Mechanisms
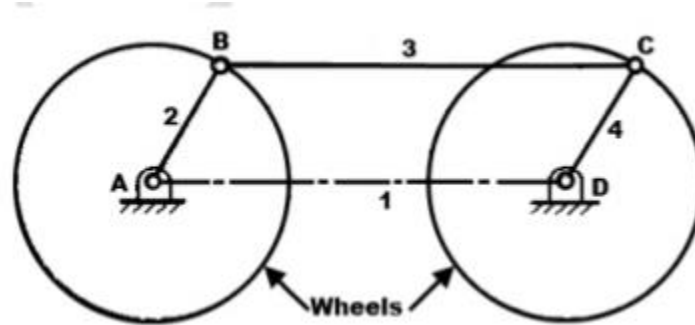
10) coupled wheels of locomotive mechanism.

Links -

link AD frame (Fixed)
link AB (Crank)
link BC (Coupling Rod)
link CD (Crank)

Pairs -
Turning Pair = AD (Frame) & AB (Crank)
Turning Pair = AD (Frame) & CD (Crank)
Turning Pair = AB (Crank) & BC (Connecting Rod)
Turning Pair = CD (Crank) & BC (Connecting Rod)

Construction: This mechanism is an inversion four bar kinematic chain . This has four turning pairs.
It is consists of frame AD which is fixed, on which two cranks AC & BD are fitted on it .The cranks are free to rotate about points A and D. Both the cranks have same lengths. Two cranks are connected to each other by means of coupling rod, which connects the other ends B and C of both cranks. At the connections B and C there is turning pair.

Working –

When link AB starts rotating about fixed point A. The rotary motion of wheel is transmitted to next wheel by means of coupling rod BC. As a result the other wheel also starts rotating in same direction and same speed, because both cranks have same radius of rotation.

Application –

The mechanism is used to connect driving & driven shaft of locomotive. Here both driving & driven wheels always rotate in same direction.

11) **Beam engine**

Beam engine mechanism.
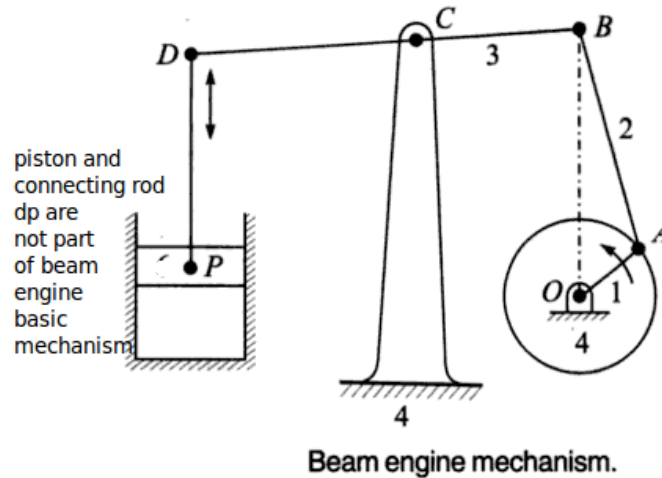
links -
Link 4 OC (frame)
Link 1 OA (Crank)
Link 2 AB (connecting Rod)
Link 3 BCD (lever)

Pairs -
Turning Pair = Frame OC & Crank OA Turning
Pair = Crank OA & Connecting Rod AB Turning
Pair = Connecting Rod AB & lever BCD Turning
Pair = Frame OC & lever BCD

Construction –
This mechanism is an inversion of four bar chain . It has four turning pair. It consists of frame OC which is fixed and on which all other elements are fitted. The Crank is fixed at pt. 'O' at frame. The crank is free rotates about pt.'O' . Other end of crank is connected to connectin rod AB. Other end of connecting rod AB is linked to one end of lever. The lever is pivoted at pt 'C' other end of lever 'D' is attached to piston -cylinder mechanism as shown.

