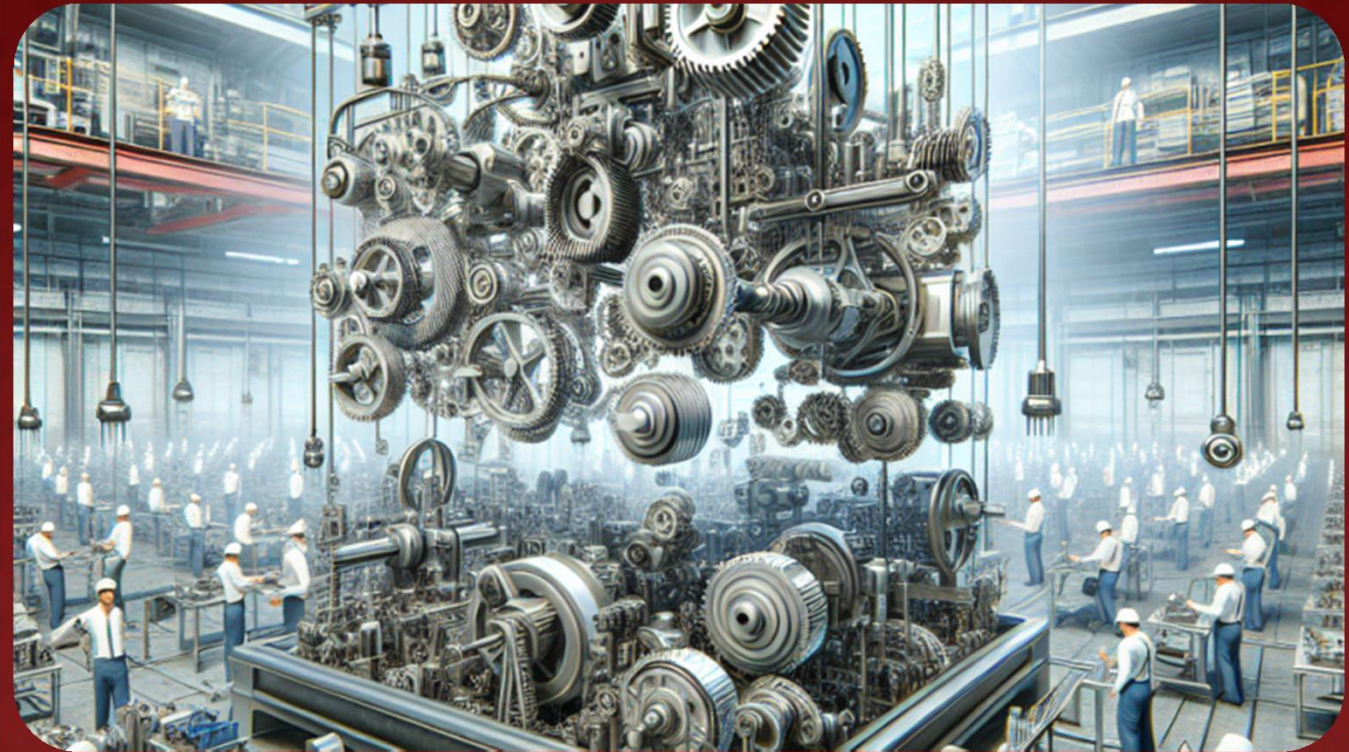23MET204
MECHANICS OF MACHINES

GRASHOFF'S LAW & INVERSION OF FOUR BAR MECHANISMS

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AP/MECH

RECAP !!!

GRASHOFF'S LAW

✓ **Grashoff 4-bar linkage:**

A linkage that contains one or more links capable of undergoing a full rotation. A linkage is Grashoff if:

$$S + L < P + Q$$

(where: S = shortest link length, L = longest, P, Q = intermediate length links).

Both joints of the shortest link are capable of 360 degrees of rotation in a Grashoff linkages. This gives us 4 possible linkages:

❖Crank-Rocker (input rotates 360),

❖Rocker-Crank-rocker (coupler rotates 360),

❖Rocker-Crank (follower),

❖Double Crank (all links rotate 360).

✓ **Non Grashoff 4 bar:** No link can rotate 360 if: $S + L > P + Q$

INVERSION OF FOUR BAR MECHANISMS

Four bar Chain – The chain has four links and it looks like a cycle frame and hence it is also called quadric cycle chain. It is shown in the figure. In this type of chain all four pairs will be turning pairs.

Inversions - By fixing each link at a time we get as many mechanisms as the number of links, then each mechanism is called „Inversion" of the original Kinematic Chain.
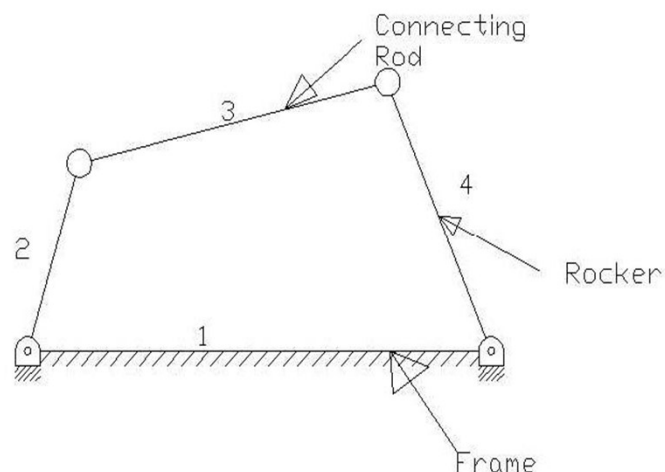
INVERSION OF FOUR BAR MECHANISMS

Inversions of four bar chain mechanism:

There are three inversions:

❖ Beam Engine or Crank and lever mechanism.

