Theory Of Machine

FUNDAMENTALS & TYPES OF MECHANISM

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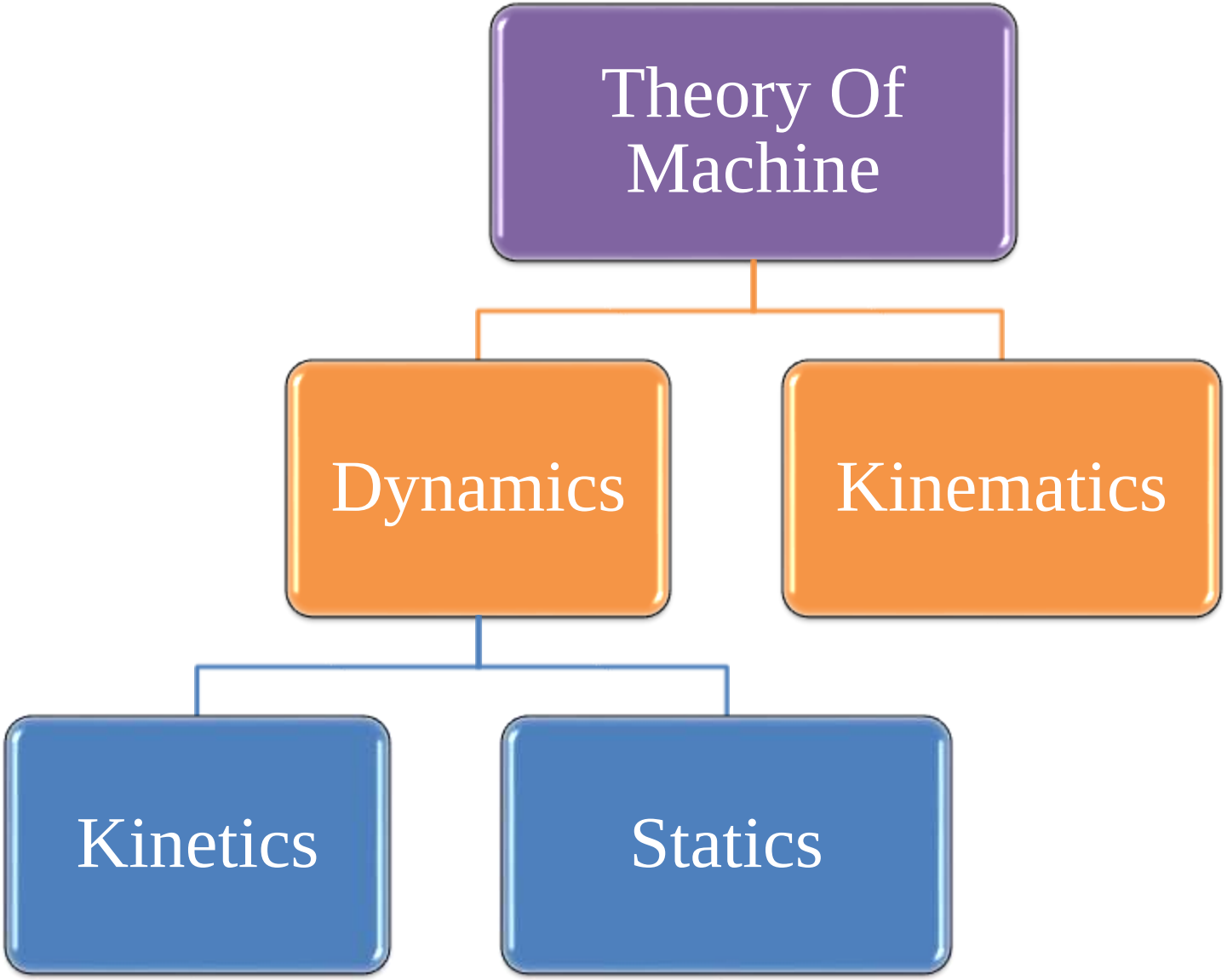

Theory Of Machine
Dynamics
Kinematics
Kinetics
Statics

Theory Of Machine

- The Machine receives energy in some available form and uses it to do some particular type of work

STATICS

- It deals with the study the forces acting on machine in rest.

DYNAMICS

- It deals with the study the forces acting on various parts of a machine

KINEMATICS

- It is the study of motion, quite apart from the forces which produce that motion.
- It is the study of position, displacement, rotation, speed, velocity and acceleration.

KINETICS

- It is the study of inertia force which arries due to combined effect

STRUCTURE

- It is defined as the combination of rigid or resistance bodies assembled they having no relative motion in between them and transmit only forces

MECHANISM

- An assembly of moving parts performing a complete functional motion.
- A **mechanism** is a device designed to transform input forces and movement into a desired set of output forces and movement.
- Mechanisms generally consist of moving components such as gears and gear trains, belt and chain drives, cam and follower mechanisms, and linkages as well as friction devices such as brakes and clutches, and structural components such as the frame, fasteners, bearings, springs, lubricants and seals, as well as a variety of specialized machine elements such as splines, pins and keys.

MACHINE

- It is defined as a device which receives energy and transforms it into some useful work.
- If the mechanism is used to transmit power (or) to do work, then it is known as machine.
- We can define machine as a device for transferring and transforming motion and force or power from the input that is, the source to the output that is the load

KINEMATIC LINK

- It is a resistant body or assembly of resistant body of a machine connecting other parts of the machine with relative motion between them.
- There are three types of links available in order to transmit motion. They are as follows:
  - » Rigid link
  - » Flexible link
  - » Fluid link

TYPES KINEMATIC LINK

Rigid link

A rigid link is one which does not undergo any deformation while transmitting motion. Practically rigid link does not exists. Ex : crank shaft, piston etc.,

Flexible link

A flexible link is one which undergoes partial deformation without affecting the transfer motion. Ex : ropes, belts, chains, springs etc.,

Fluid link

A fluid link is a link which has fluid inside the container and motion is transmitted through the fluid by pressure or compression. Ex: fluids used in hydraulic press, hydraulic jack, hydraulic crane etc.,

KINEMATIC PAIR

- A joint of two links that permits relative motion is called pair.

Types of kinematic pair

1. Nature of relative motion between the links.
2. Nature of contact between the links.
3. Nature of mechanical arrangement.

TYPES OF KINEMATIC PAIR

Nature of relative motion

- » Sliding pair
- » Turning pair
- » Cylindrical pair
- » Rolling pair
- » Spherical pair
- » Helical pair

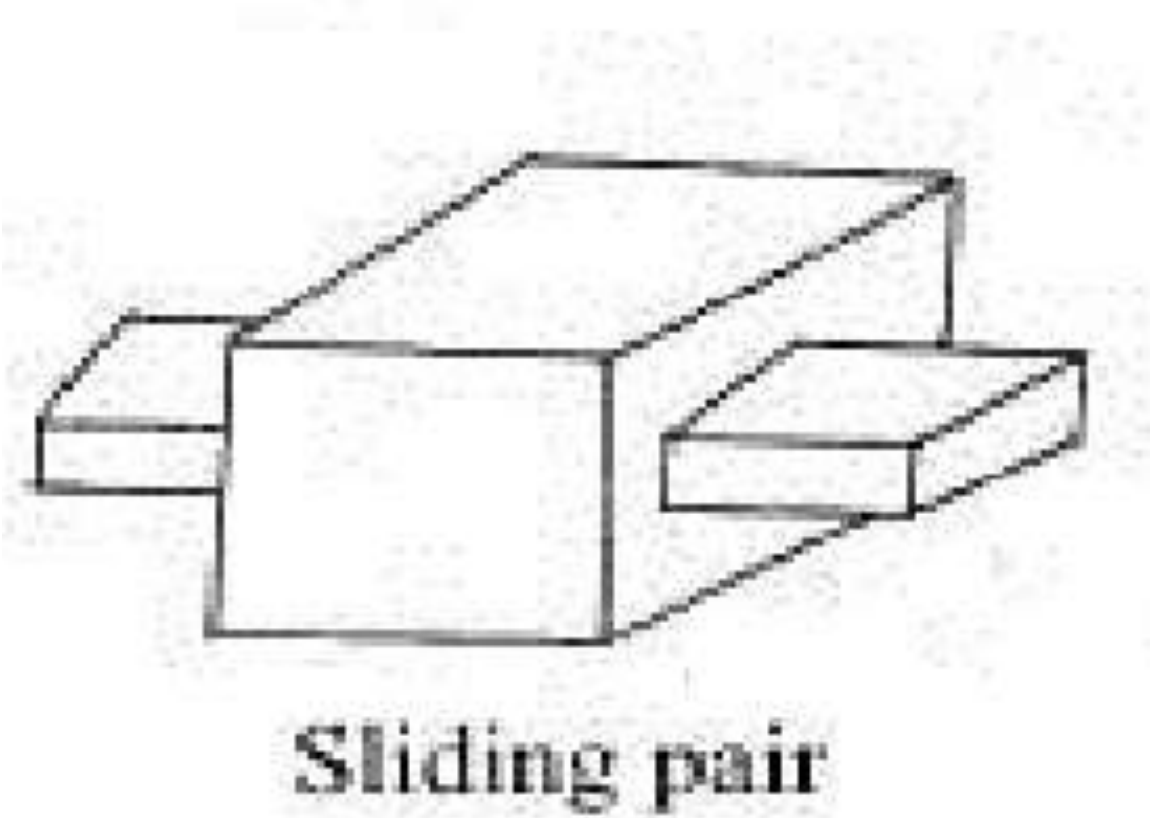
Nature of contact

- » Lower pair
- » Higher pair

Nature of mechanical constraint

- » Closed pair
- » Unclosed pair

Sliding pair



Sliding pair

Turning pair

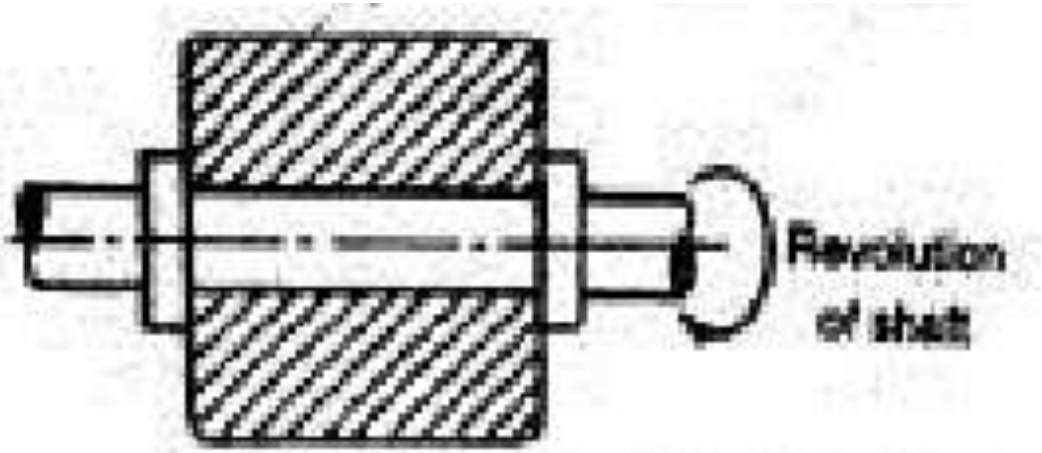
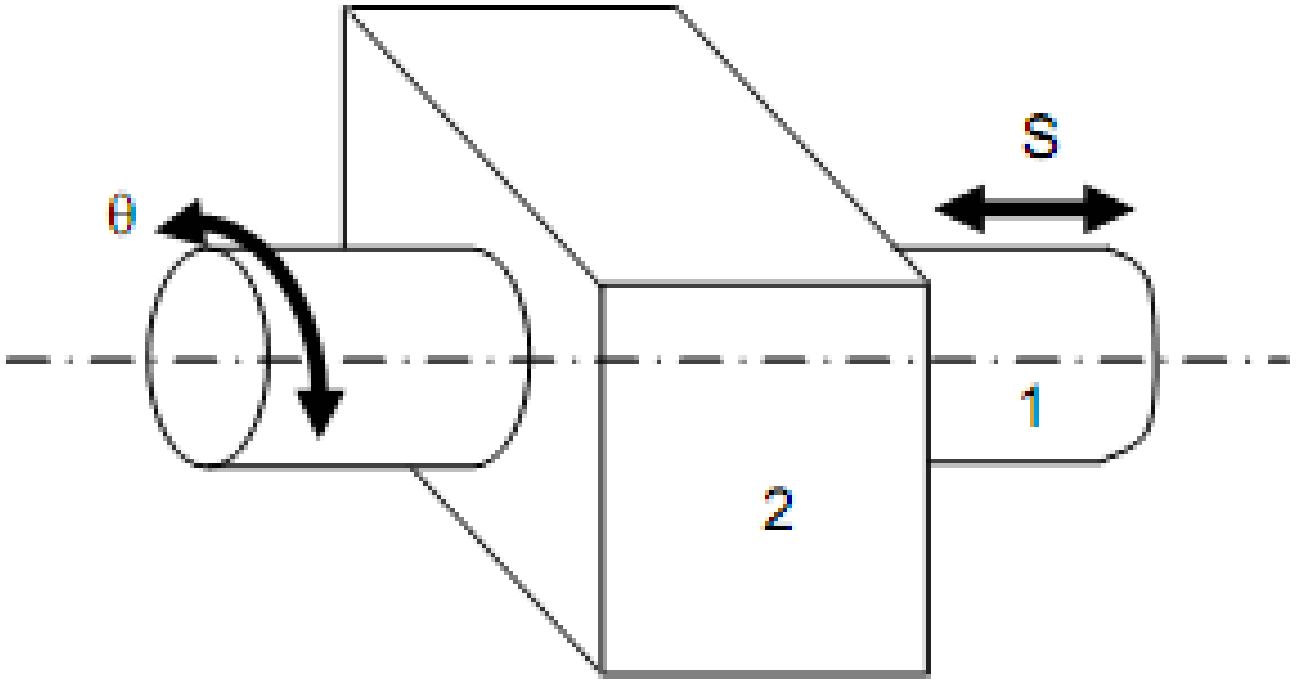
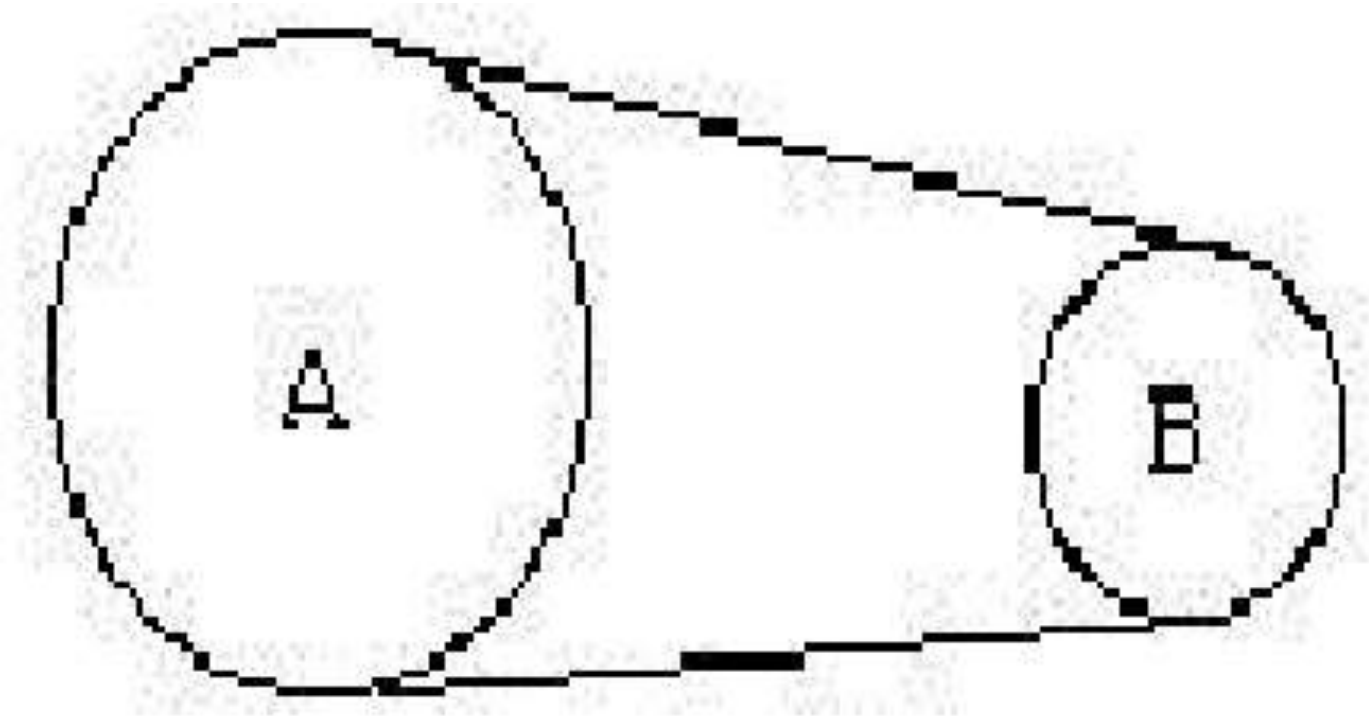


