MECHANISMS (1)

This mobile revision pdf is based on detailed work found in the 'MECHANISMS' section. Tap on the green link button below to go to the complete website section

Tap the blue button to view MECHANISMS covered by this Revision PDF

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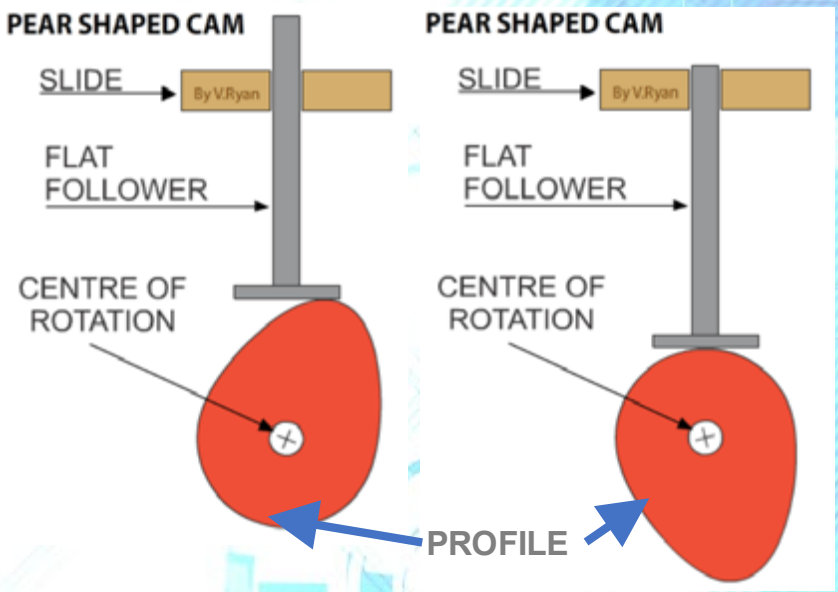
MECHANISMS(1)

CAMS

A CAM changes the input motion, which is usually rotary motion (a rotating motion), to a reciprocating motion of the follower. They are found in many machines and toys.

As the CAM PROFILE rotates, the follower lifts upwards and then drops back down. This motion continues as long as the CAM PROFILE rotates

Tap the images for an animation
And further information



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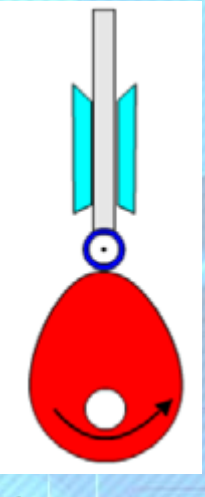
CAM PROFILES

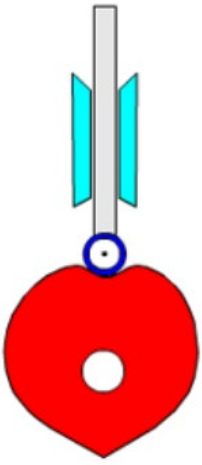
Tap the images for further information

Cams can be shaped in any number of ways and this is determined by the way the follower is to move. The shape of the cam is called the PROFILE. Some common profiles are shown here.

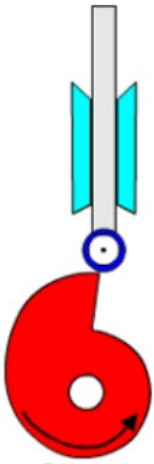
PEAR



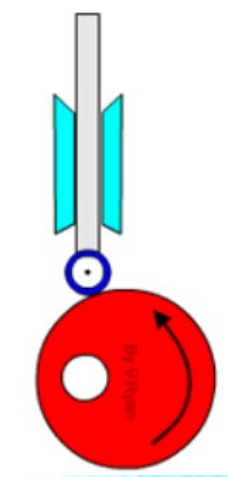
HEART



DROP



ECCENTRIC



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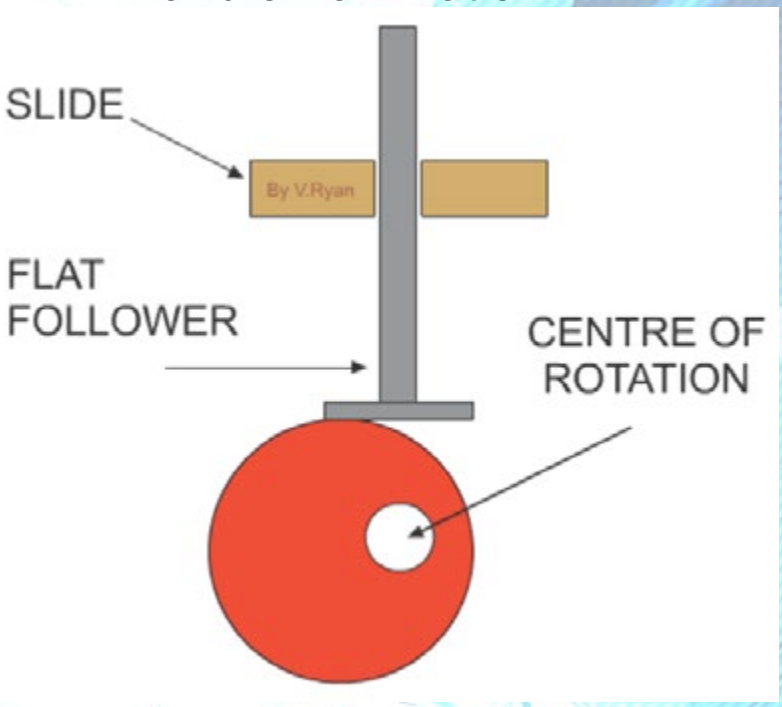
THE ECCENTRIC CAM

