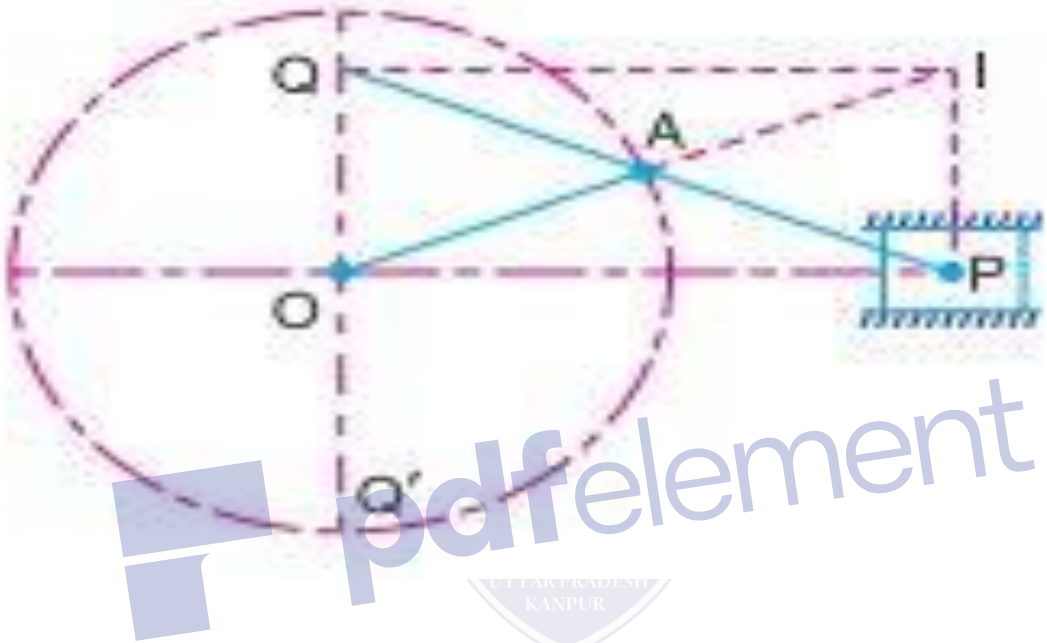
The link Oa rotates about O. A little consideration will show that the mechanism OAP is same as that of the reciprocating engine mechanism in which OA is the crank and PA is the connecting rod.

In this mechanism, the straight line motion is not generated but it is merely copied.

In Fig, A is the middle point of Pq and OA= AP= AQ. The instantaneous centre for the link PA Q lies at Iin OA produced and is such that IPis perpendicular to OP. Join IQ.

Then Q moves along the perpendicular to IQ. Since OP IQ is a rectangle and IQis perpendicular to OQ, therefore Q moves along the vertical line Oqf or all positions of QP.

Hence Q traces the straight line OQ′. If OA makes one complete revolution, then P will oscillate along the line OP through a distance 2 OA on each side of O and Q will oscillate along OQ ′through the same distance 2 OA above and below O. Thus, the locus of Qis a copy of the locus of P



Approximate Straight Line Motion Mechanisms

The approximate straight line motion mechanisms are the modifications of the four-bar chain mechanisms. Following mechanisms to give approximate straight line motion, are important from the subject point of view :

1. Watt's mechanism.It is a crossed four bar chain mechanism and was used by Watt for his early steam engines to guide the piston rod in a cylinder to have an approximate straight line motion.

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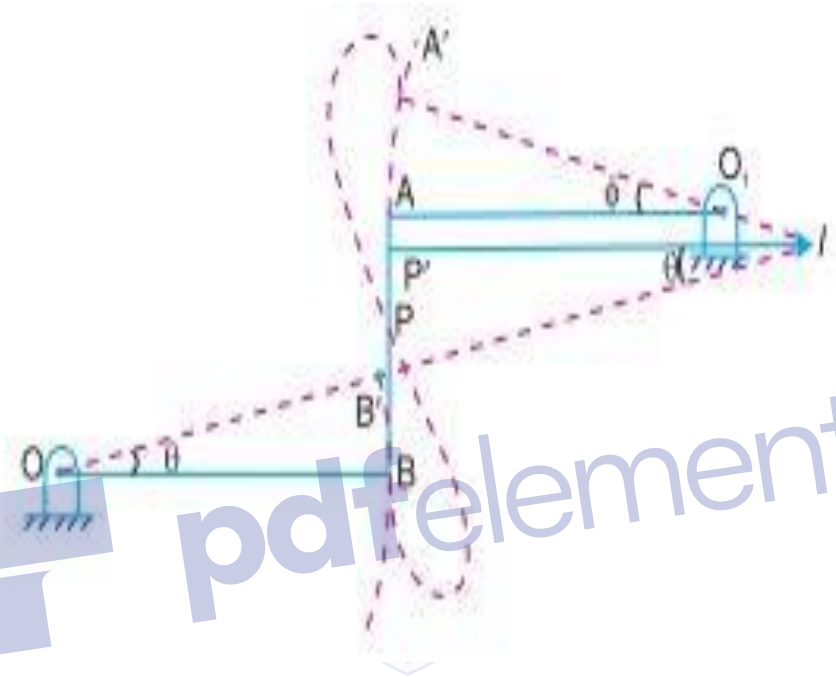

OBAO1

is a crossed four bar chain in which Oand O1 are fixed. In the mean position of the mechanism, links OBand O1 Aare parallel and the coupling rod ABis perpendicular to O1 Aand OB. The tracing point Ptraces out an approximate straight line over certain positions of its movement, if PB/PA= O1 A/OB. This may be proved as follows :