Fig- Turning pair

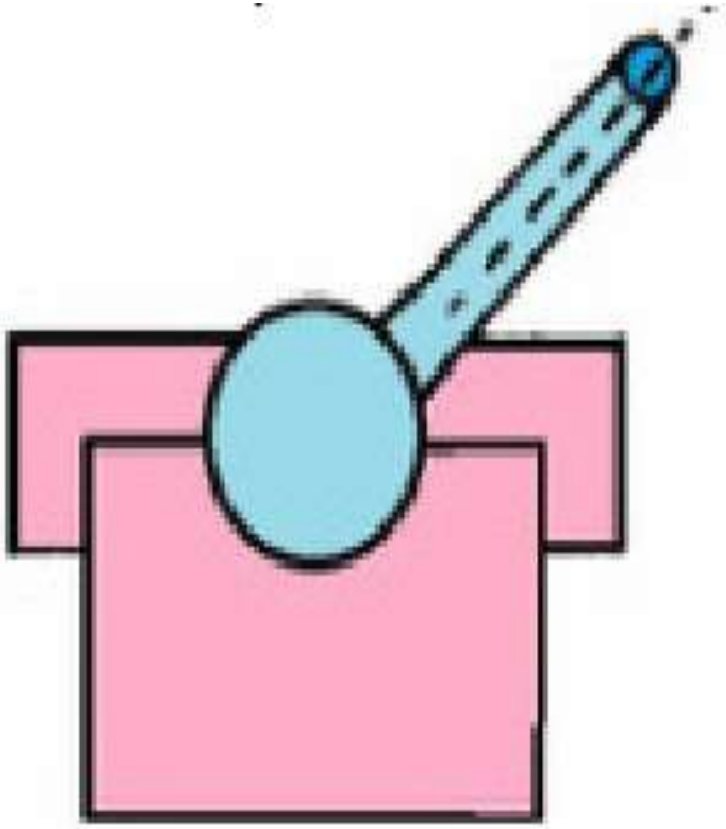
Cylindrical pair

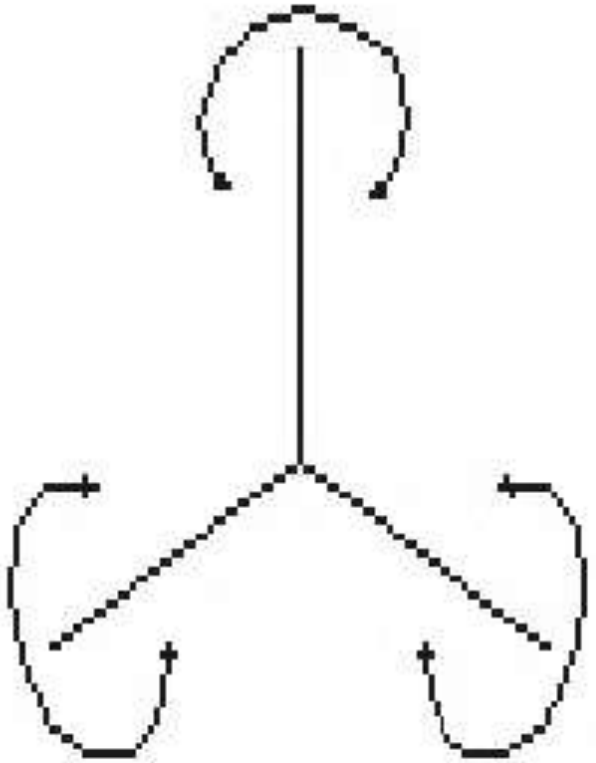


Rolling pair

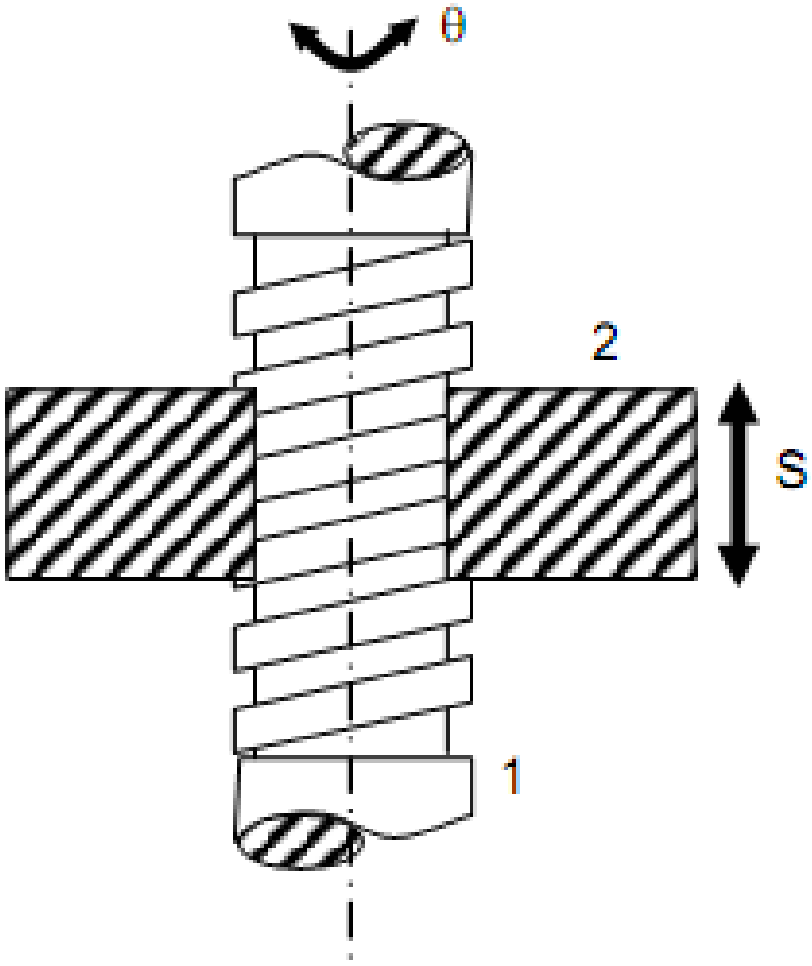


Spherical pair

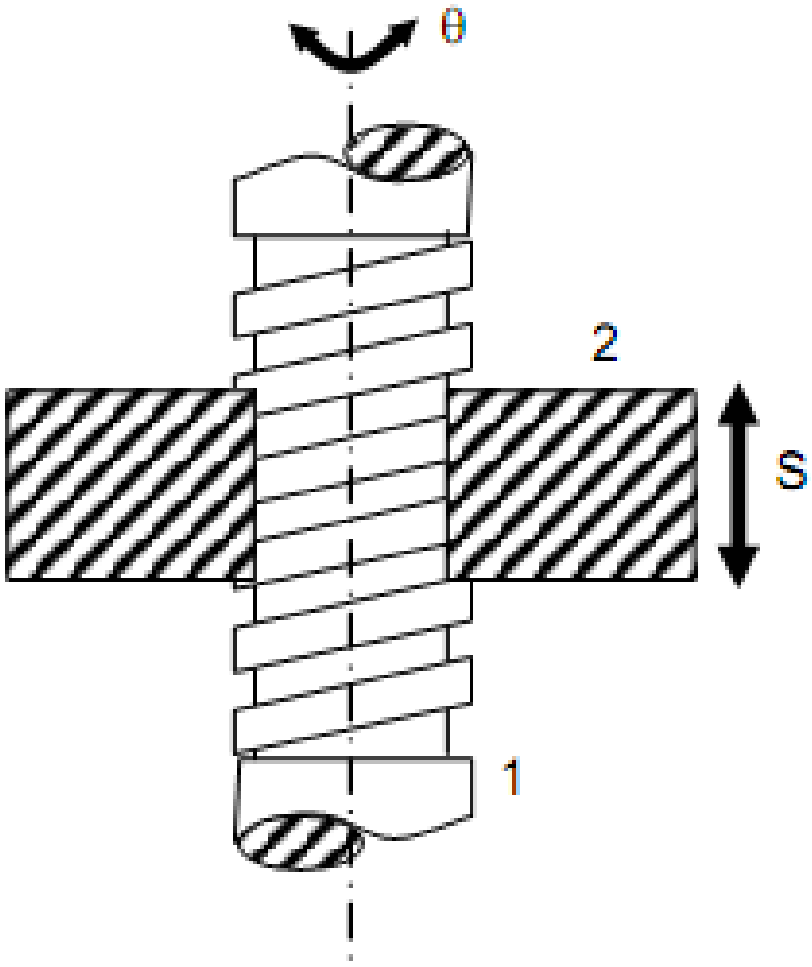




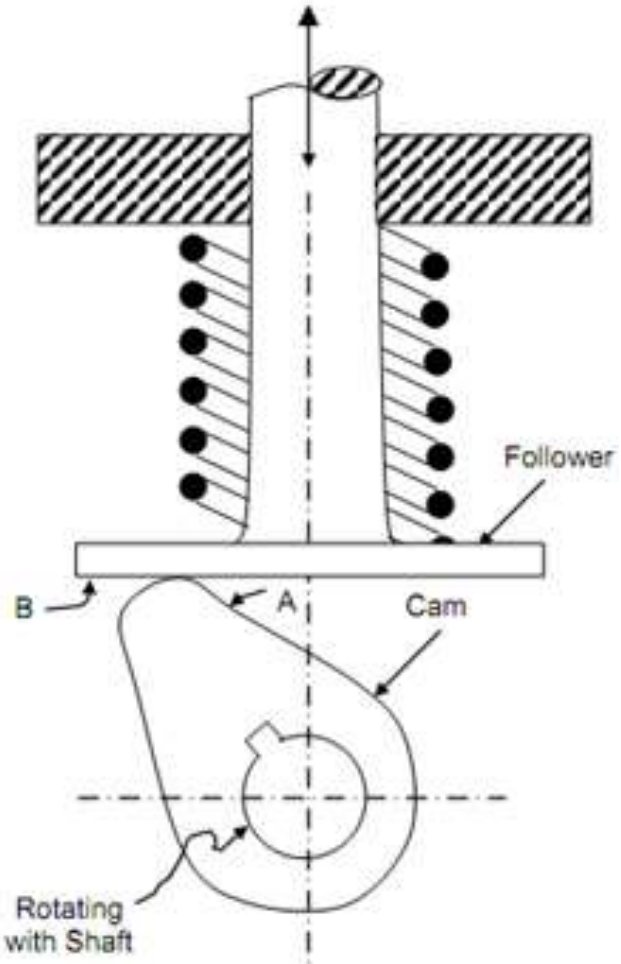
Helical pair or screw pair



Lower pair



Higher pair



NATURE OF CONTACT

Closed pair

- When two elements of a pair are held together mechanically, they constitute a closed pair.

  Ex : All pair

Un closed pair

- When two elements of a pair are not held together mechanically, they constitute a unclosed pair.

