Cam and Follower: Definition, Types, Working Principle, and Applications

In mechanical engineering, engineers often use a higher pair links mechanism that is renowned as **Cam and Follower Mechanism**. This pair of higher links are used to move links spontaneously or periodically.

Although, cam and follower mechanisms are also used by engineers for ensuring zero or minimum degree of error. The device that is known as Cam in the 3rd century was devised by Hellenistic water-driven automata.

Alongside, that device was found in the 4th century in Al-jazari design. The Cam and Follower Mechanism is mostly used in the IC engines for driving the valves. Apart from that, the mechanism is often used by engineers as a part of the I.C.Es timing system.

Moreover, in the automotive industry Cam-Follower mechanism is used to drive fuel pumps. Furthermore, when multiple cams are incorporated within a single shaft it is called a camshaft.

The mechanism is developed by incorporating three members they are, a driver member named Cam, a frame that supports cam and follower, the follower is guided by the frame and lastly, the driven member named as a follower.

What is Cam?

A cam is a rotating element that gives oscillating or reciprocating motion to the follower which is another element of this machine by direct contact.

This part is mainly used to transform the motion from rotary into linear to another part. It is a part of a machine which can be a rotating wheel (an electric wheel) or a shaft that strikes a lever's various points at its circular path.

In a steam hammer, an engineer can use a cam as a simple tooth to deliver pulses of the power to a Steam Hammer.

Types of Cam:

There are various types of cams available, that are listed below:

- *Disk or Plate cam*
- *Cylindrical cam*
- *Translating cam*
- *Wedge cam*
- *Spiral cam*
- *Heart-shaped cam*

Disk or Plate Cam:

The disk (or plate) cam has not regular contour to transmit a specific motion to the follower.

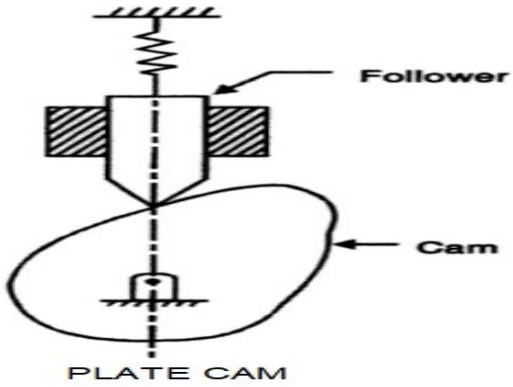
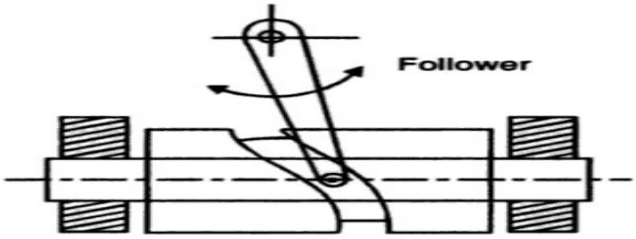


PLATE CAM

Cylindrical Cam:

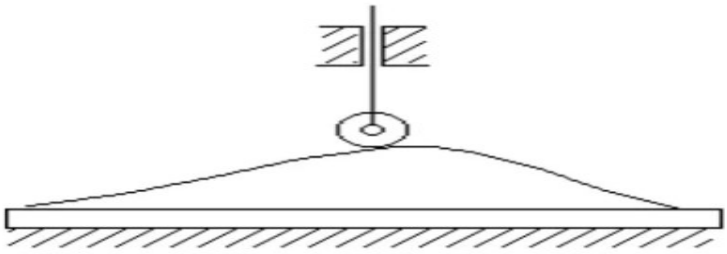
The cylindrical cam has a groove in a cylindrical surface and the follower runs on the cylindrical surface parallel to the axis of the cylinder.



CYLINDRICAL CAM

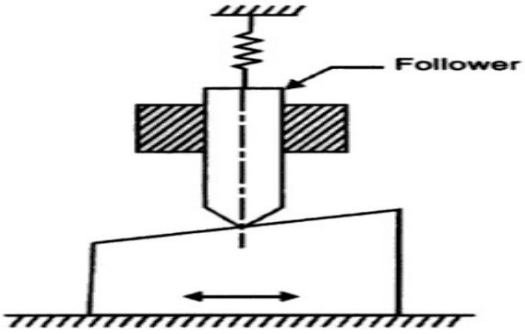
Translating Cam:

Translating cam has a grooved or contoured plate and its follower oscillate in the face of the plate. The groove or the contour has specified the motion of the follower.