An eccentric cam is a disc with its centre of rotation positioned 'off centre'. This means as the cam rotates the flat follower rises and falls at a constant rate. This type of cam is the easiest to make and yet it is one of the most useful.

Tap the images for further information and an animation



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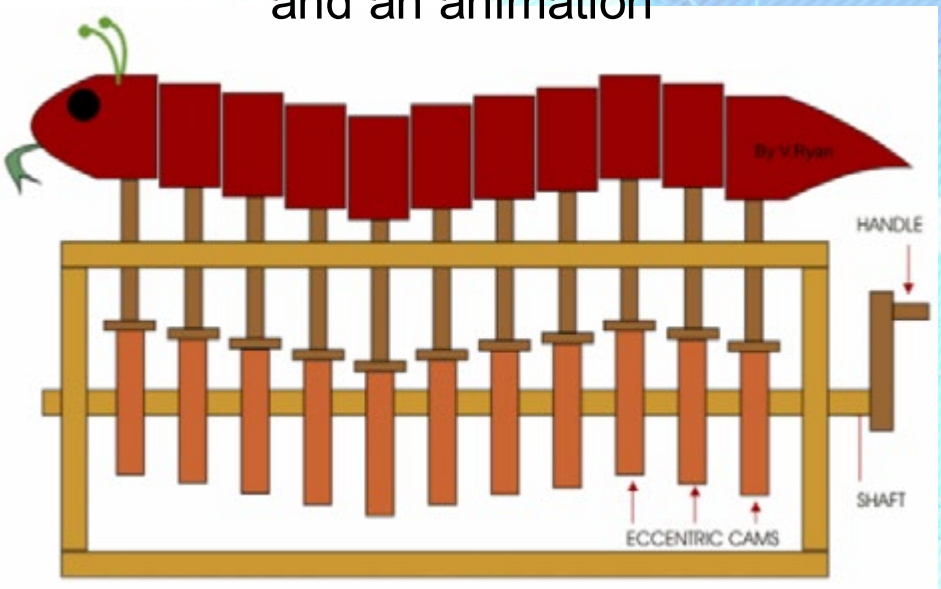
THE ECCENTRIC CAM
A PRACTICAL EXAMPLE

The mechanical toy based on a series of eccentric cams is seen below. As the handle is turned, the shaft and the cams rotate. Placed above the cams are a number of segments representing a 'snake'. As the cams rotate some of the flat followers are pushed upwards whilst others drop down. This gives the impression that the snake is moving.

Tap the image for further information and an animation



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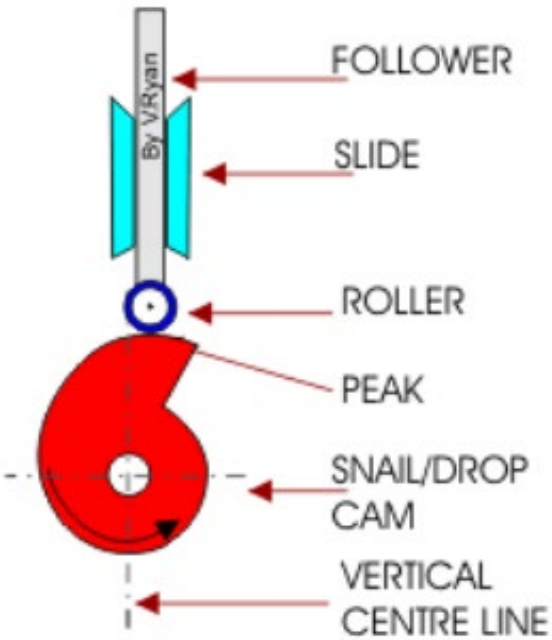
THE SNAIL / DROP CAM

A snail / drop cam, is used where the drop or fall of the follower must be sudden.

The example snail/drop cam below, rotates in an anticlockwise direction.

When rotating for one complete revolution the follower stays level for approximately the first 120 degrees The follower then rises slowly and then suddenly drops when it reaches and passes the peak.