  Ex : cam and follower

KINEMATIC CHAIN

- If the last link is joined to first link to transmit definite motion, then it is known as kinematic chain.
- To determine the given assemblage of links form the kinematic chain or not:
  - The two equations are:

$$l = 2p - 4$$

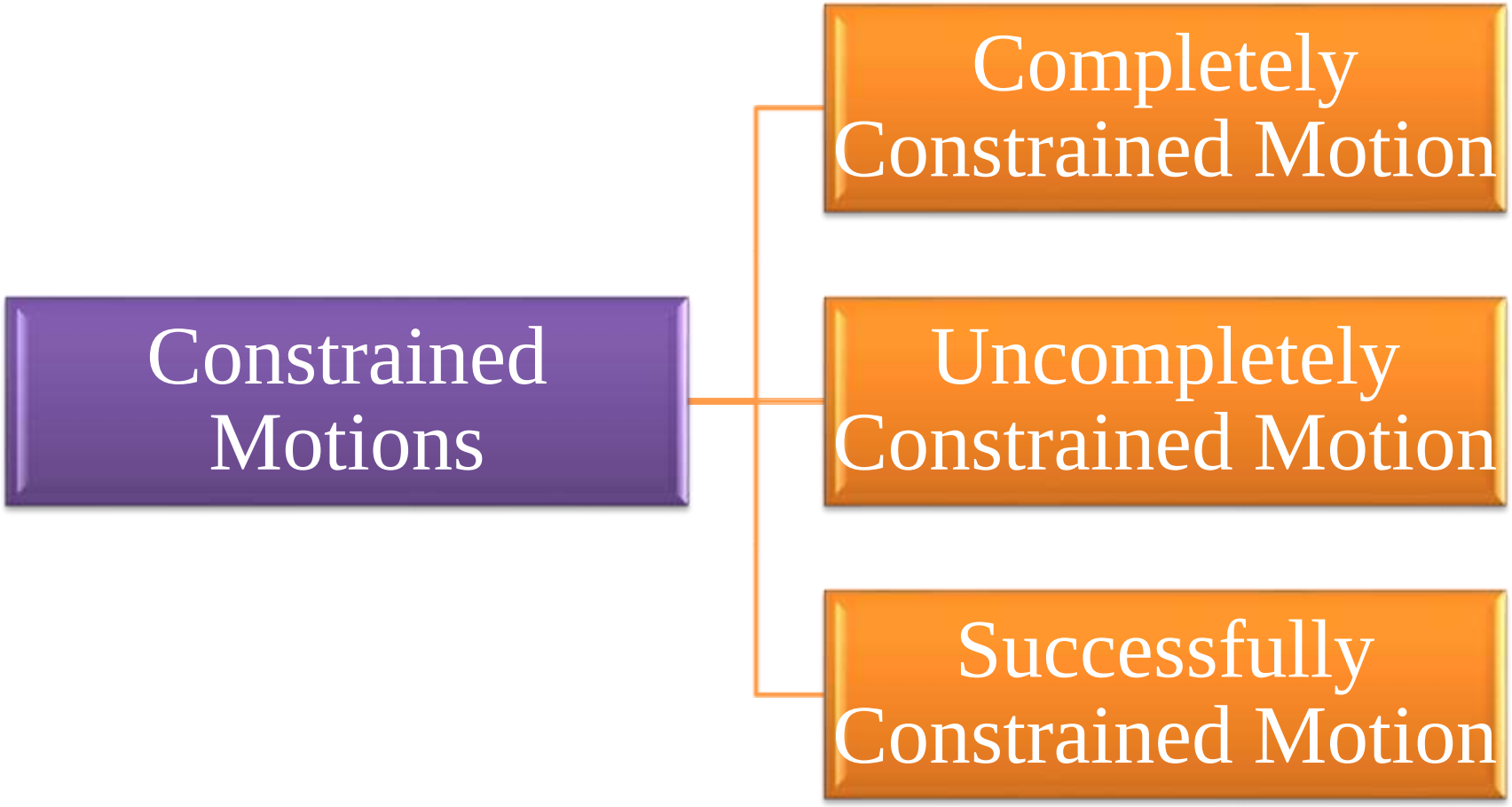
$$j = (3/2) * l - 2$$

Where, l = number of links

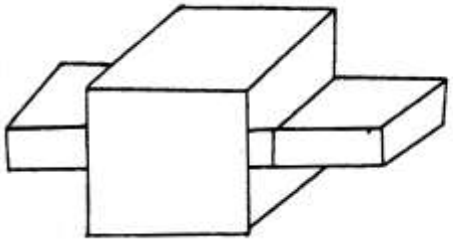
p = number of pairs

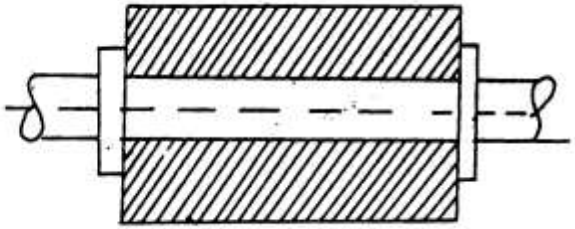
j = number of joints

CONSTRAINED MOTIONS



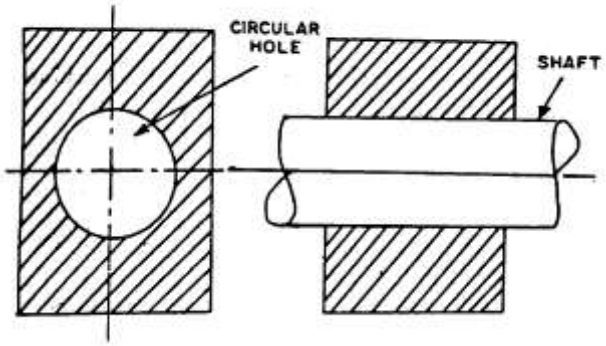
- Completely Constrained Motion

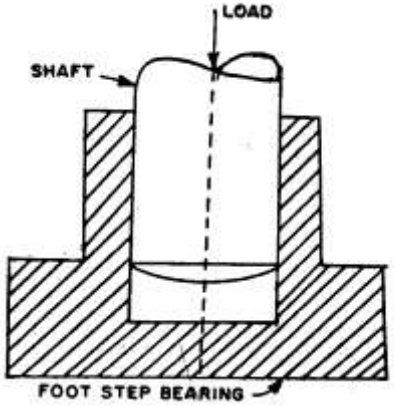




- Successfully Constrained Pair

Unconstrained Pair

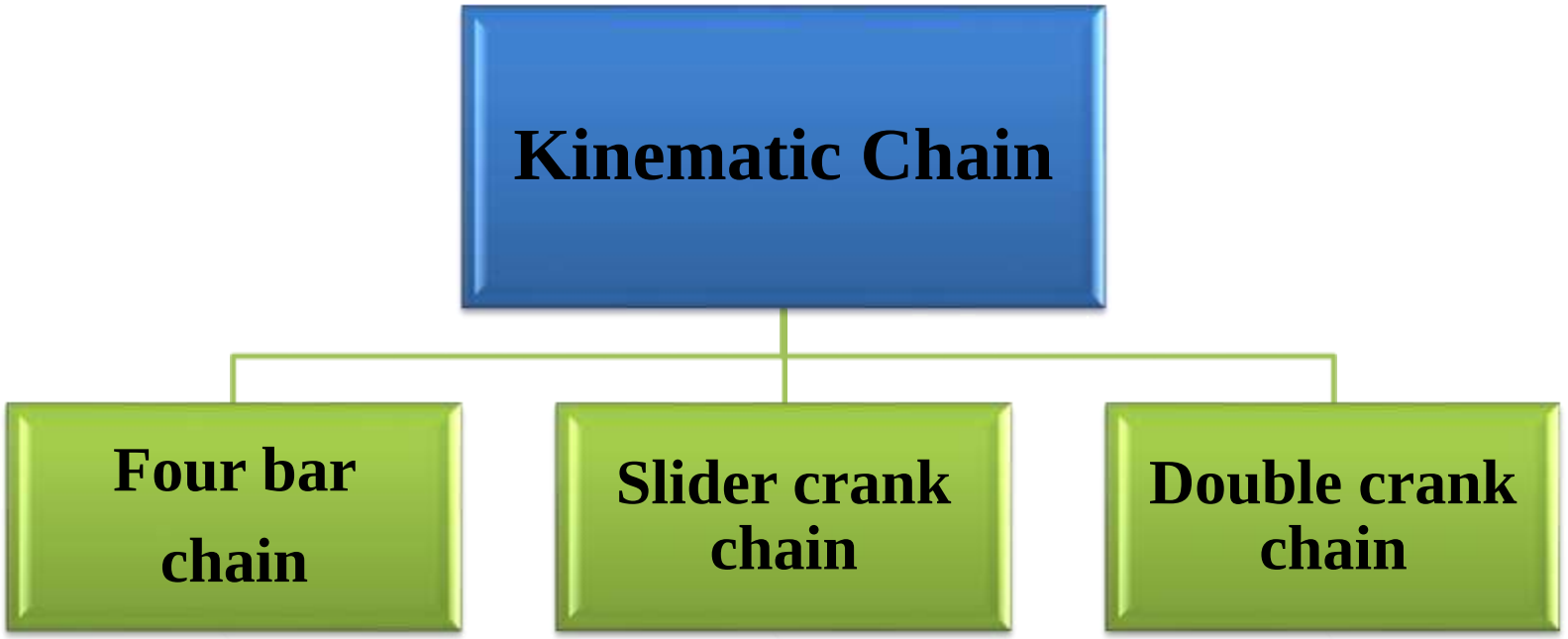




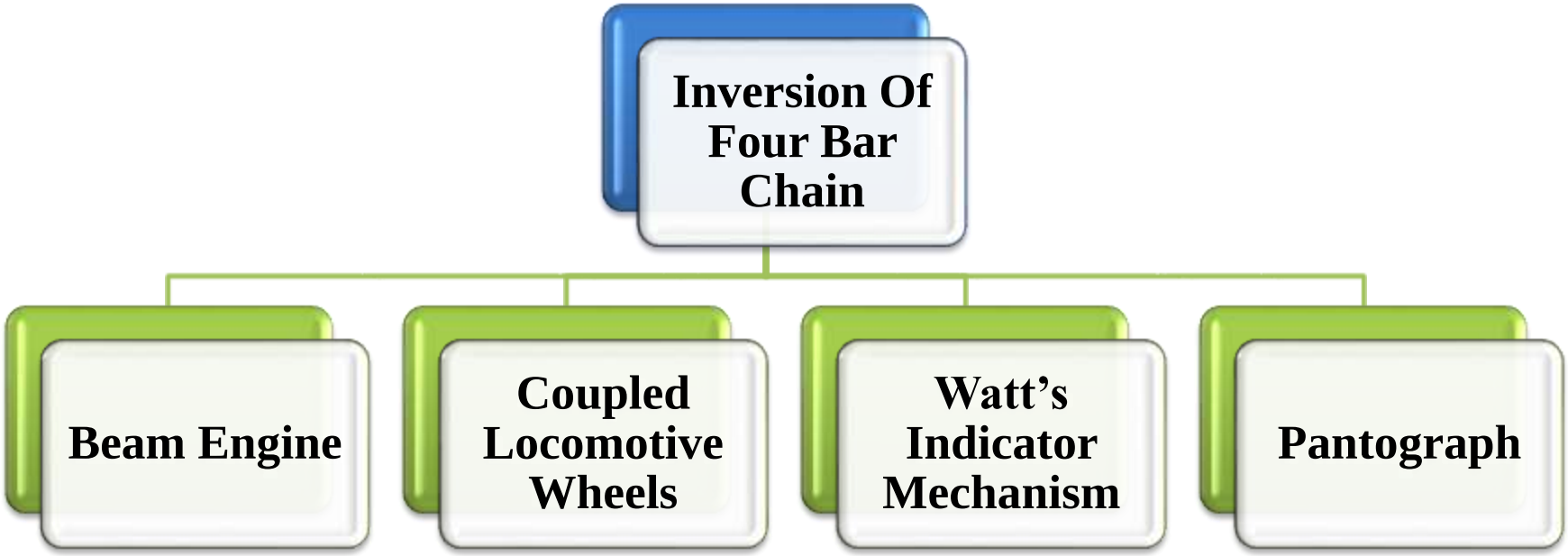
INVERSION OF MECHANISM

- The method of obtaining different mechanisms by fixing different links in a kinematic chain, is known as inversion of the mechanism.