Working –As the crank starts rotating this motion is transmitted to lever by connection rod. As crank continues to rotate the lever starts to oscillate about pt. 'C', this oscillatory motion is transmitted to piston & cylinder.

Application – The mechanism converts rotary motion to reciprocating motion. This is used in machine tools & pumps. It is used for extracting oil from oil wells; the equipment is called Pump-jack.

12) **Pantograph**
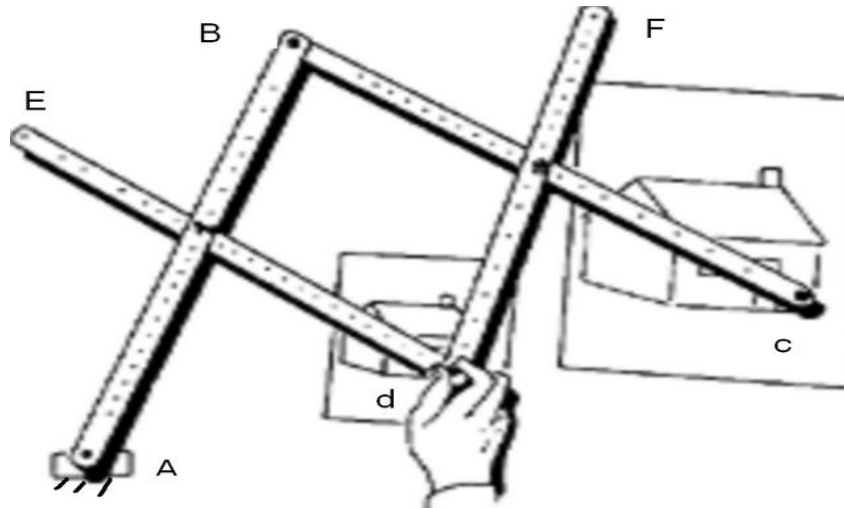
Links
Link AB - End A is fixed
link BC
link DE
link DF

Pairs -
Turning Pair - AB & BC
Turning Pair – AB & DE
Turning Pair – BC & DF
Turning Pair – ED & DF

Construction –
This mechanism is an inversion of four bar chain . It has four turning pairs. One link is fixed to the table. The stylus is attached to the junction of link DE and DF and the pen is attached to the end C of the link BC. The lengths of all links are adjustable through the holes provided on the links.

Working –
As the operator traces the "Drawing" with the stylus, the same drawing is reproduced by the pen either in enlarged or reduced scale depending upon the links lengths. The links have holes for the adjustment of magnitude of enlargement or reduction.

Application – The mechanism is used for:
1. Reducing large drawing.

2.Used in copy machining such as copying lathe using hydraulic system.3.Used in electric train supply system on top of train, which supplies current to electric train from cables on top.

14) Oscillating Cylinder Mechanism.
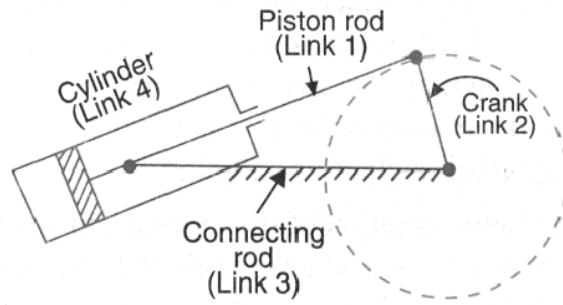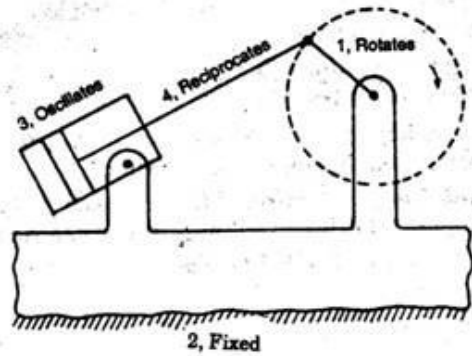
links -
Connecting rod (link 3) – Fixed Crank
(Link 2)
Piston and rod (link 1)
Cylinder (link 4)

Pairs -
Turning – Crank and Connecting rod
Turning – Crank & piston rod
Sliding – Piston rod & Cylinder.
Turning – Cylinder and connecting rod

Construction –
This mechanism is an inversion of Single slider crank chain , which is obtained by fixing connecting rod. It has three turning pairs & one Sliding pair. As shown in figure. both rod & piston form one link . There is no relative motion between rod & Piston . The cylinder is pivoted to frame, due to which whole cylinder is free to oscillate about the frame.