Tap the image for further information and an animation



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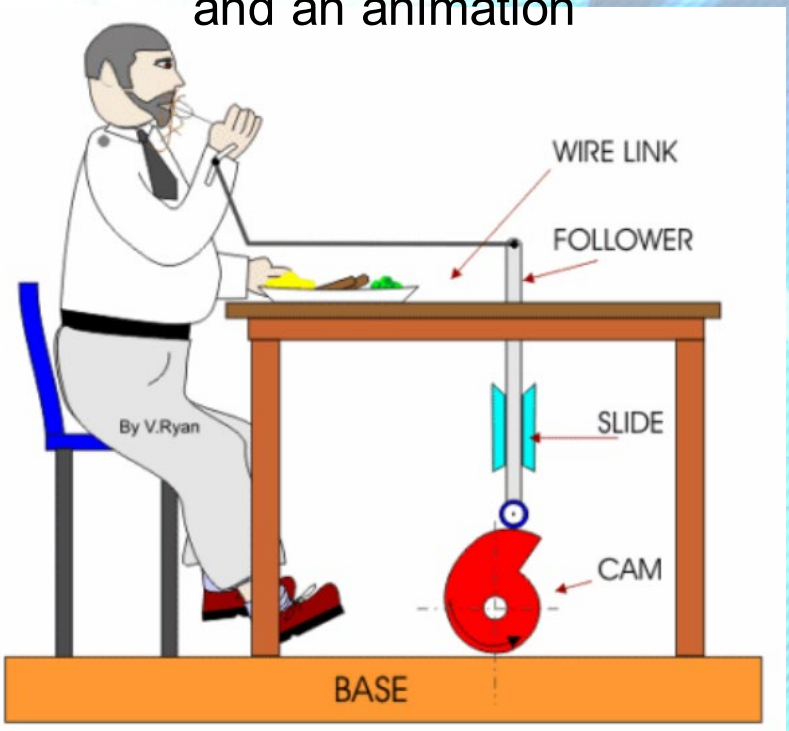
THE SNALE / DROP CAM
A PRACTICAL EXAMPLE

The mechanical toy seen below has a snail/drop cam as its main part. As the cam rotates, the follower rises and the wire link lifts the characters arm, Giving the appearance of the character lifting a fork full of food towards his mouth. As the cam continues to rotate the follower suddenly falls and also the characters arm and fork.

Tap the image for further information and an animation



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SWASH PLATE CAMS

A swash plate cam is usually a disc that rotates around a shaft. The disc is set at an angle so that the follower moves up and down as the disc rotates.
Swash cams can have a number of followers, that rise and drop as the disc rotates.

Tap the image for further information and an animation

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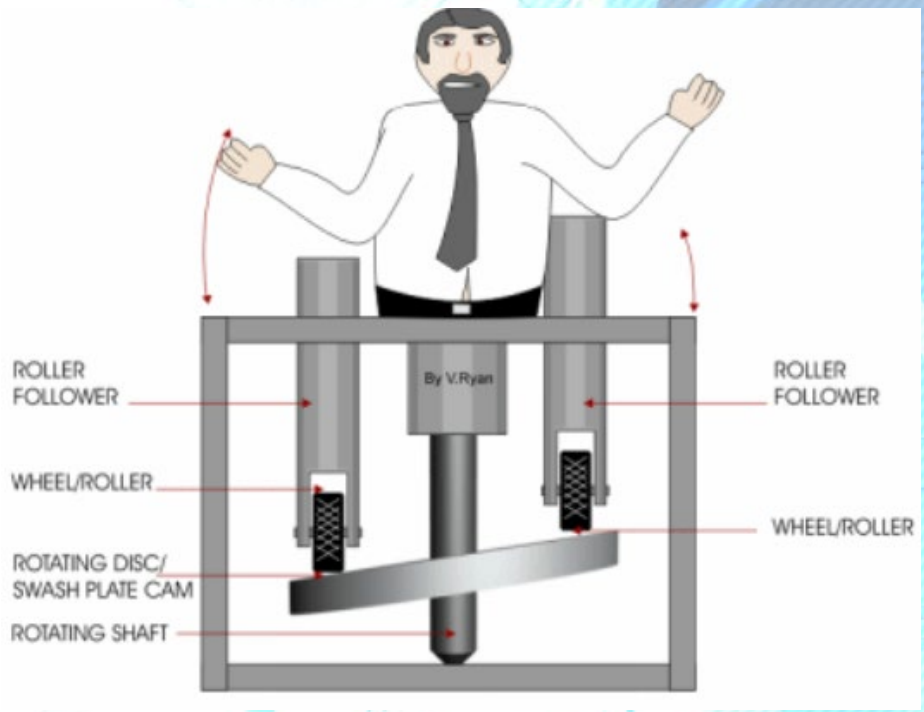
SWASH PLATE CAMS
A PRACTICAL EXAMPLE

Below is a dancing puppet. As the swash plate cam rotates, the two roller followers rise and fall. This motion makes the puppet look as if it is dancing / waving its arms. The cam mechanism would normally be 'boxed in' for safety reasons.