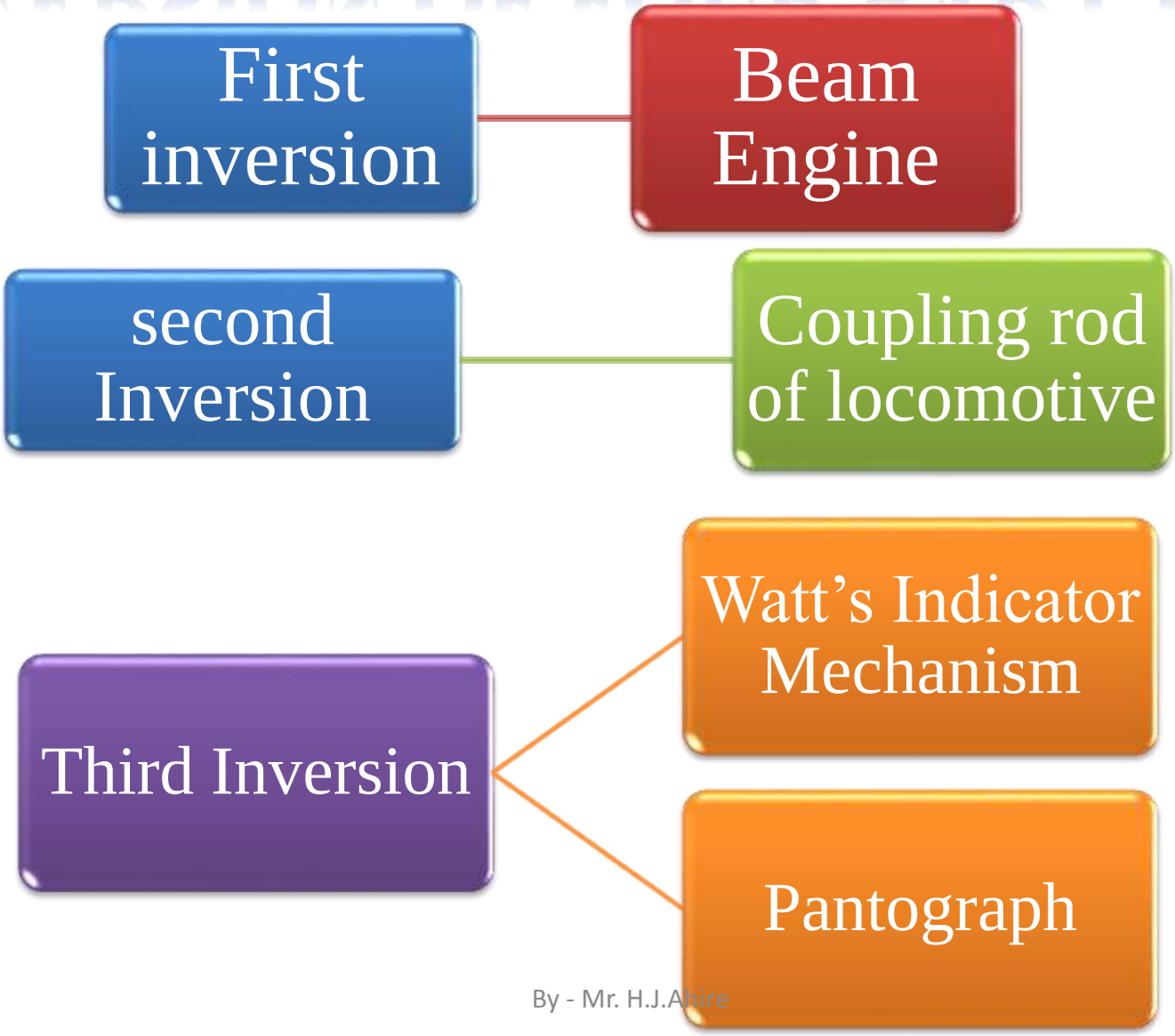
TYPES OF KINEMATIC CHAIN



FOUR BAR CHAIN

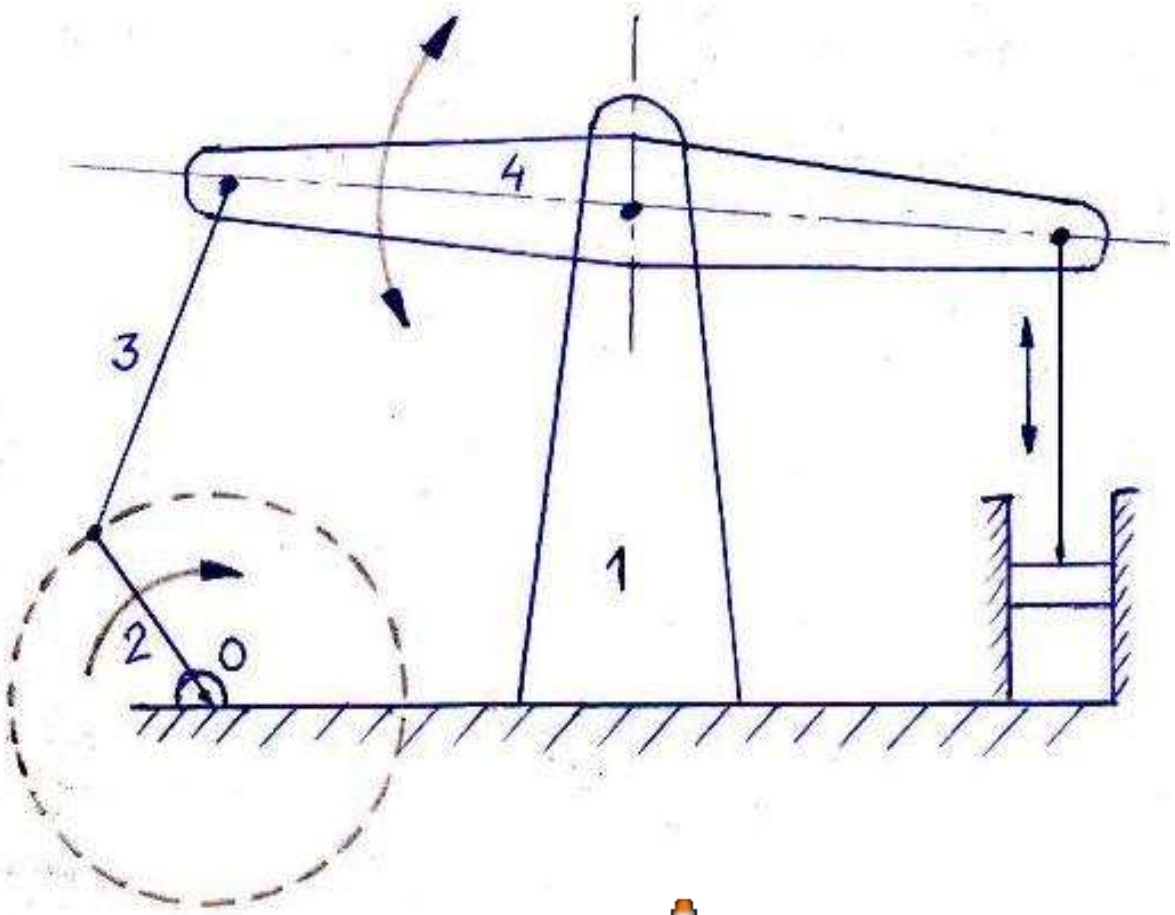


INVERSION OF FOUR BAR CHAIN



SECOND INVERSION

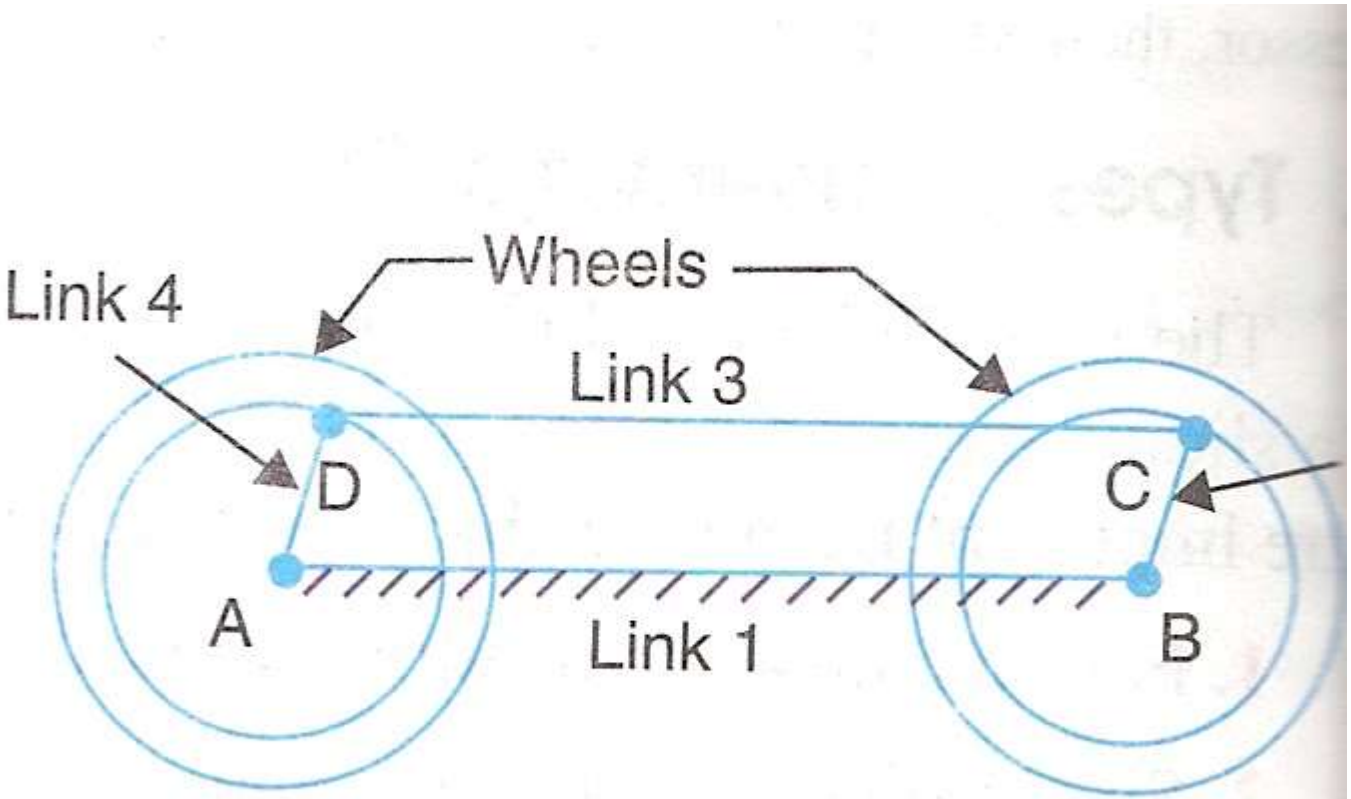
Beam engine



BEAM Engine Crank & Lever Mechanism.mp4

SECOND INVERSION

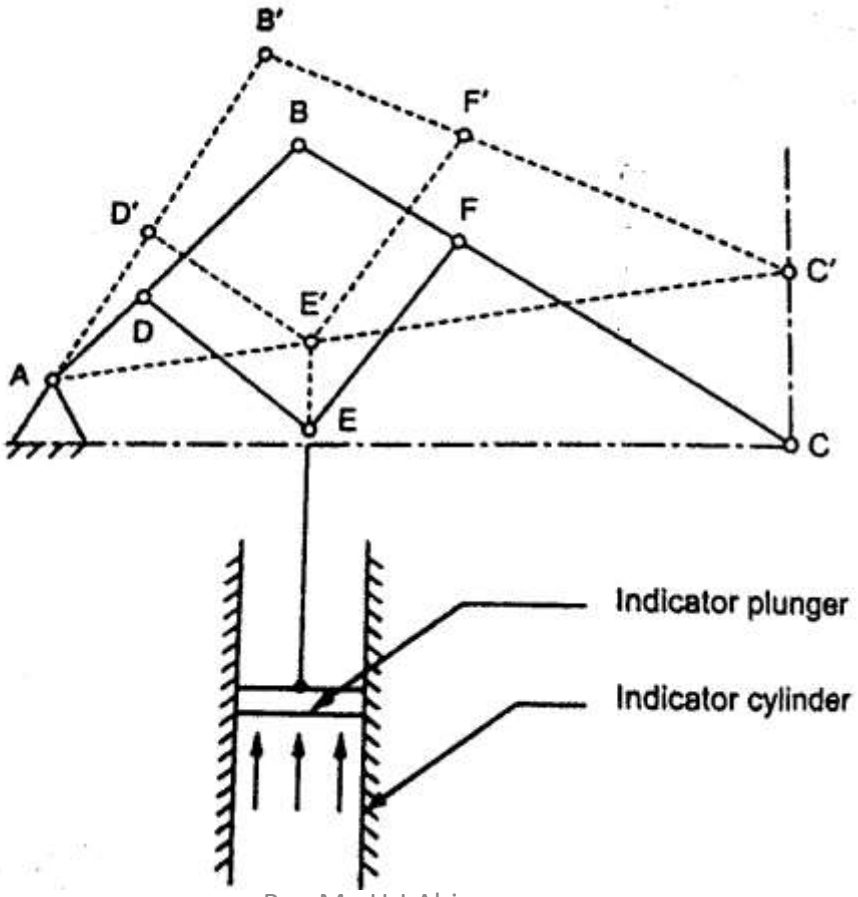
Coupling rod of a locomotive



COUPLING ROD OF LOCOMOTIVE MECHANISM.mp4

SECOND INVERSION

Watt's indicator mechanism



How Watts Straight Line motion mechanism works.mp4

SECOND INVERSION

Pantograph

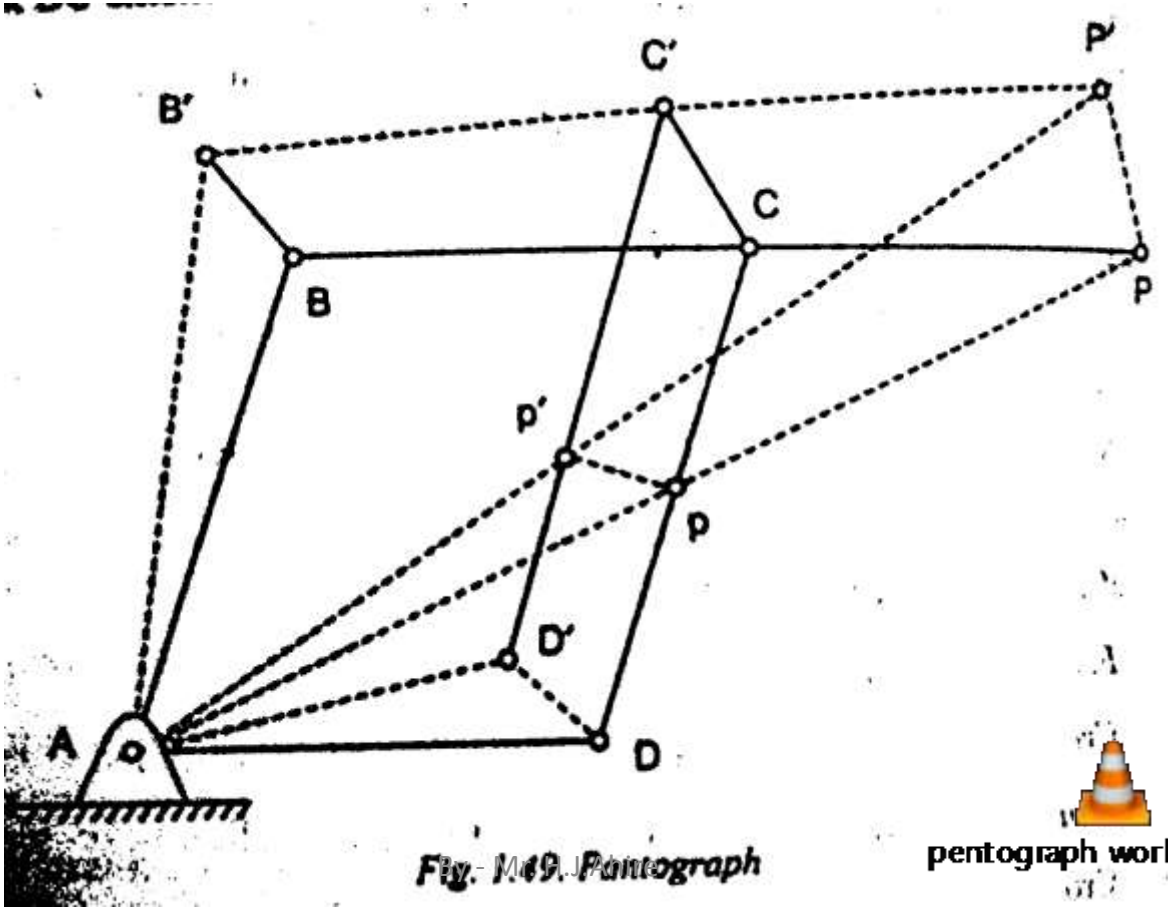