TRANSLATING CAM

Wedge Cam:

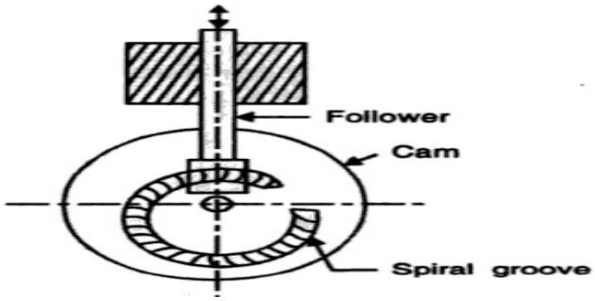
The wedge cam has an angled flat regular contour to impart a specific motion of the follower.



WEDGE CAM

Spiral Cam:

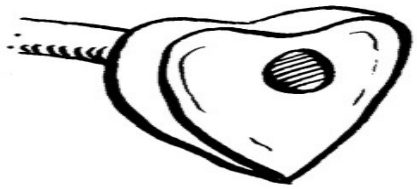
The spiral cam has a half-circular or a spiral shaping grooved contour, the cam moves in reciprocating motion and the follower moves vertically to the axis of the cam.



SPIRAL CAM

Heart-shaped Cam:

This type of cam looks like an asymmetric heart. It is mainly used to return a shaft to hold the cam to a set position by its pressure from a roller.



HEART SHAPED CAM

What is a Follower?

A follower is a rotating or an oscillating element of a machine that follows the motion of cam by direct contact.

If a cam moves in reciprocating motion the follower moves in vertically respect to the axis of the cam.

This part of the machine is mainly following the cam which can be reciprocating or oscillating in motion. It converts the rotary motion of cam into reciprocating or oscillating motion.

Types of Follower:

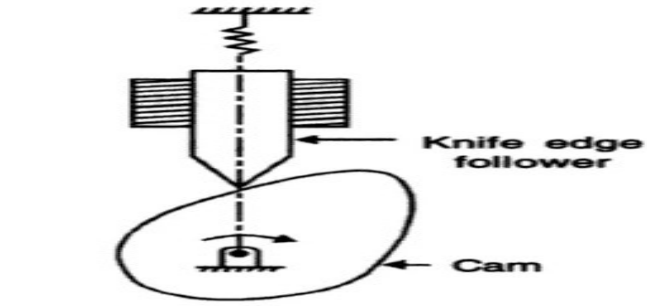
There were various types of follower which are bellowed:

- *Knife edge follower*
- *Roller follower*
- *Flat-faced follower*
- *Spherical follower*
- *Radial follower*
- *Offset Follower*

Knife-edge Follower:

This type of follower has a sharp area of contact with the cam. This is the simplest among all of the followers and these kinds

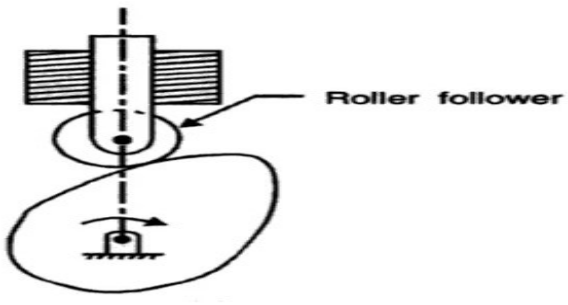
of followers are not in use in the case of fast application, because of its sharp edge.



KNIFE EDGE FOLLOWER

Roller Follower:

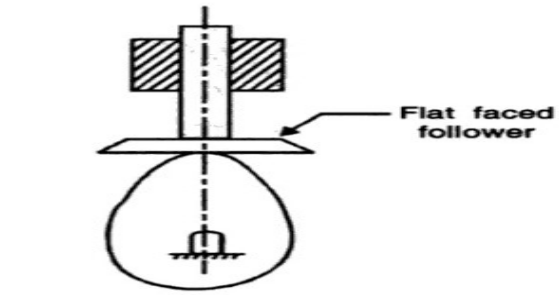
This type of follower is mainly used in high-speed operation because it has a smooth contact with the surface. This type of follower has less wear and tear as compared to the other followers.