Tap the image for further information and an animation



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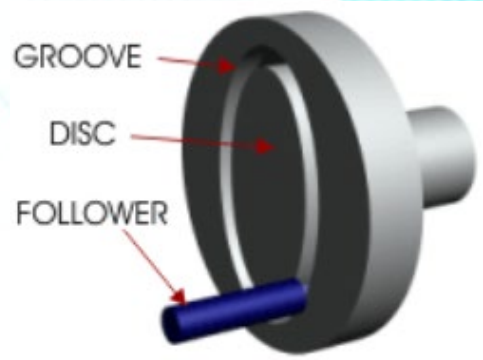
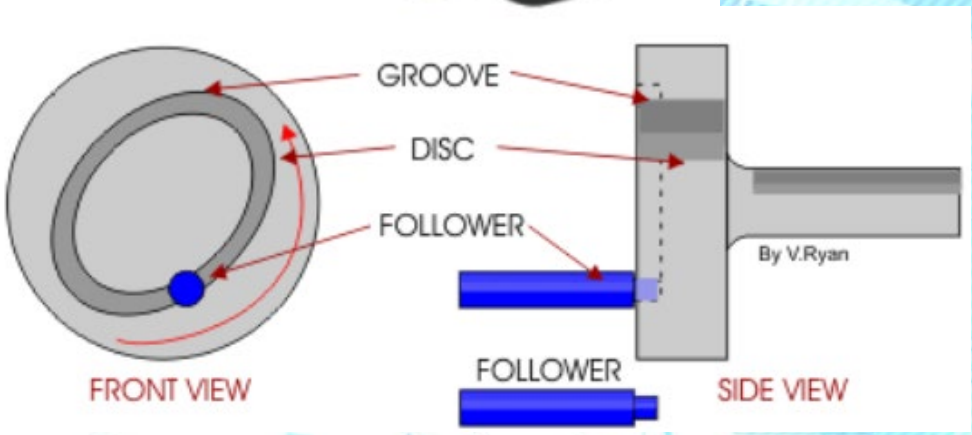
BOX CAMS

A box cam consists of a rotating disc. A groove is cut / milled into its surface to a specific depth (the profile). As the disc rotates, the follower 'follows' the path of the groove. Cams of this type are used in a range of machines, where a repetitive motion is needed.

Tap the image for further information and an animation





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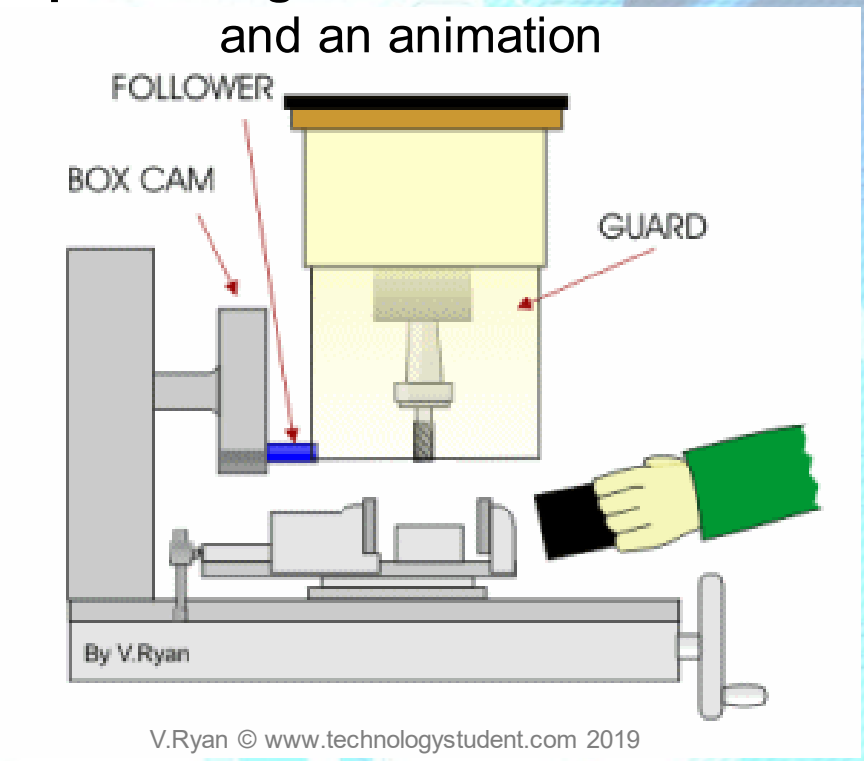
BOX CAMS
A PRACTICAL EXAMPLE

A practical application of a box cam can be seen opposite. The machine cuts slots in steel parts for car engines. The box cam and follower automatically operates the guard. The rotating box cam ensures that the follower lifts the guard after machining has taken place, so that a new part can be placed in the vice and machined.