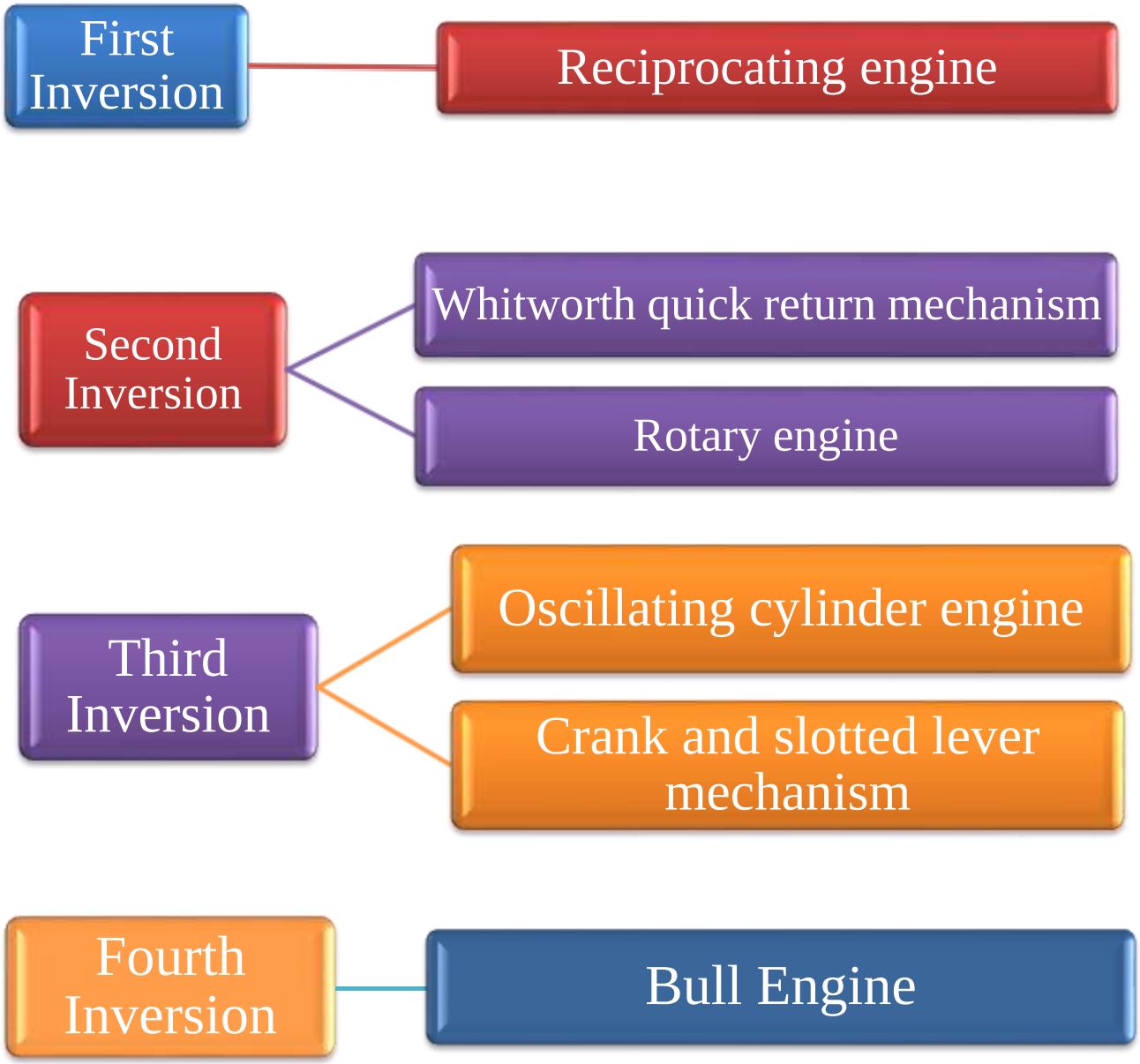
Fig. 1.49. Pantograph

pentograph working.mp4

INVERSION OF SLIDER CRANK CHAIN

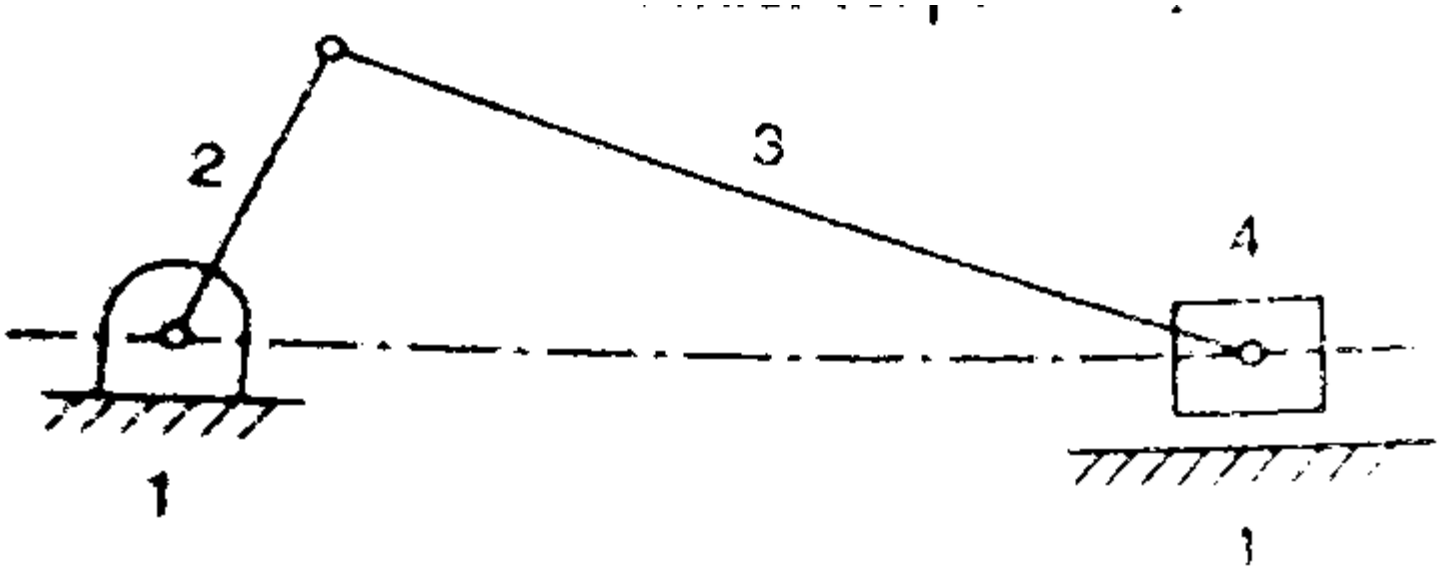
SINGLE SLIDER CRANK CHAIN

- Reciprocating engine
- Whitworth quick return mechanism
- Rotary or Gnome engine
- Crank and slotted lever mechanism
- Oscillating cylinder engine
- Bull engine


First Inversion
Reciprocating engine
Second Inversion
Whitworth quick return mechanism
Rotary engine
Third Inversion
Oscillating cylinder engine
Crank and slotted lever mechanism
Fourth Inversion
Bull Engine