ROLLER FOLLOWER

Flat-faced Follower:

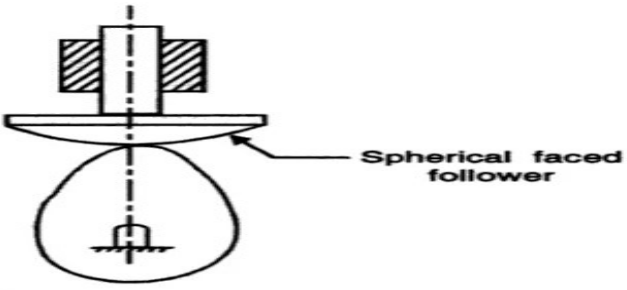
This type of follower looks like a flat surface with an irregular cam. This type of cam is used when the space is limited and this follower can resist more side thrust. This follower can also be used in a precision application.



FLAT FACED FOLLOWER

Spherical Follower:

This type of follower has a curved but regular follower as well as cam. This is a modification of a flat-faced follower.



SPHERICAL FACED FOLLOWER

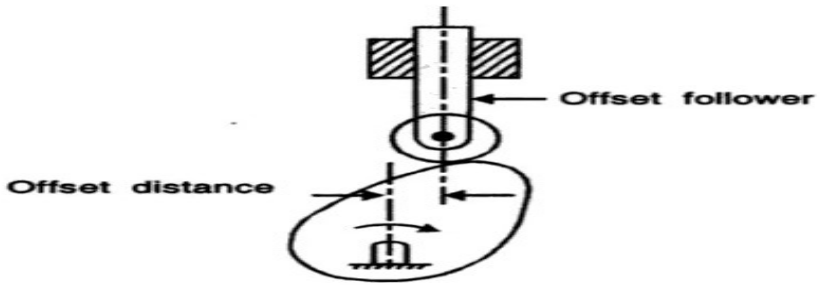
Radial Follower:

In this type of follower, the line of movement passes through the center of the camshaft. Mainly the movement of the follower is in line. The follower is in a reciprocating motion.

DIAGRAM IS SAME AS KNIFE-EDGE FOLLOWER

Offset Follower:

In this type of follower, the movement of the axis of the follower is not colinear with the cam axis.



OFFSET FOLLOWER

Working Principle of Cam and Follower:

The working principle of Cam and Follower depends on the mechanism of the combination of both Cam and Follower.

Cam Mechanism:

Cam is a mechanical component which is a rotating circle or eclipse about the minor axis of the Follower.

Hence it can be explained easily that Cam is a mechanical component that transmits reciprocating, oscillating or linear motion to Follower.

Cam's shape is usually an oval or an imperfect circle or an eclipse. If an engineer considers an oval-shaped Cam then he or she can see the movements which will form the outer burge, which is periodic to its locus.

This outer burge is very useful and effective for works which are periodic mechanical. There are two types of Head Cams. First is Single Head Cam and the second is Multiple Head Cam.

Cam is Rotating about minor axis or respect to Follower.

Follower Mechanism:

A follower is a mechanical component concerning which, the Cam rotates in an oscillatory or circular motion. Follower inhibits the push and pulls of the Cam. A follower is used to transfer the motion to the required machine part.

The Follower rotates in an oscillating or circular arc.

The mechanism for Cam and the mechanism for Follower depend upon each other so that the main mechanism of Cam and Follower.

The mechanism of Cam and Follower is essential in the engineering field and has many different functions to the different machines.

The Terminology of a Cam:

Cam Profile:

It is the surface area of a cam where follower touches.

Base Circle:

It is the smallest circle of a cam profile drawn from the center of rotation of the cam.

Trace Point:

By this point, we can trace the cam profile.

Pitch Curve:

This curve is generated if we assume the cam is fixed and the tracepoint of the follower moves around the cam.

Pressure Angle:

It is formed between normal to the pitch curve and line of motion of the follower.