Tap the image for further information and an animation



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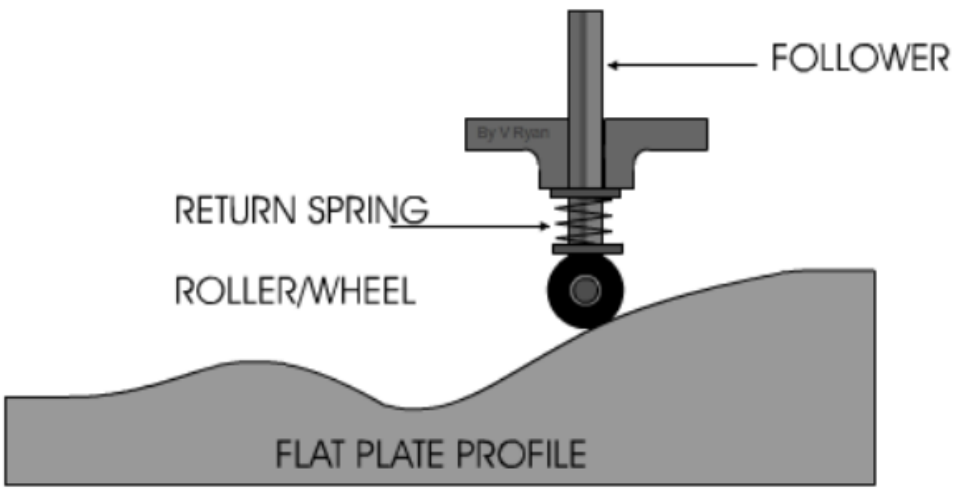
FLAT PLATE CAM / LINEAR CAM

As the flat plate cam profile moves to the left the follower moves up and down, matching the shape of the profile. The flat plate cam then reverses in the opposite direction and the follower drops and rises again. The follower has a 'return spring', that pushes the follower against the profile, ensuring that it always runs against it and follows the shape precisely.

Tap the image for further information and an animation



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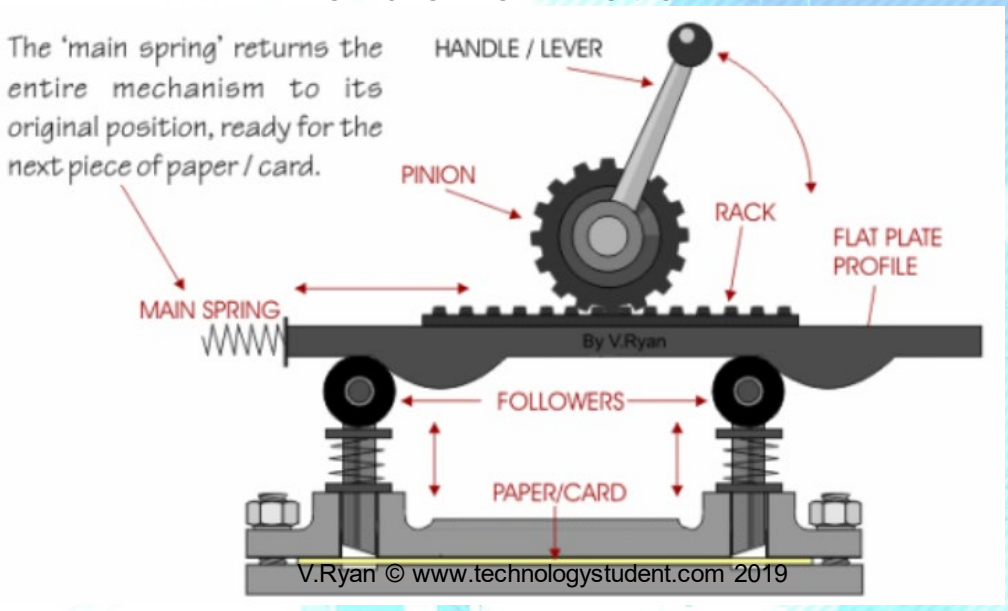
FLAT PLATE CAM / LINEAR CAM
A PRACTICAL EXAMPLE

The machine seen below is a mechanical paper punch. As the lever is pushed down, a gear system moves the flat plate profile to the left. In turn this pushes down the followers which punch two holes in a piece of paper / card. The edge of the flat plate cam can be shaped to give different vertical movements of the cam follower. Flat plate / linear cams are used frequently in machines that carry out the same repetitive movements.

Tap the image for further information and an animation



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CYCLINDRICAL / BARREL CAM

As the cylinder cam profile rotates the follower moves upwards. When the follower reaches the top, the cylinder cam rotates in the opposite direction and follower moves back down.