FIRST INVERSION

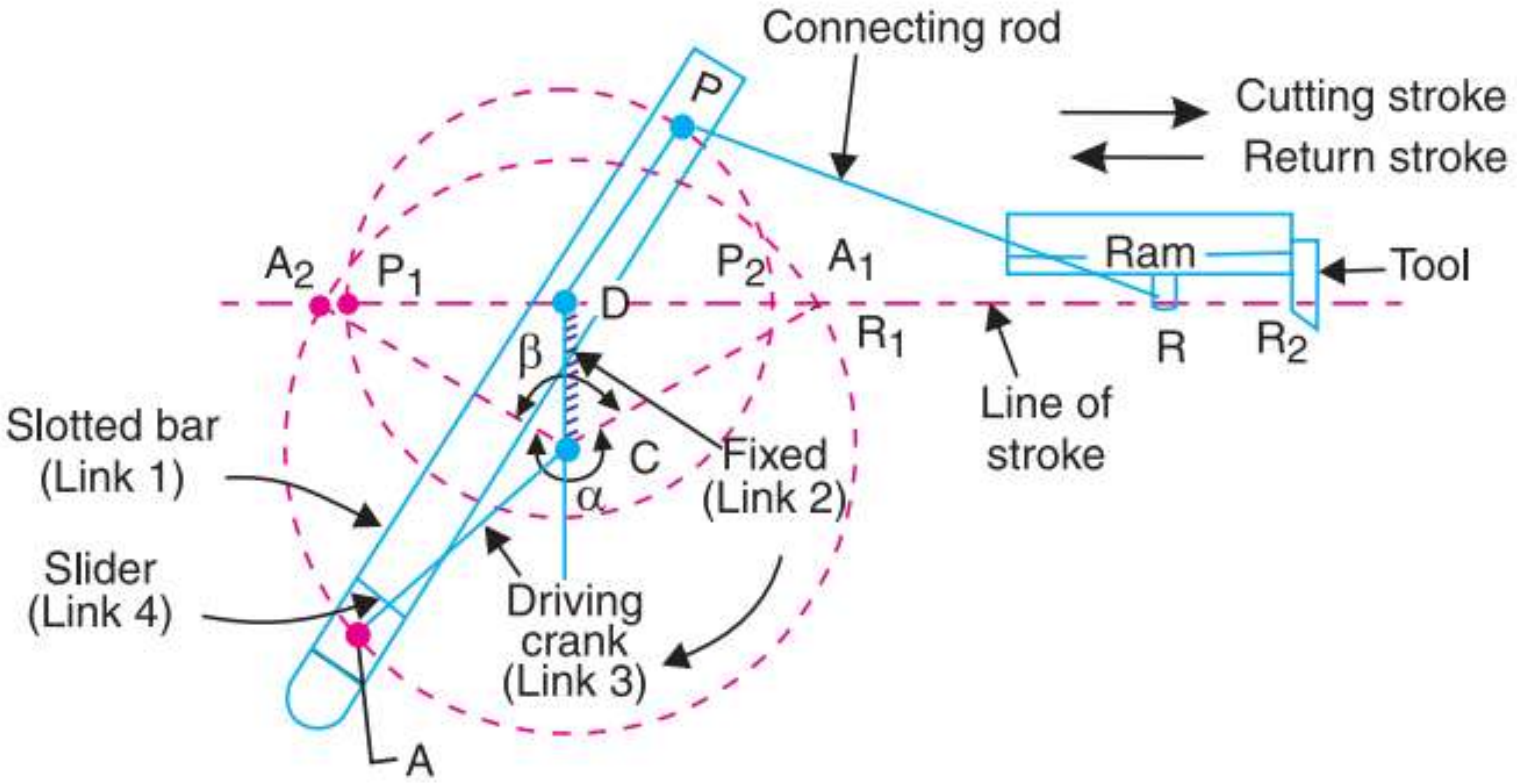
- Reciprocating engine



Animation Of Single Slider Crank Mechanism.mp4

SECOND INVERSION

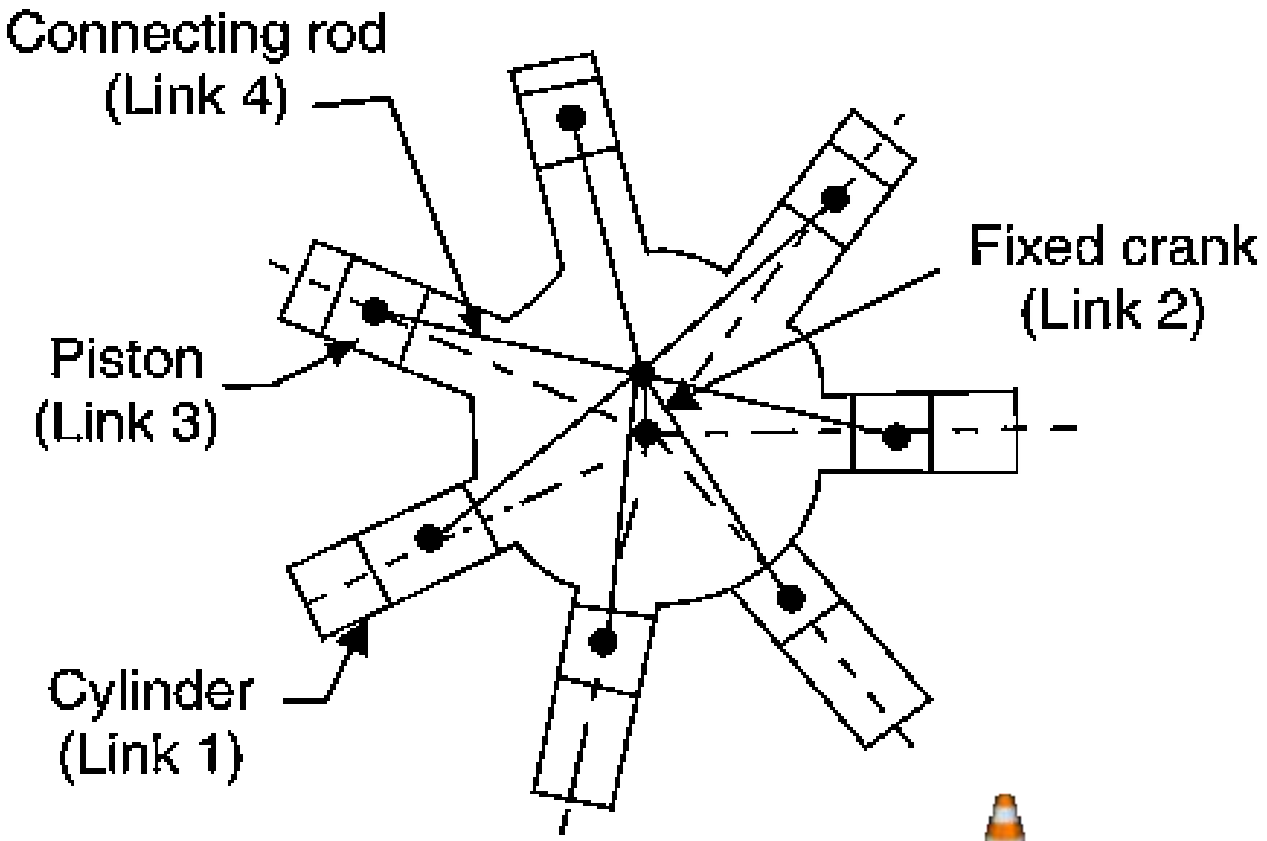
- Whitworth Quick Return Mechanism



How Whitworth Quick Return motion mechanism works.mp4

SECOND INVERSION

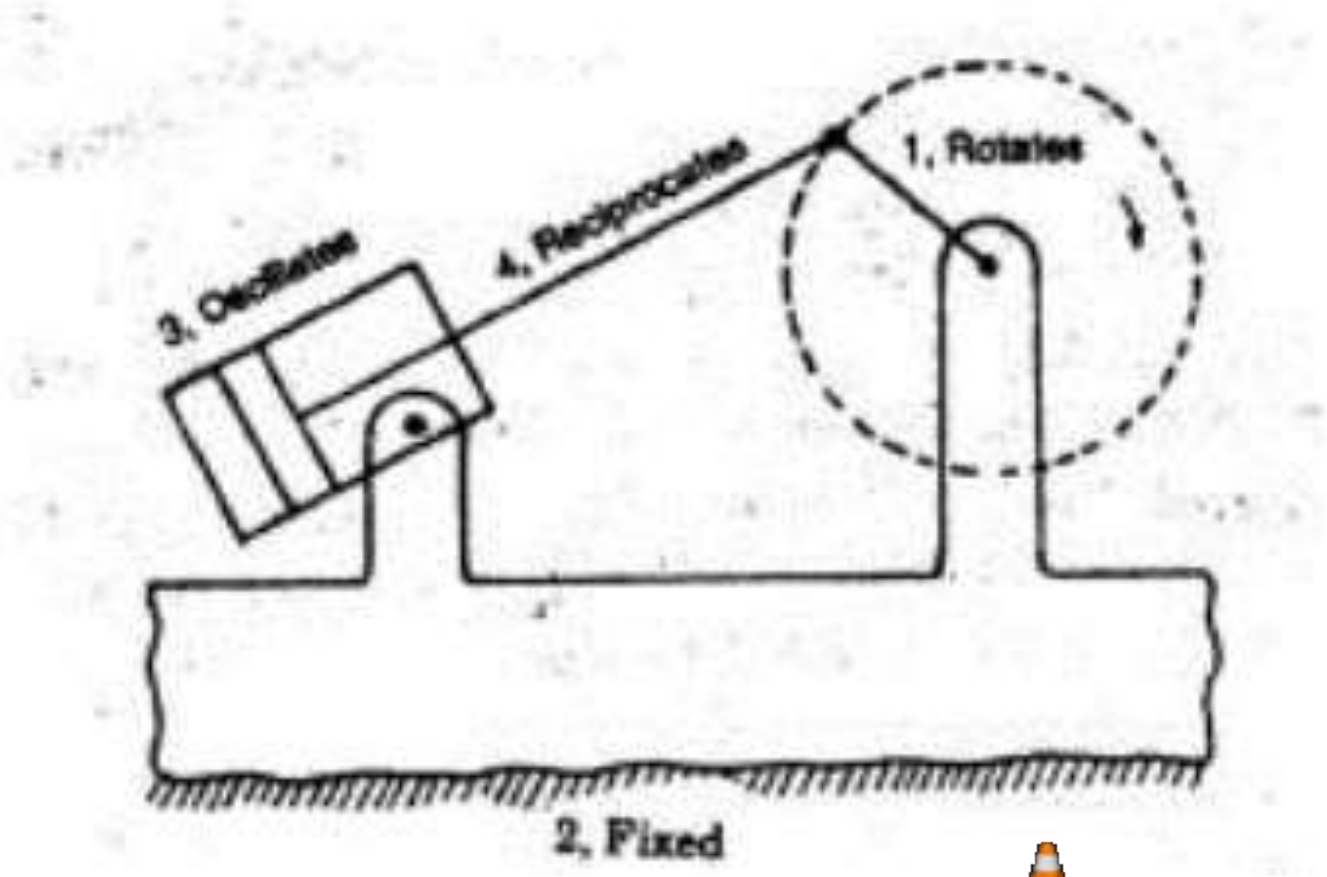
- Rotary Engine



Introducing MechaniCards Mechanical Greeting Cards.mp4

THIRD INVERSION

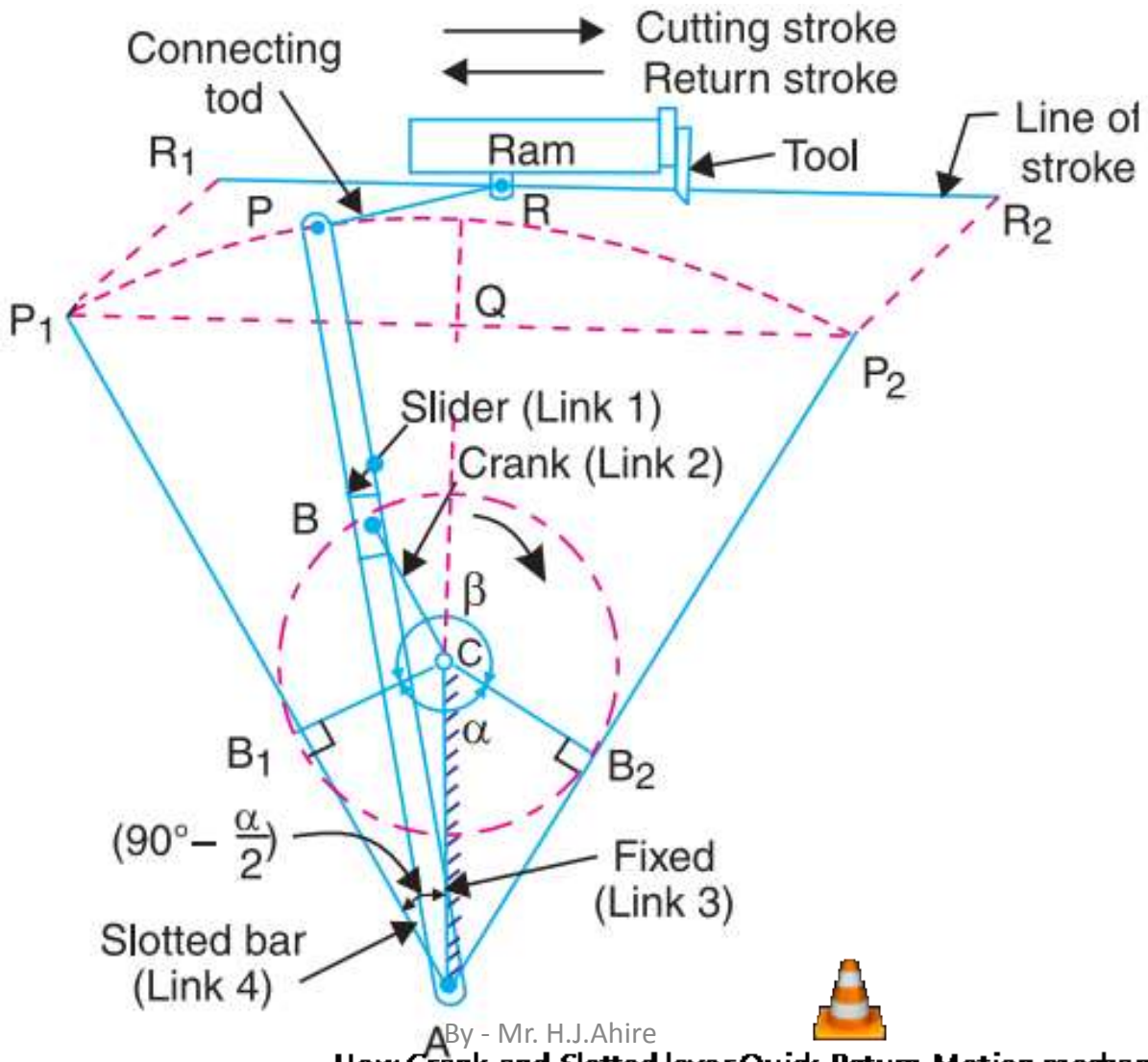
- Oscillating Cylinder Engine



Oscillating Cylinder engine mechanism.mp4

THIRD INVERSION

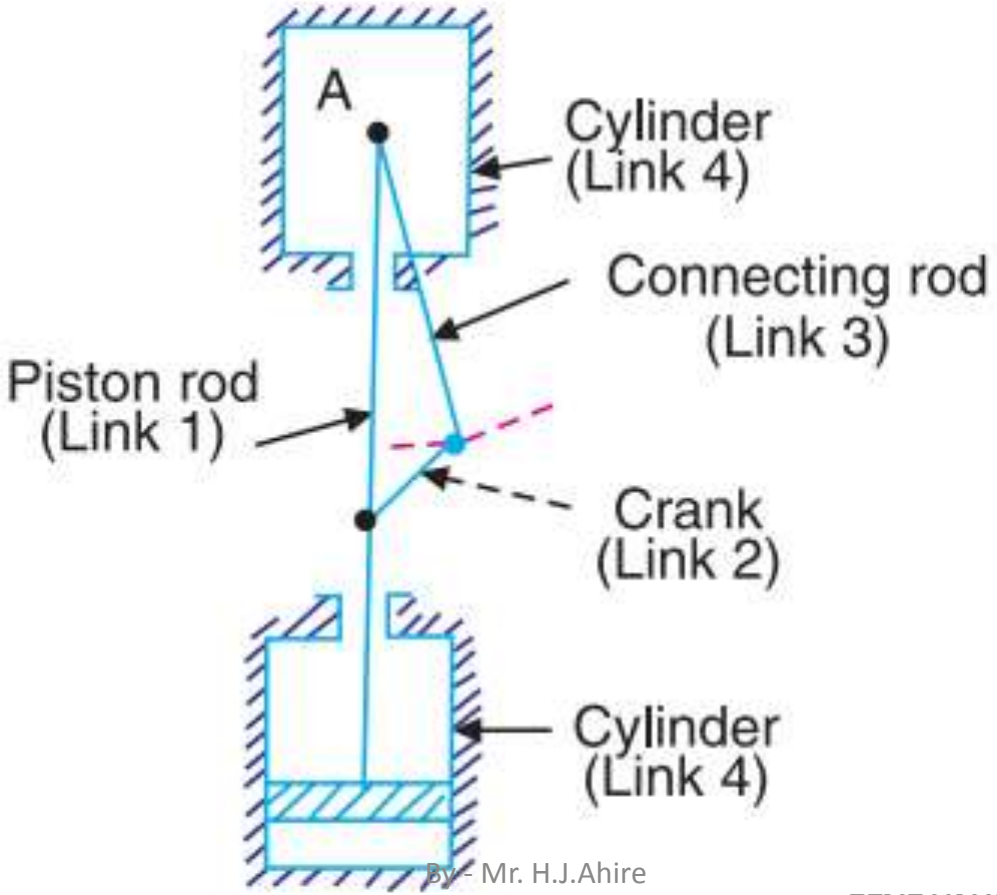
- Crank and Slotted lever Quick return Mechanism