Working –

When crank starts rotating, it causes the piston to reciprocate inside the cylinder. A piston while reciprocating causes the cylinder oscillate about pt.'O' ,because there is no relative motion between connecting rod and piston.

Application –
The mechanism is used where rotary transmitted into oscillating motion. It is used in printing press m/c.

15) **Bull engine mechanism {Pendulum Pump}**
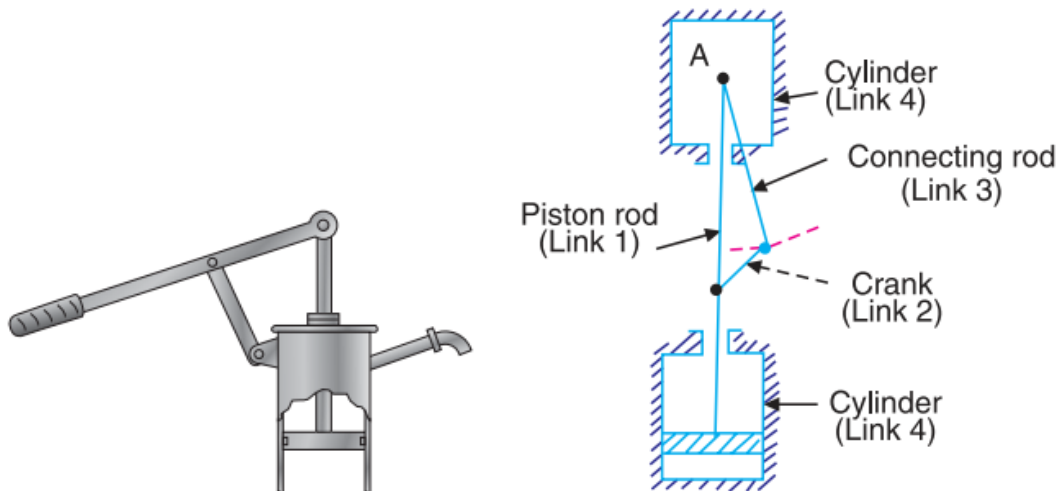
Links –
Crank
Cylinder
Piston & Piston Rod
Connecting Rod.

Pairs-
Turning – Piston & Piston Rod & Connecting Rod
Turning – Connected Rod & Crank
Sliding – Piston - Piston Rod & Cylinder.
Turning – Crank & Cylinder.