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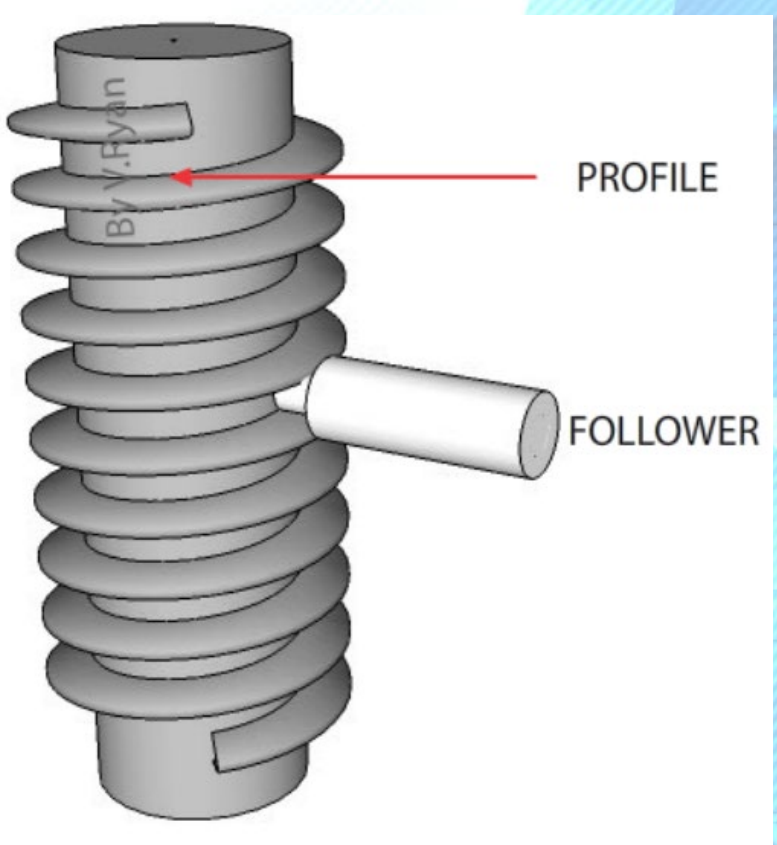

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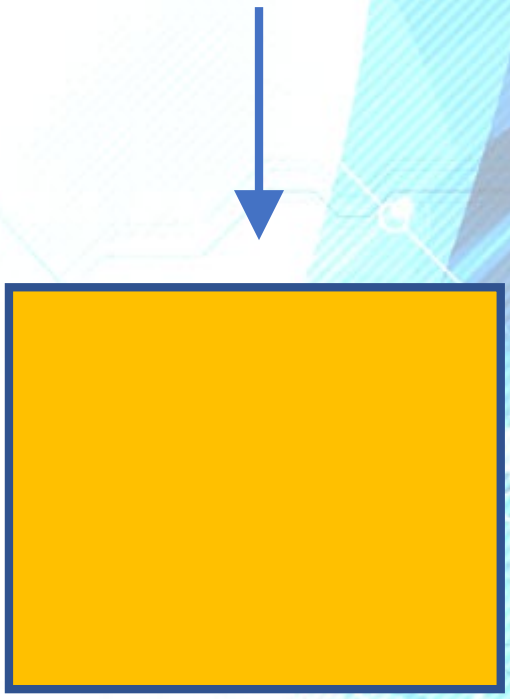
Tap on the link button below for detailed information on CAMS and numerous examples, projects and videos



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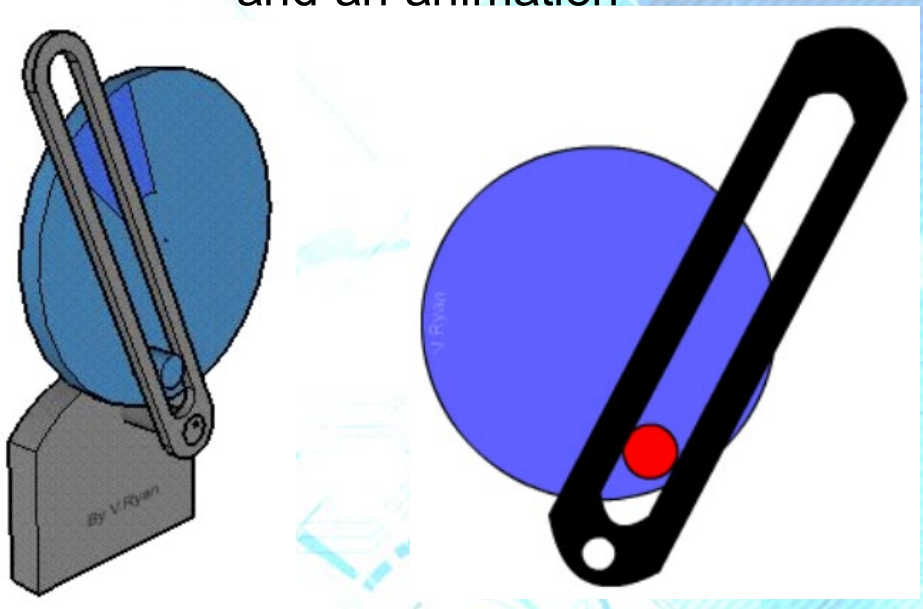
QUICK RETURN CRANK MECHANISM