How Crank and Slotted lever Quick Return Motion mechanism works.mp4

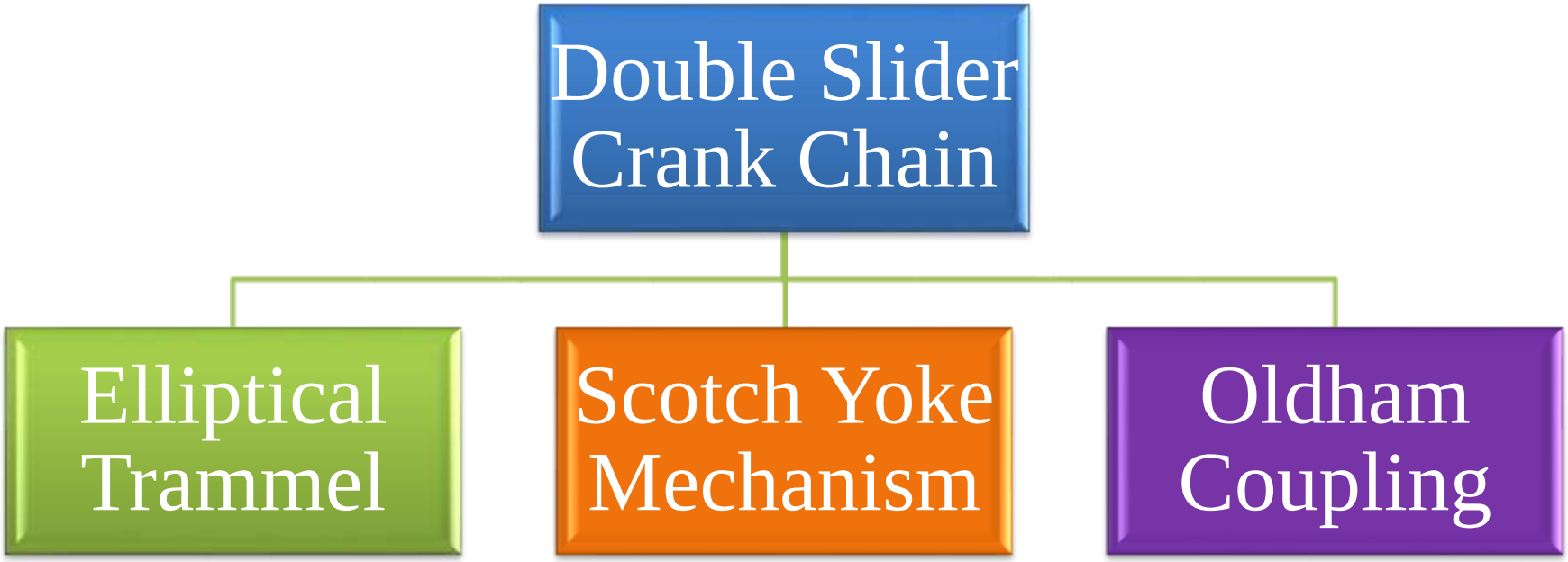
FOURTH INVERSION

- Pendulum pump or bull engine



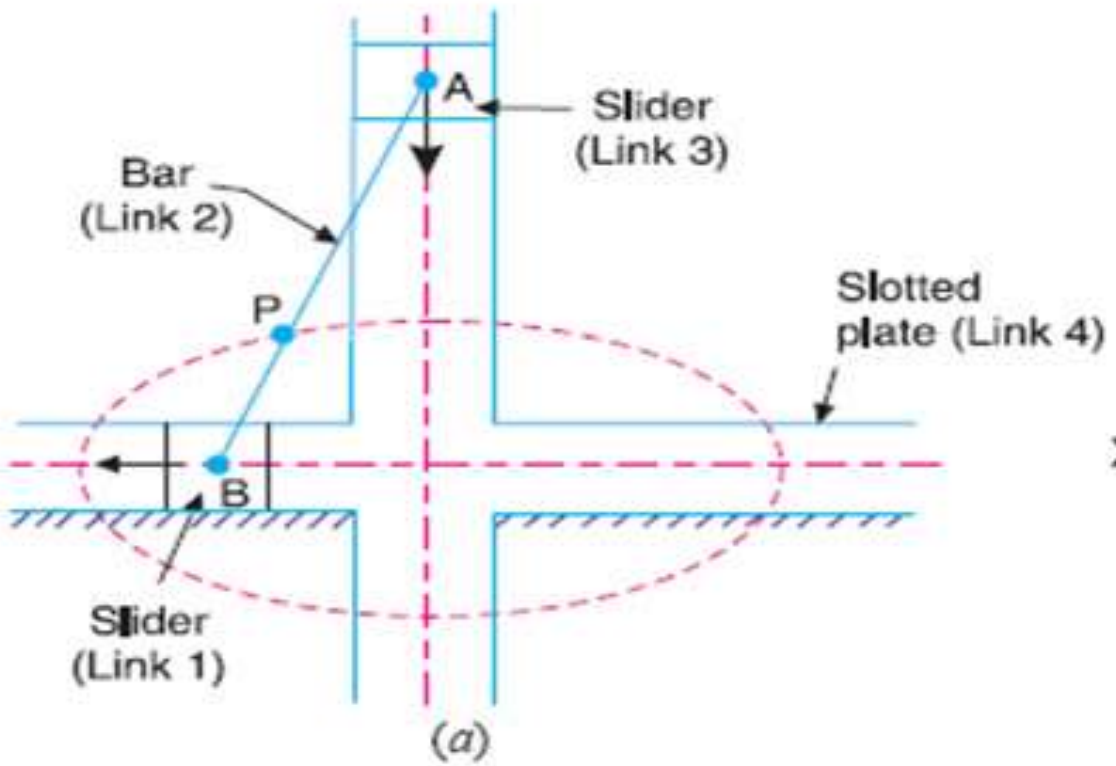
PENDULUM PUMP MECHANISM.mp4

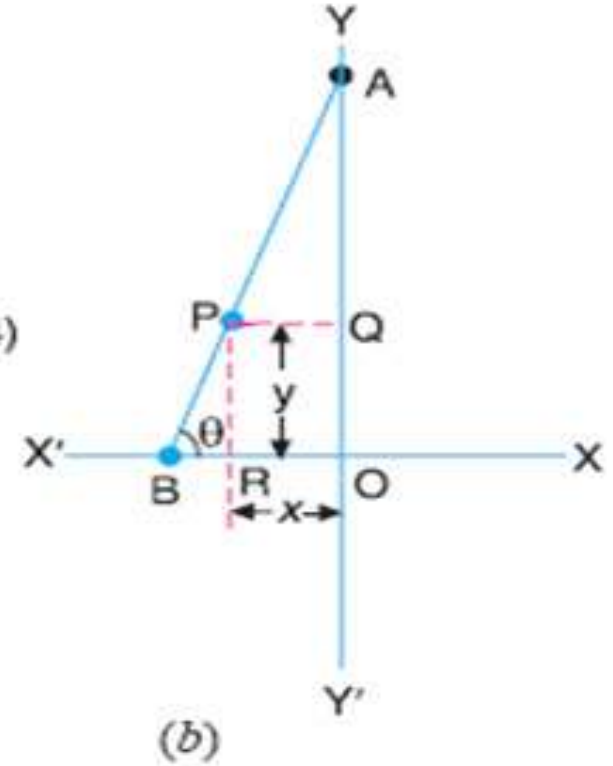
DOUBLE SLIDER CRANK CHAIN



FIRST INVERSION

Elliptical Trammel

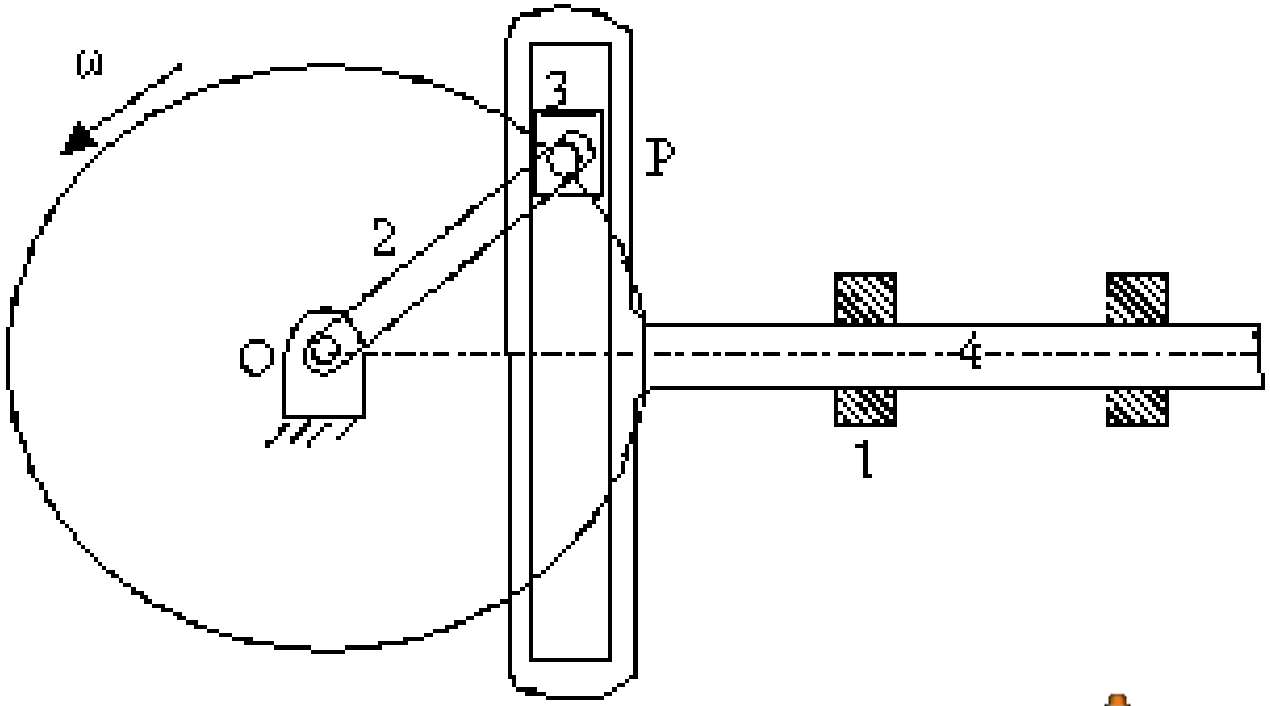




Slider Crank Mechanism.mp4 Elliptical Trammel mechanism in CATIA!!!!!.mp4

SECOND INVERSION

Scotch Yoke Mechanism

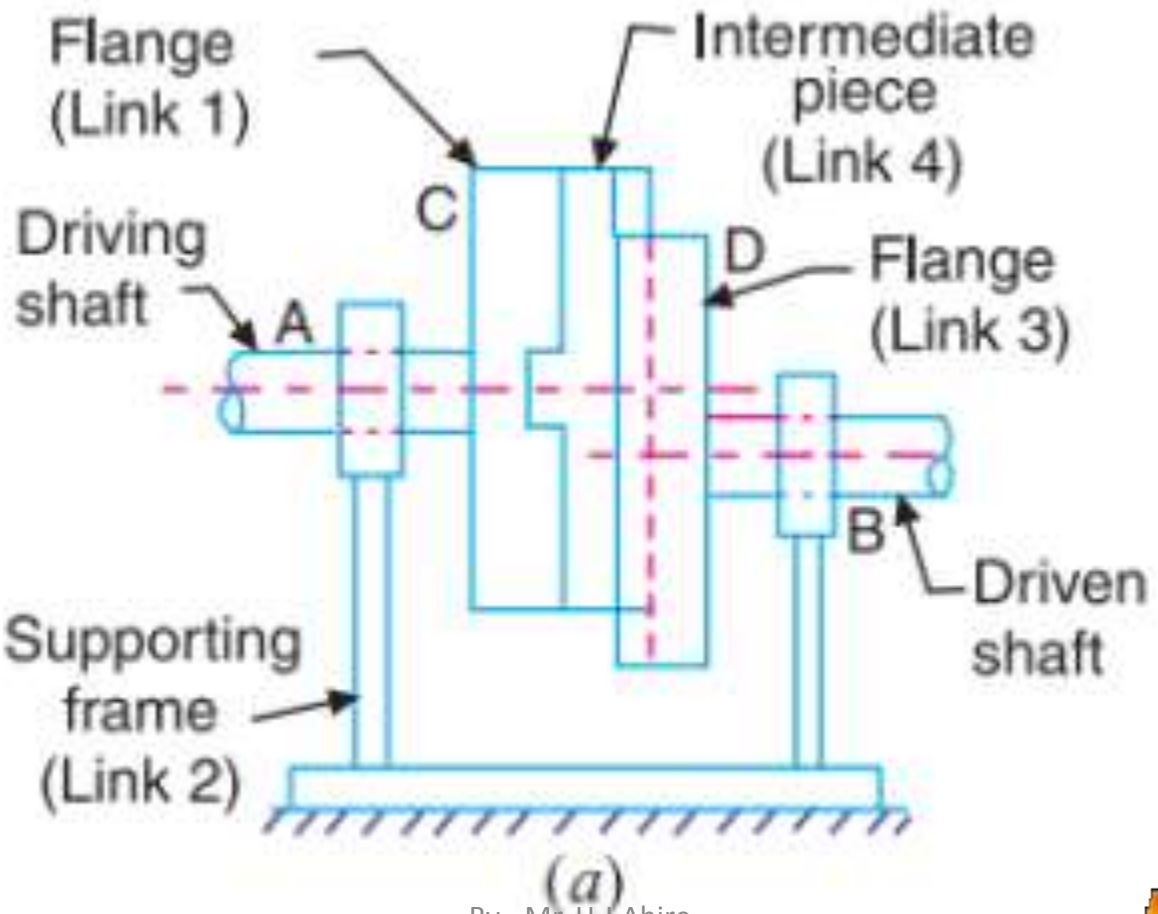


Double slider crank chain.mp4

Scotch yoke Mechanism.mp4

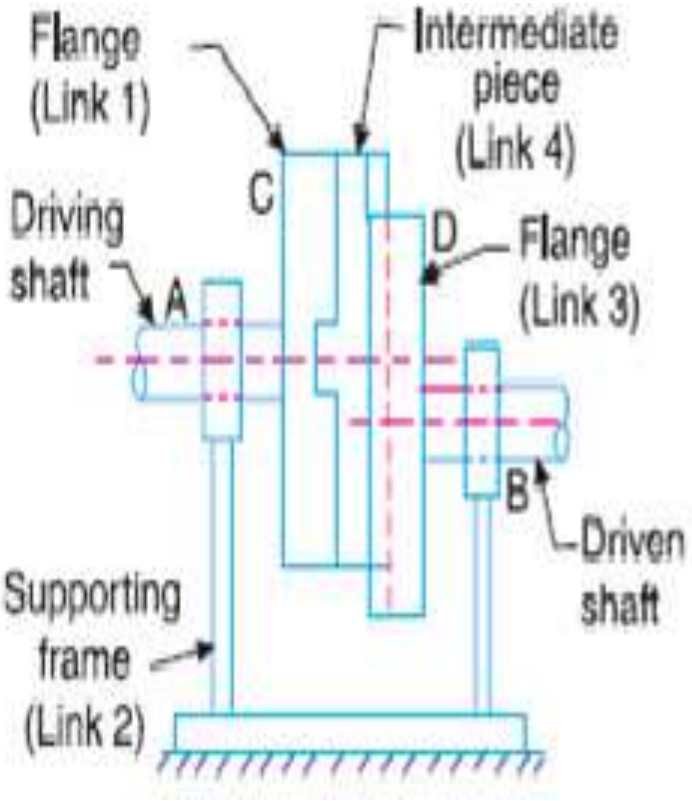
THIRD INVERSION

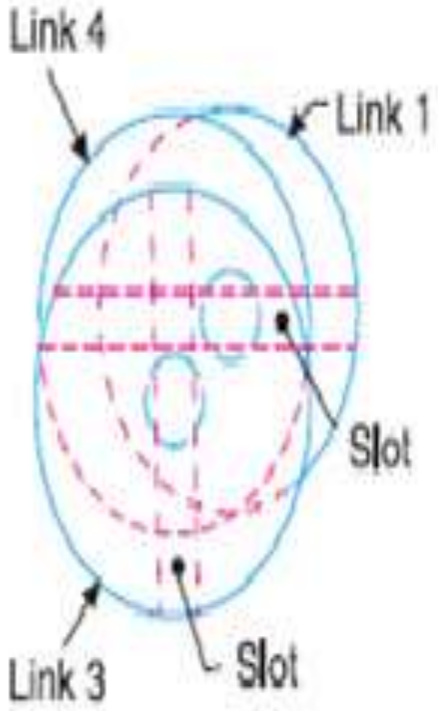
Oldham's Coupling

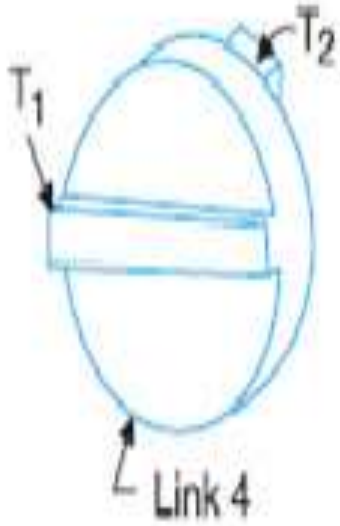


OLDHAMS COUPLING ANIMATION.mp4

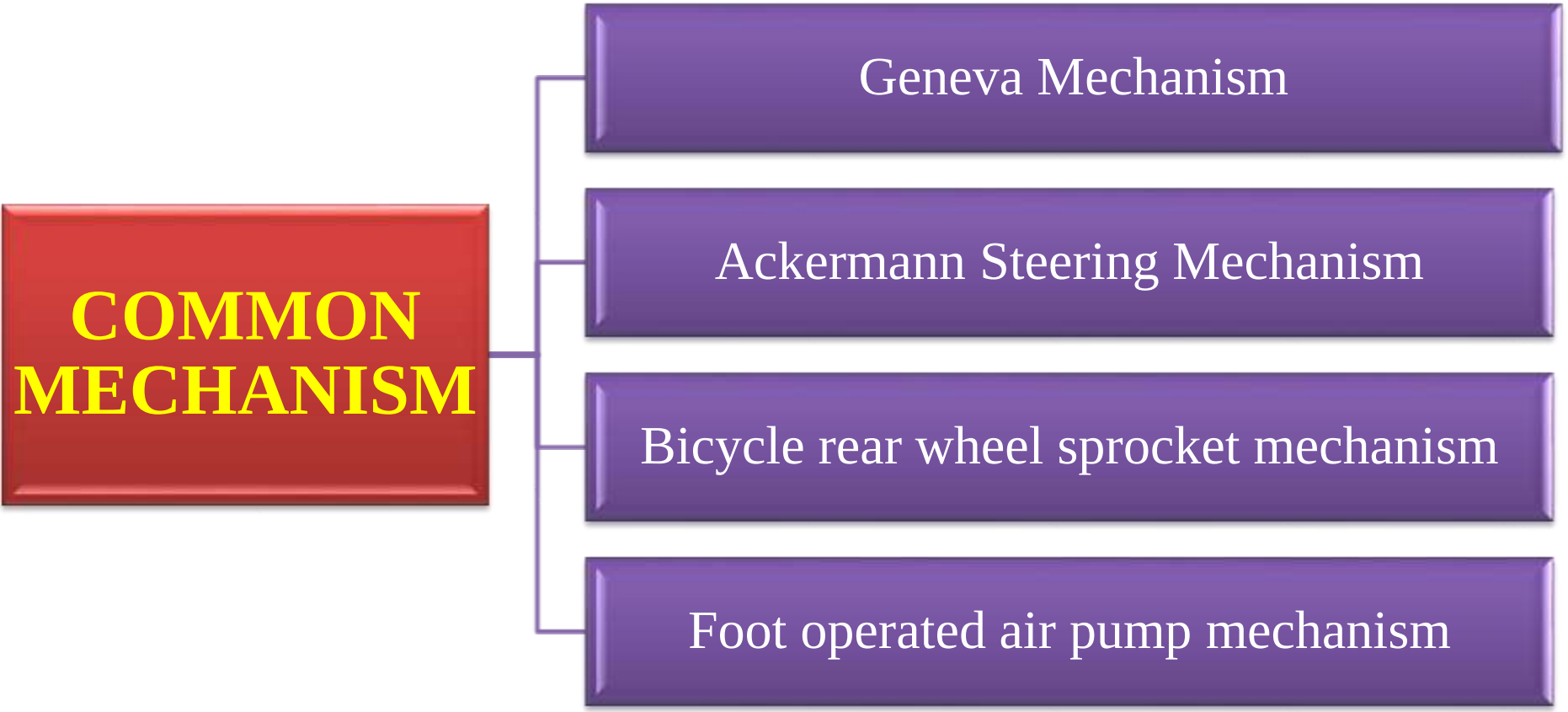
- Oldham's Coupling



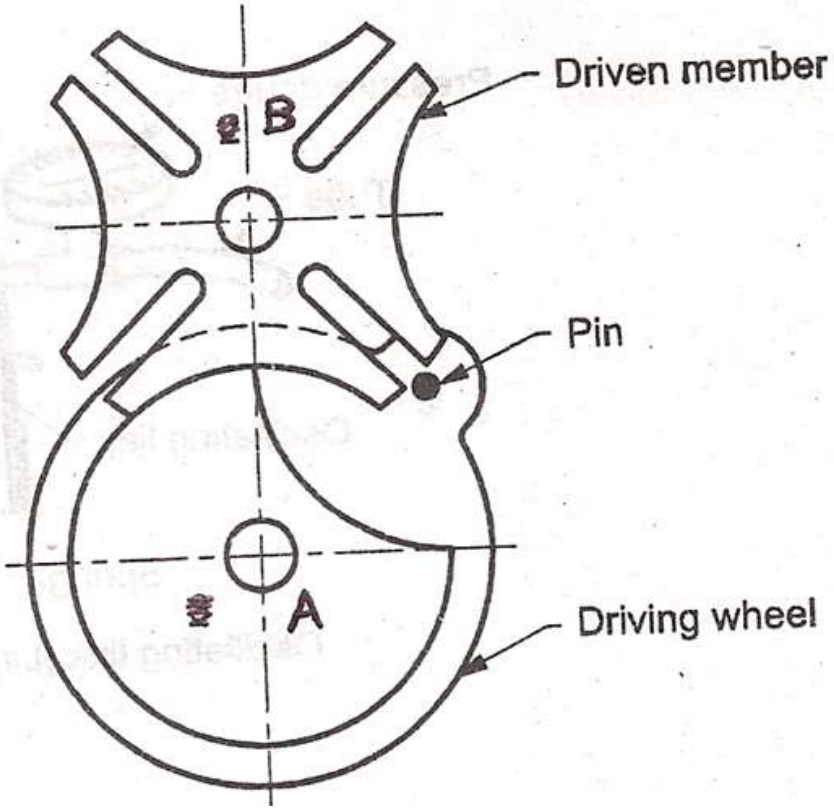




COMMON MECHANISM



GENEVA MECHANISM



Geneva Mechanism.mp4