Construction –
This mechanism is an inversion of Single slider crank chain it is obtained by fixing the slider of the basic chain .It has three turning pairs & one Sliding pair. As shown in figure the first link is piston and piston rod, second is connecting rod which is extended beyond its connection to crank. the third link is crank and fourth link is cylinder which is placed vertically and is fixed.
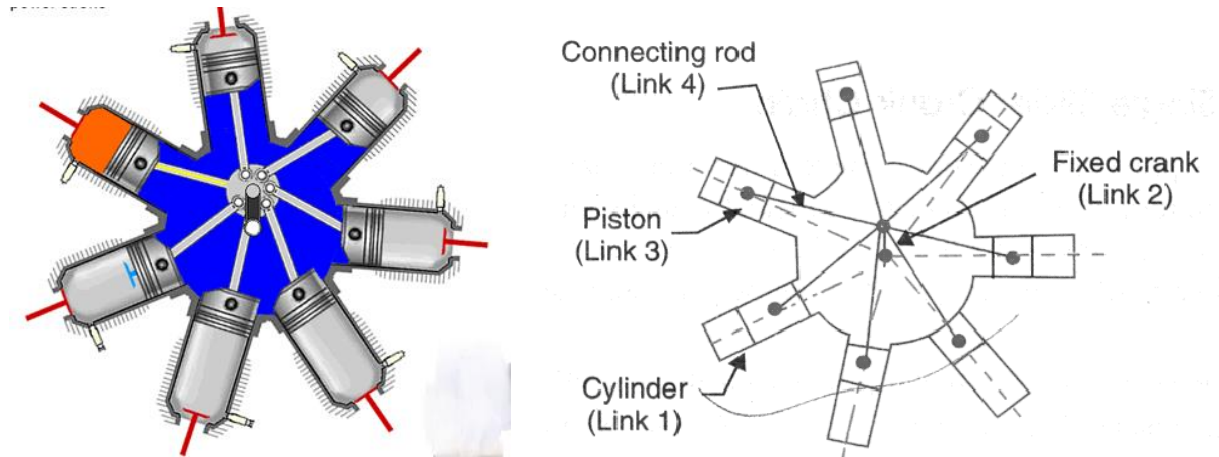
Working –
When the upward motion is given to connected Rod it causes downward motion of piston & vice versa.

Application –

The mechanism is used in duplex pump in boilers, and also in manual hand pumps fitted on bore well.

16) Gnome Engine or Rotary Engine

Links -
1.Crank (fixed)
2.Piston
3.Connecting Rod
4.Cylinder & Frame

Pairs-

Crank & Connecting Rod – turning
Connected Rod & Frame – turning
Crank & Frame – turning
Piston & cylinder - Sliding

Construction –

This mechanism is an inversion of Single slider crank chain, obtained by fixing the crank .It has three turning pairs & one Sliding pair.As shown in diagram it has 5 or 7 cylinders and connecting rods of all pistons are connected to one point which is another end of crank. In this mechanism crank itself is fixed.

Working –

As pistons start reciprocating inside cylinders, whole frame starts rotating about fixed pt 'O' the crank remains at its place. The rotation of frame causes suction, comp,expansion & exhaust strokes in different cylinders at same time.

Application –
It was used in airplane engines in past, now a days it is not used.

17) Crank and Slotted lever quick mechanism used in shaping machine.
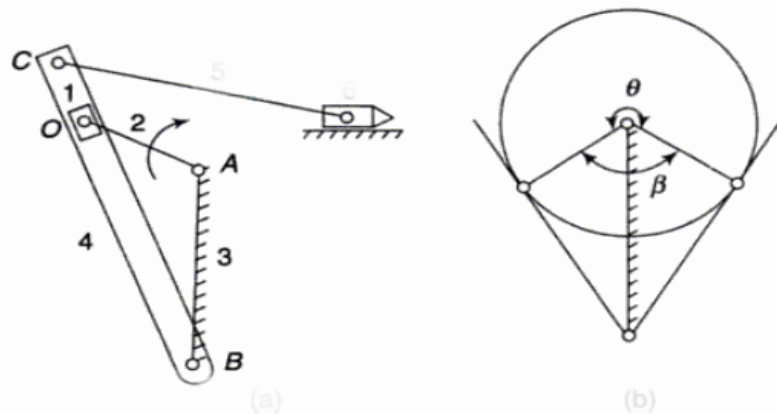
Links -
1.Slider
2. Crank
3.Frame
4.Slotted Lever

Pairs-
Frame & Slotted lever – turning
Frame & Crank – turning
Crank & Slider – turning
Slider & Slotted lever - Sliding

Construction –
This mechanism is inversion of Single slider crank chain, which is obtained by fixing connecting rod of basic chain. It has three turning pair & one Sliding pair.
Crank is fitted to frame at pt. 'A' & slotted lever is fitted to frame at pt.'B'. The crank & slotted lever are connected to each other through slider. The slider is free to slide in side slotted lever. The upper end of slotted lever is attached to the ram of shaping machine through a linkage {The ram and lever connecting to ram are not part of the basic inversion}

Working –
As the crank starts rotating about pt.'A', it also transmits motion to slider. As the slider is fitted

inside the slotted lever, the slotted lever starts oscillating about pt.'B'.
As shown in second fig. The forward stroke is making an angle of θ, whereas the return stroke covers and angle of β. From the figure it is clear that angle θ > β, hence forward stroke is takes more time than return stroke . Hence this mechanism is called as quick Return mechanism.