A quick return mechanism such as the one seen below is used where there is a need to convert rotary motion into reciprocating motion. As the disc rotates the black slide moves forwards and backwards. Many machines have this type of mechanism and in the school workshop the best example is the shaping machine.

Tap the image for further information and an animation



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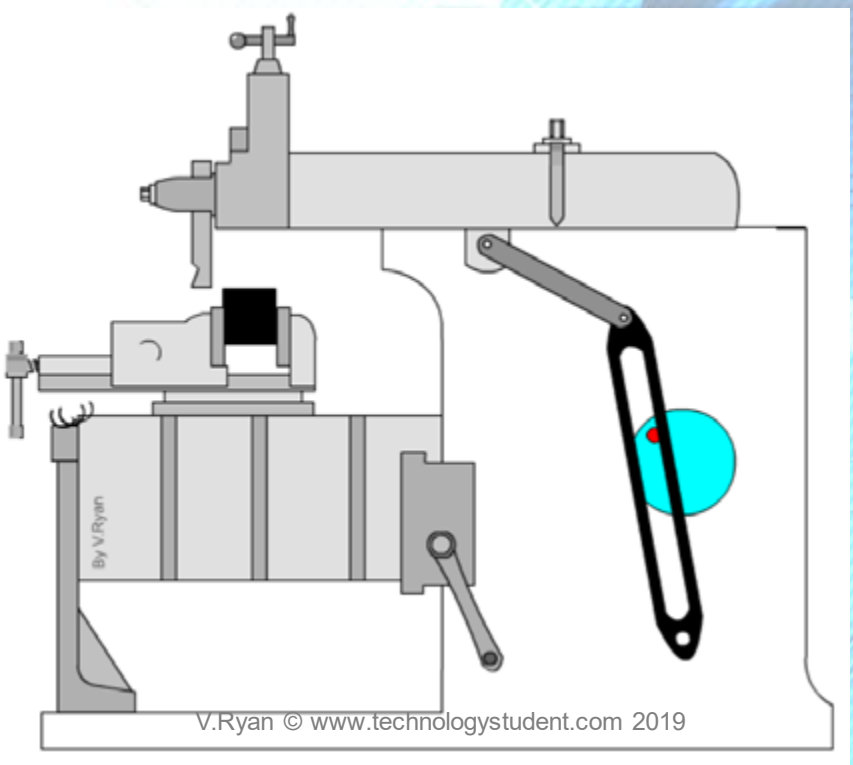
QUICK RETURN CRANK MECHANISM
A PRACTICAL APPLICATION

The reciprocating motion of the mechanism inside the shaping machine can be seen in the diagram. As the disc rotates the top of the machine moves forwards and backwards, pushing a cutting tool. The cutting tool removes the metal from work which is carefully bolted down.

Tap the image for further information and an animation



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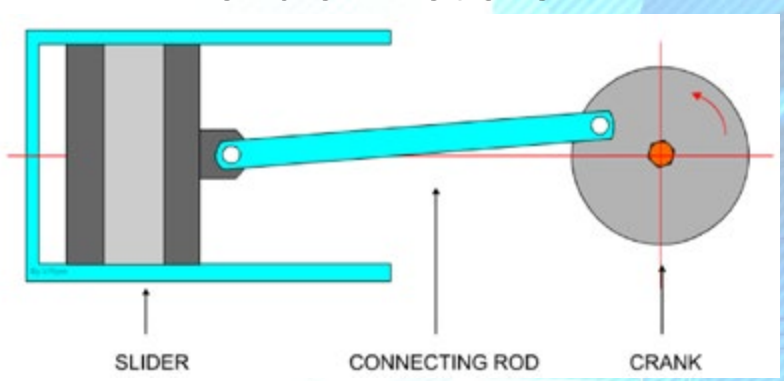
CRANK AND SLIDER MECHANISM

This mechanism is composed of three important parts: The crank which is the rotating disc, the slider which slides inside the tube and the connecting rod which joins the parts together. A good example is the drive mechanism on a steam train