❖ Coupling rod of locomotive or double crank mechanism.

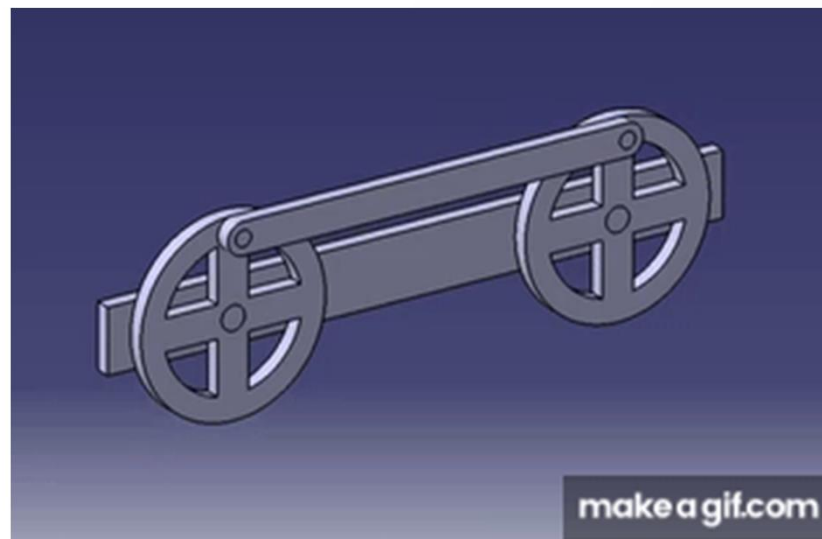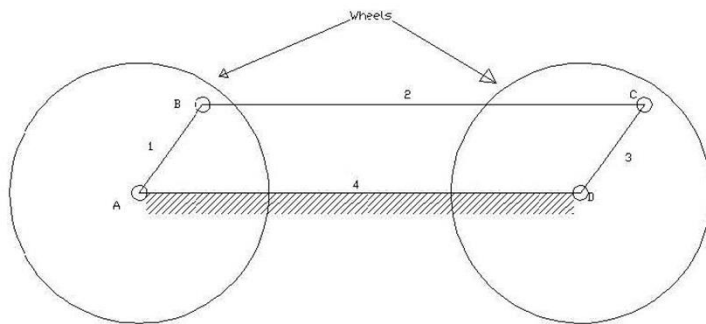❖ Watt's straight line mechanism or double lever mechanism.

BEAM ENGINE OR CRANK AND LEVER MECHANISM

When the crank AB rotates about A, the link CE pivoted at D makes vertical reciprocating motion at end E. This is used to convert rotary motion to reciprocating motion and vice versa. It is also known as Crank and lever mechanism.
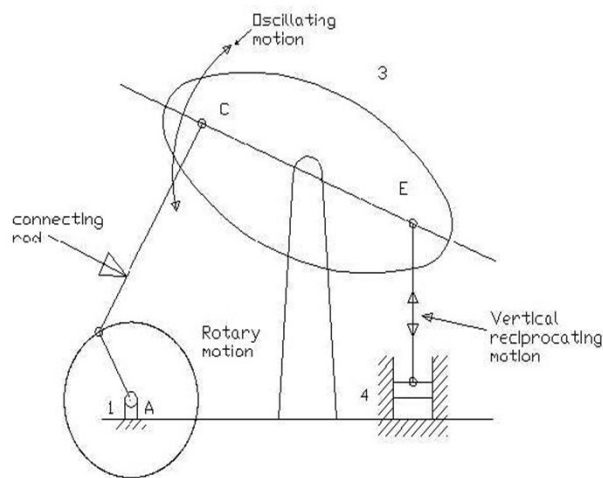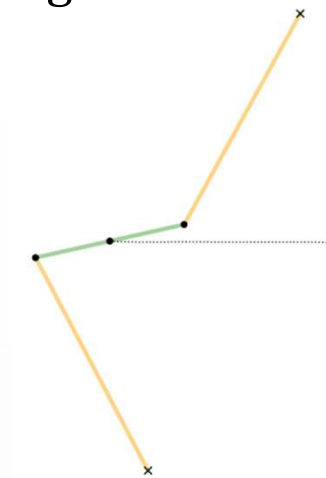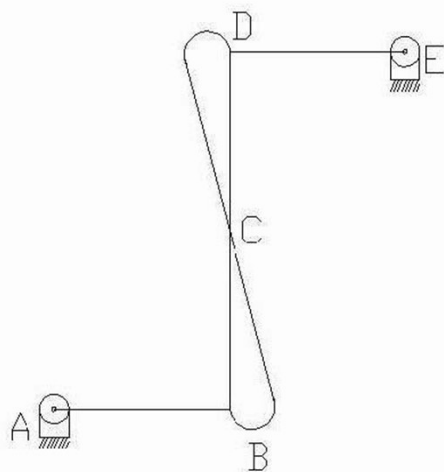
COUPLING ROD OF LOCOMOTIVE OR DOUBLE CRANK MECHANISM

In this mechanism the length of link AD = length of link C. Also length of link AB = length of link CD. When AB rotates about A, the crank DC rotates about D. this mechanism is used for coupling locomotive wheels. Since links AB and CD work as cranks, this mechanism is also known as double crank mechanism.

WATT'S STRAIGHT LINE MECHANISM OR DOUBLE LEVER MECHANISM

In this mechanism, the links AB & DE act as levers at the ends A & E of these levers are fixed. The AB & DE are parallel in the mean position of the mechanism and coupling rod BD is perpendicular to the levers AB & DE. On any small displacement of the mechanism the tracing point „C" traces the shape of number „8", a portion of which will be approximately straight. Hence this is also an example for the approximate straight line mechanism

ASSESSMENT !!!