Pitch Point:

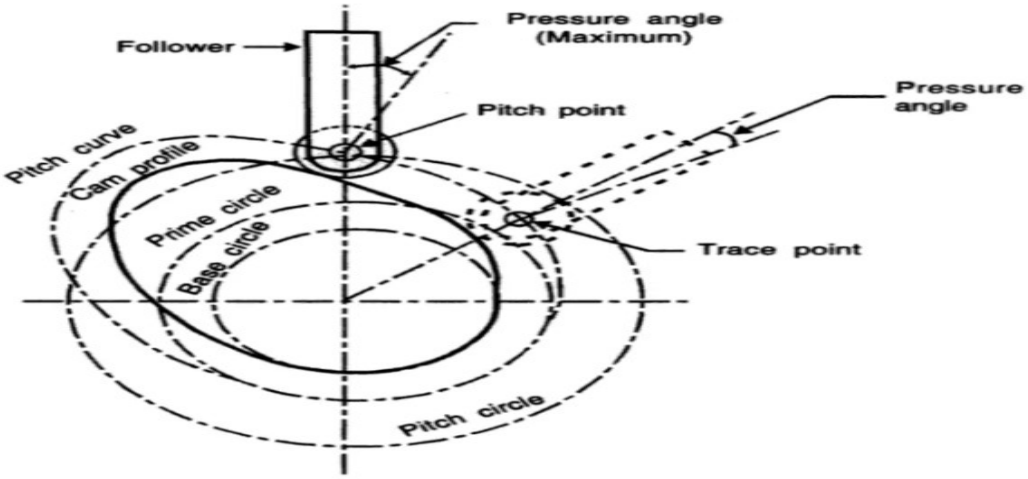
At this point the pressure angle is maximum.

Pitch Circle:

It is the circle which passes through the pitch point.

Prime Circle:

This is a circle that drawn tangentially to the pitch curve and concentric to the base circle.



CAM TERMINOLOGY

Applications of Cam and Follower:

There are so many different applications of Cam and Follower mechanism. Those are:

- *Internal Combustion Engine to close and open the outlet valve and intake valve.*
- *Automated Types of machinery, Cam and Follower are used in different parts which are automated in motion.*
- *In Hydraulic Systems, the main mechanism is Cam and Follower mechanism.*
- *In that case, the mechanism is dependent on the fluid pressure.*
- *In Printing Machinery, the mechanism of Cam and Follower helps the screen to be printed. The push helps to take the position where the printing will be done and the pull helps to print on that.*
- *In Textile Types of machinery, the mechanism of Cam and Follower helps to stitch clothes by a push and pull to move the Maku.*
- *Screw pieces of machinery.*
- *Gear-Cutting Machineries.*
- *Wall-Clock.*
- *Automatic Lathe Machine.*

Importance of Cam and Follower:

In the field of mechanical engineering, the Cam-follower mechanism plays a significant role in achieving even distribution of forces in a single machine component.

By attaching a cylindrical roller in a machine component spontaneous movement can be achieved by an engineer.

Cam follower can be used in a machine component regardless of the shape and size of the nut. Apart from that, varieties of linear motions can be found by utilizing the mechanism.

Moreover, due to higher thickness as compared to other bearings Cam follower mechanism can absorb a higher amount of shock that increases the mechanical efficiency of a machine component.

Furthermore, the mechanism is entirely versatile that it can be used in a soda machine or also in an aircraft application. Besides, the mechanism is also used in the conveyor belt.

In the case of engines, bearing the load of a camshaft can easily be devised by utilizing the fundamental approach of a crankshaft bearing.

Although, flat followers are used by engineers to operate the valves of an engine whereas roller followers are used by engineers in oil and stationary engines.

This type of preference occurred due to more availability of space of roller followers.

A Simple Cam, Follower Mechanism:

Conclusion:

Cam follower mechanism plays a significant role as it utilized to drive a minute machine component seamlessly. Central locks and ordinary lock systems are also developed by incorporating the mechanism of cam and follower.

https://youtu.be/wPMtPl7HG68

Various terminologies are integrated with the mechanism that has to be understood by the user of the mechanism. Some of the terminologies are tracepoint, pitch curve, pressure angle and so on.

Cam and follower mechanisms are not a small part of mechanical engineering. Therefore, precision and patience are required to implement the mechanism in practice.

At first, the user should aware of the links and pairs before understanding the conception of cam and follower.

Cam is a higher pair device thus, the user should grant the degree of freedom to apply the same in a machine component. Lastly, it can be recommended that the pressure angle should not be increased by the user to restrict the potential impact of side thrust.