Application –
The mechanism is used in shaping machine.

18) Whitworth's quick return Mechanism?
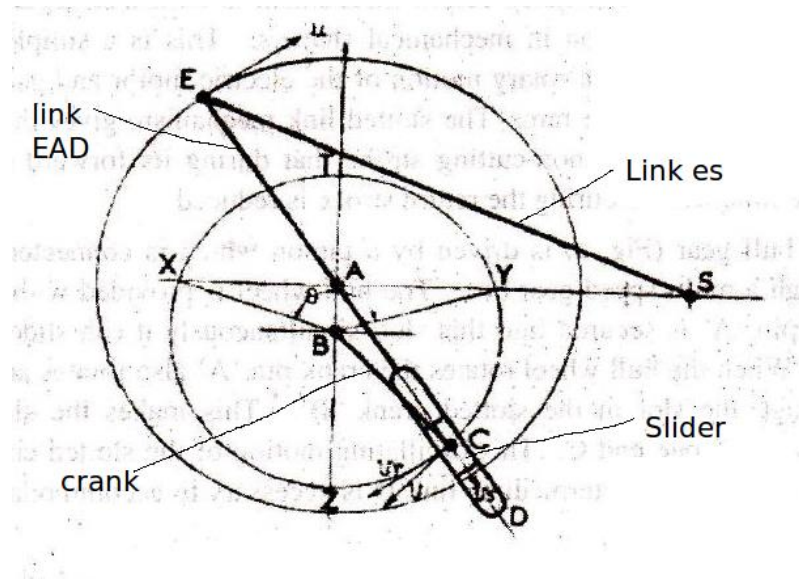
Links: Crank BC
Slotted lever EAD
Slider
Frame AB (FIXED)
{Link Es is not part of basic mechanism}

Pairs: Crank BC and frame AB : Turning Pair
Slotted lever EAD and frame AB : Turning Pair
Crank Bc and slider : Turning Pair
Slider and Slotted lever EAD : Sliding pair

Construction : This mechanism is an inversion of single slider crank chain, obtained by fixing the crank of the connecting rod. It has three turning pairs and one sliding pair.

It has crank BC turning about point B. Other end of crank carries a slider, connected with turning pair. The slide fits inside the slotted lever EAD. The slider is free to slide inside the slotted lever. The lever is pivoted at point A. The lever rotates about the point A. End E of this lever is connected to the Ram of the shaper machine.

Working: As the crank starts rotating about the point B. It transmits the motion to the Lever EAD through the slider . As a result the lever EAD starts rotating about the point A. As shown in figure the forward stroke of the ram is slower and return stroke is faster (Angle theta is greater than angle beta). Hence this mechanism is called quick return mechanism.

Application : This mechanism is used in Shaping machine.