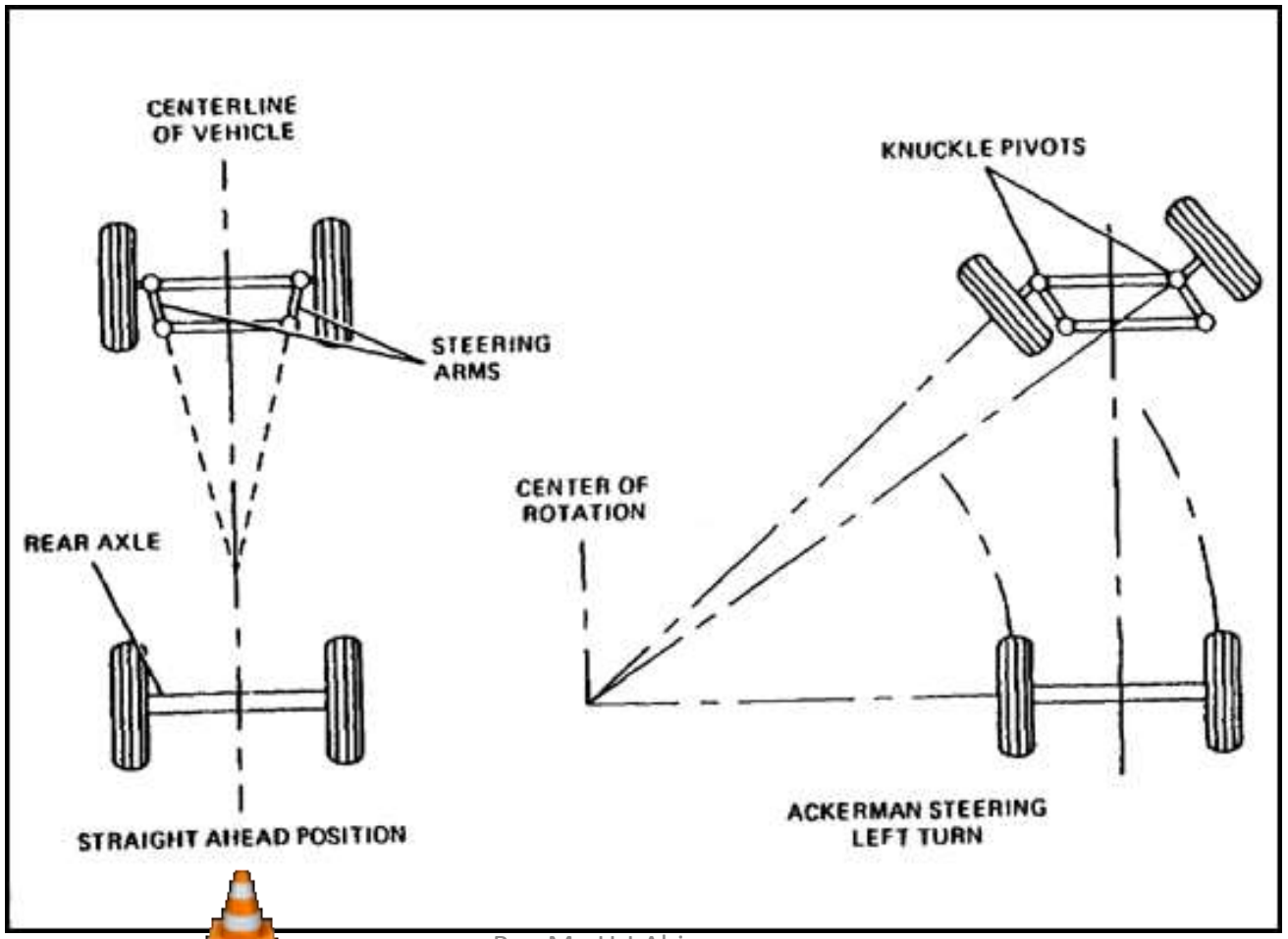
Geneva Pair - Geneva mechanism - Geneva drive - Malteserkreuzgetriebe

Application of the Geneva drive

- One is movie projectors : the film does not run continuously through the projector. Instead, the film is advanced frame by frame, each frame standing still in front of the lens for 1/24 of a second

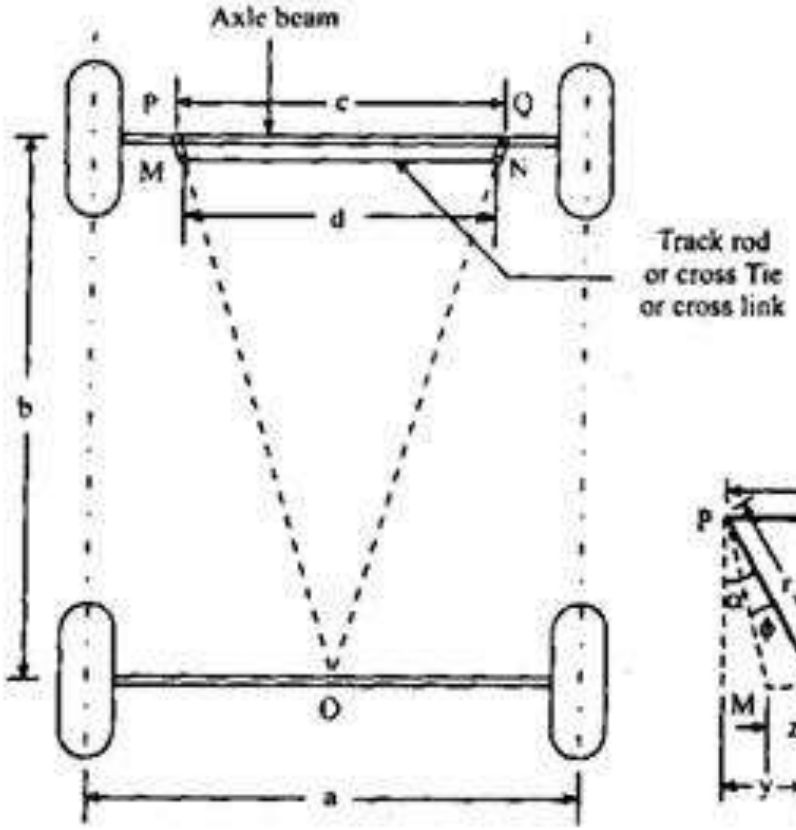
ACKERMAN STEERING

ACKERMANN STEERING

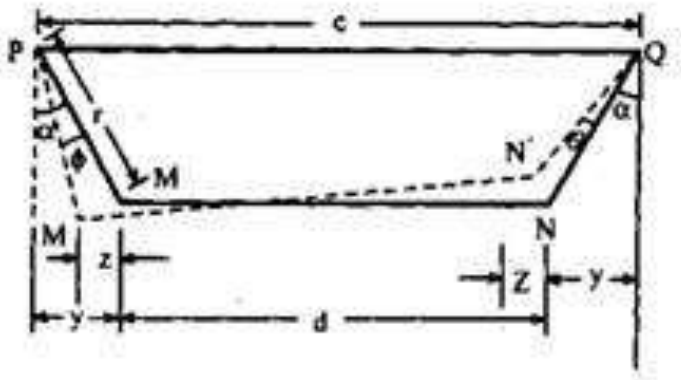


LMU 2009 Formula Student Car Steering 100% Ackerman Geometry.mp4

ACKERMAN STEERING



Ackerman's steering mechanism.3gp.mp4



BICYCLE REAR WHEEL SPROCKET MECHANISM

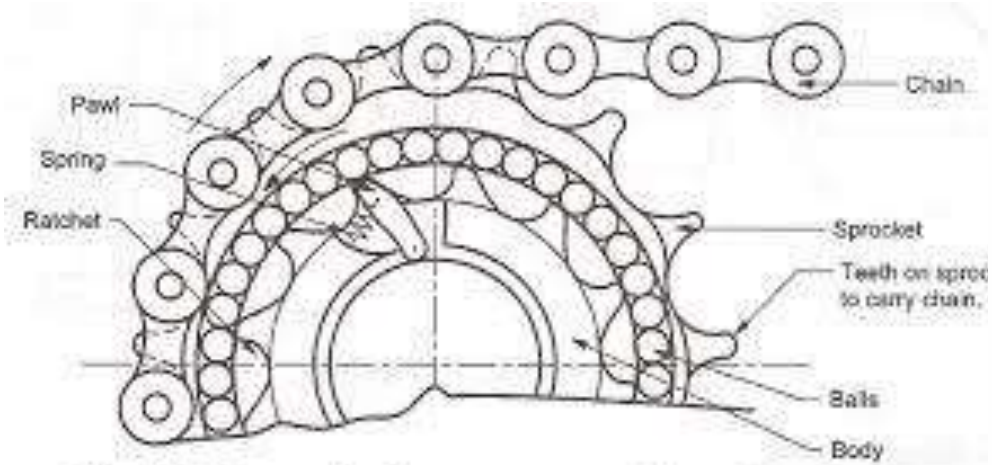
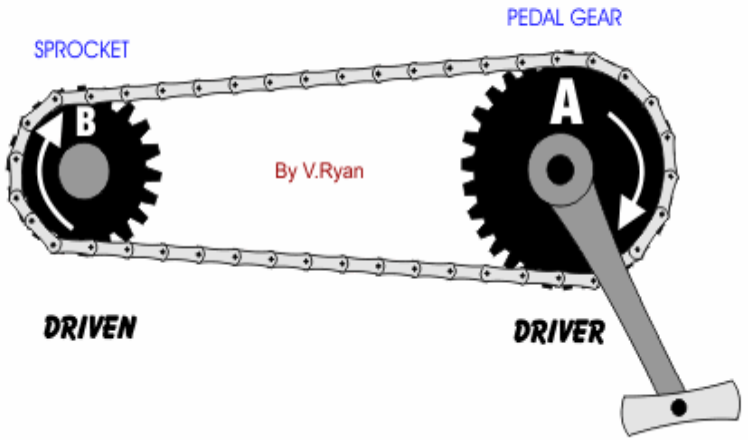
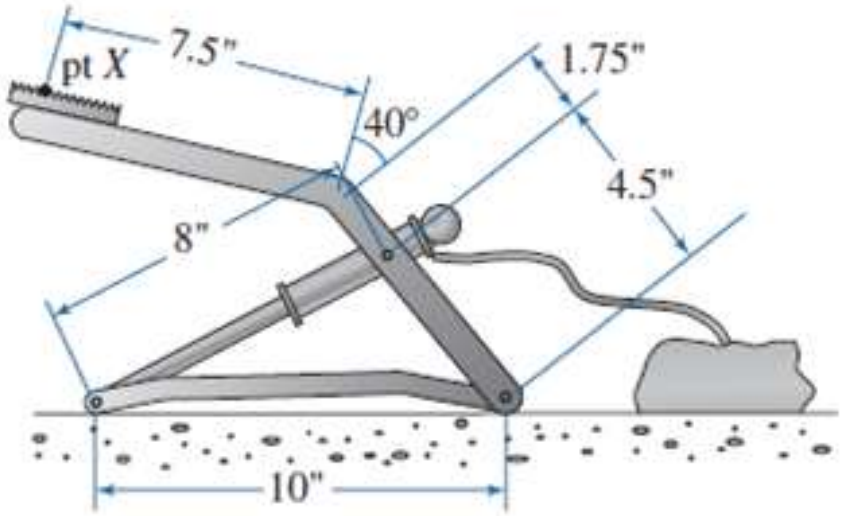


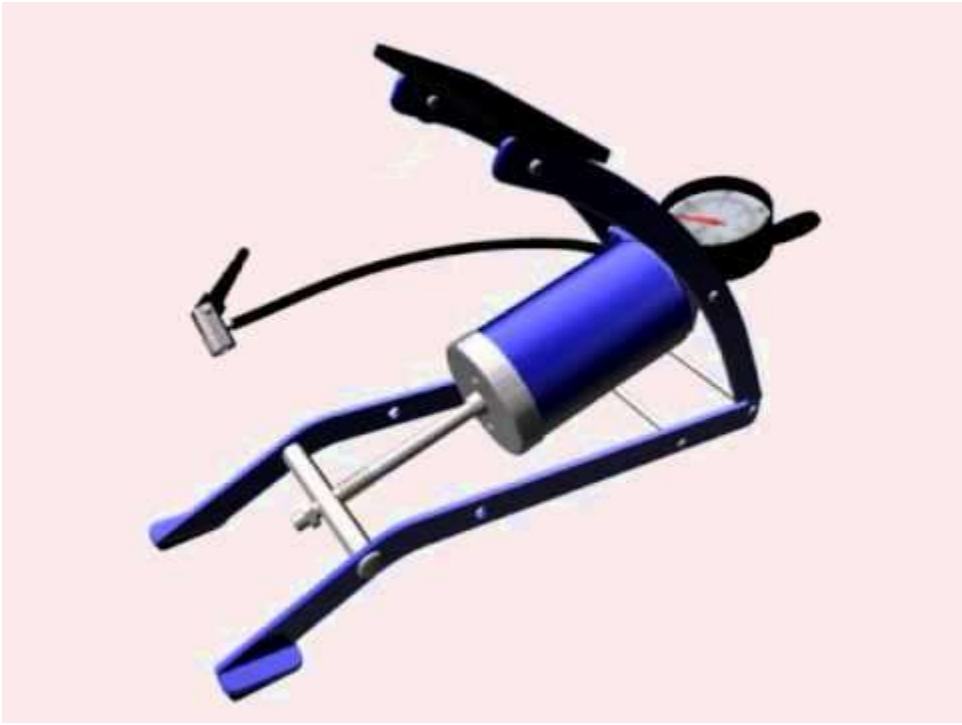
Fig. 1.25 : Rear wheel arrangement with pawl and rachet



Ratchet mechanism 5.mp4

FOOT OPERATED AIR PUMP MECHANISM





Foot Pump Animation.mp4

Status report - Harbor Freight foot pump - Item 37544.mp4