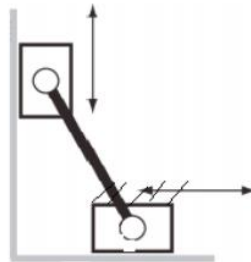## 19) Basic double slider crank chain and how different inversions are obtained from it?
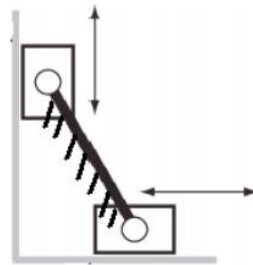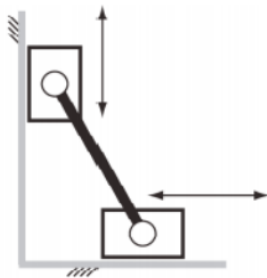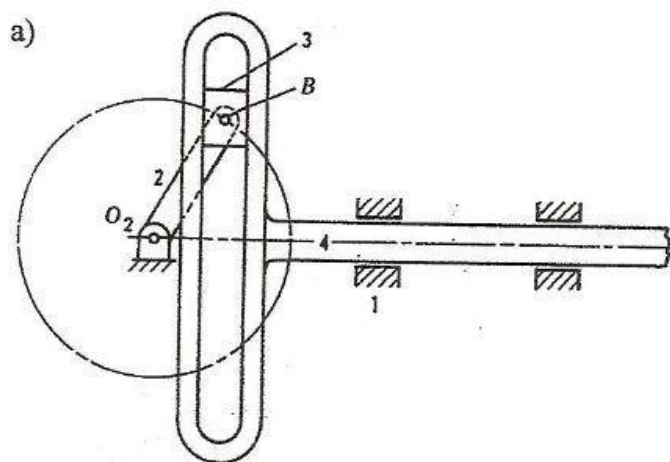

Crank Fixed
Oldhams
Coupling
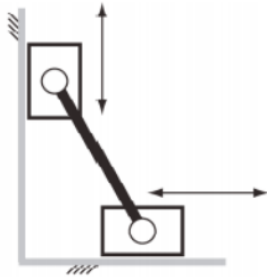
Frame Fixed
Elliptical
Trammel

One Slider
Fixed
Scotch Yoe
mechanism

20) Scotch Yoke Mechanism?

a)

b)

Links: 1.Frame (fixed)
2.Crank
3.Slider
4. Yoke

Pairs -
1.Frame & Crank – turning
2.Crank & Slider – turning
3.Yoke & Slider – Sliding
4.Frame & Yoke - Sliding

Construction –
This mechanism is inversion of Single slider Crank Chain .It has two turning pair & two Sliding pair.
As shown in fig. The crank is fitted to frame at pt 'O' .A slider is attack to other end of crank at pt 'B'. The slider fits inside Yoke. A Yoke is free to slide inside frame.
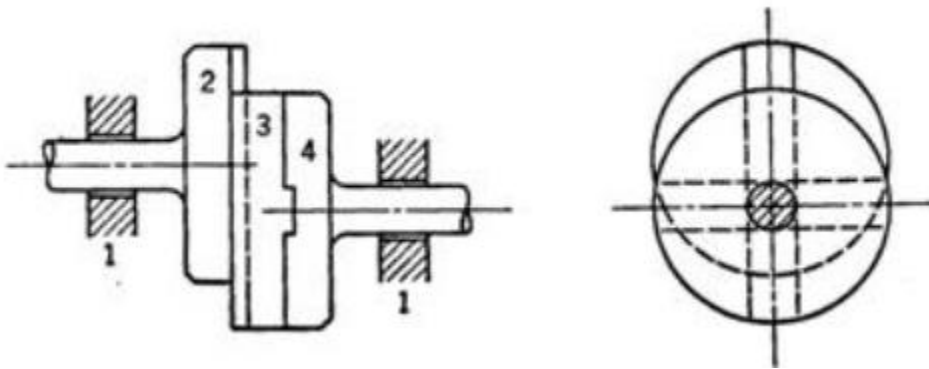
Working –
As the crank starts rotating about pt.'O' it causes the slider to slide inside Yoke. As the crank changes it's position it pulls or pushes the Yoke . Thus Rotary motion of crank is converted into Reciprocating motion of Yoke.

Application –
This mechanism is used to convert Rotary motion into reciprocating motion.

21) sketch Oldham's Coupling

Links:
  Frame (fixed) :1
Shaft & Flange on left hand :2
Shaft & Flange on right hand :4
Intermediate piece : 3

 Pairs:
  Frame & Shaft LH – turning pair
Frame & Shaft RH – turning pair
Flange LH & Intermediate piece – Sliding pair
Flange RH & Intermediate piece - Sliding pair

 Construction : This mechanism is inversion of Double slider Crank Chain .It has two turning & two Sliding pair.
Two flanges with respective shafts are free to rotates with respect to frame both flanges have rectangular slots . An intermediate piece has two rectangular projections on both sides, both projections are perpendicular to each other , each projection fits inside the slot of flange.

Working: When one shaft is given rotary motion, it is transmitted to another shaft the intermediate piece. The intermediate piece slides & adjusts itself, to keep both shafts running.

The center of the intermediate piece traces the path of a circle with radius equal to offset between shafts.

Application : This coupling is used to connect two shaft having some eccentricity (offset).

22) Elliptical Trammel Mechanism?
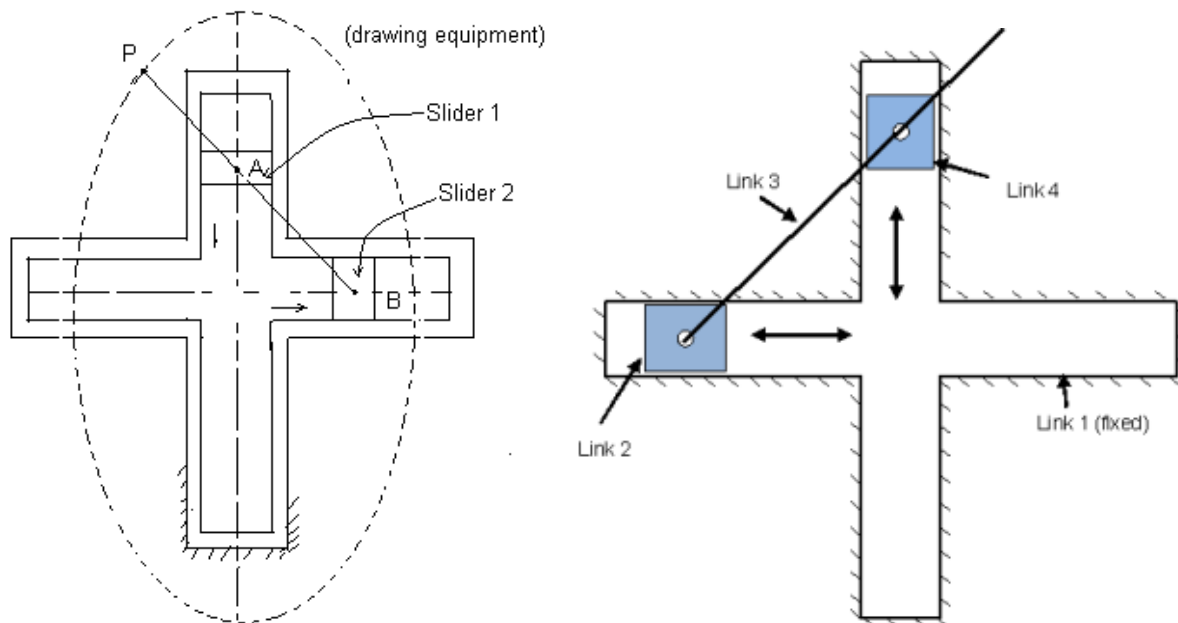
Links:
1. Frame
2.PB
3.Slider 1
4.Slider 2

Pairs: 1.Slider 1 & Frame – Sliding
2. Slider 2 & Frame – Sliding
3.Slider 1 & link PB – turning
4.Slider 2 & link PB - turning

Construction : This mechanism is an inversion of Double slider crank Chain .It has two sliding & two turning pairs. As shown in figure it has rectangular frame with vertical and horizontal slots. Two sliders are free to slide inside both slots. A link PB connects two sliders.

Working: When one of the slider is given reciprocating motion it is transmitted to another slider through the link PB . It is observed that while the two sliders slide into respective slots the pt.'P' traces the path of an ellipse. The major axis and minor axis of the ellipse can be changed by changing the point which traces the path of an ellipse.

Application : This mechanism is used for drawing ellipse of required size..