Tap the images for further information and animations



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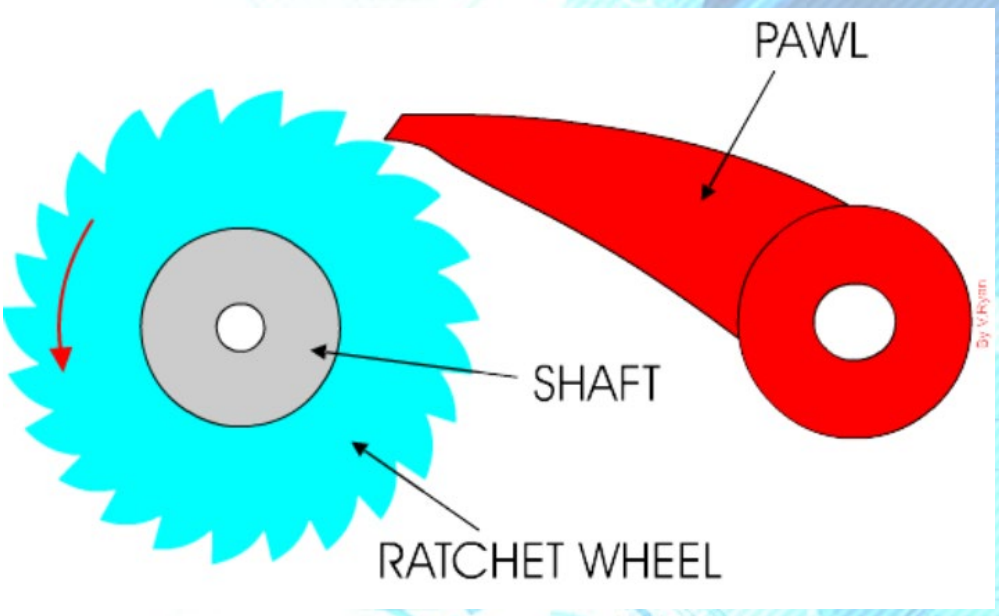
RATCHET MECHANISMS

A ratchet mechanism is based on a wheel that has teeth cut out of it and a pawl that follows as the wheel turns. As the ratchet wheel turns and the pawl falls into the 'dip' between the teeth. The ratchet wheel can only turn in one direction - in this case anticlockwise.

Tap the images for further information and animations



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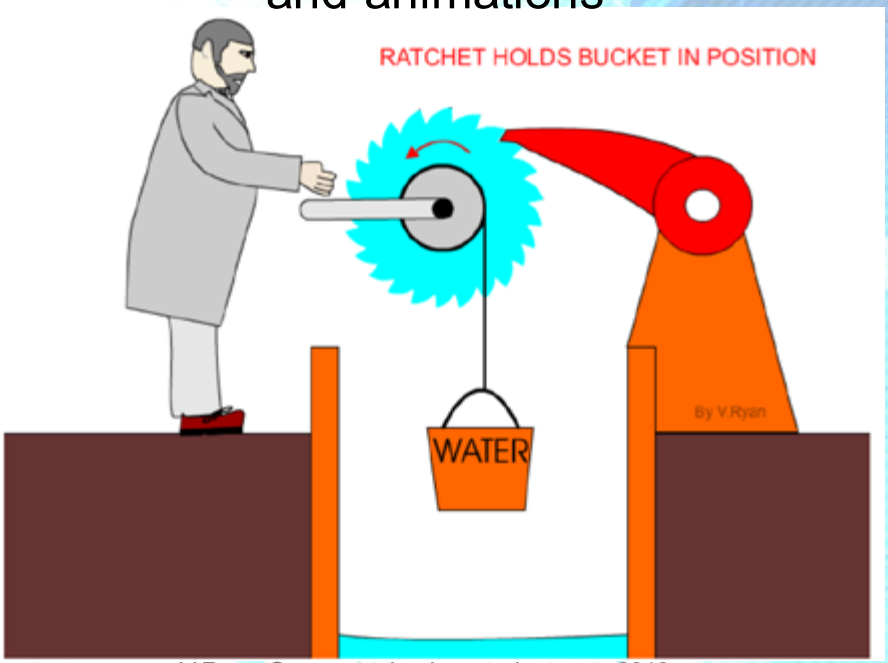
RATCHET MECHANISMS
A PRACTICAL APPLICATION

The water well seen below has a ratchet mechanism that allows the person to rotate the handle in an anticlockwise direction. The bucket of water is heavy and so the person can rest by taking his/her hands away from the handle. This is because the pawl has fallen into the 'dip' between the teeth and so the bucket cannot fall back into the well.

Tap the images for further information and animations



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CRANKS AND CRANK SHAFTS

Cranks have many uses and they can be found in some toys as part of a mechanism or in serious machinery such as car engines. Some cranks are attached to mechanisms that are difficult to turn or rotate. A crank shaft in a car engine is a good example.

Tap the image for further information and animations

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CRANKSHAFTS IN CARS AND MOTORCYCLES

The crankshaft of an engine, is the component that converts the up and down motion (reciprocating motion) created by the pistons, into rotary motion. The rotary motion ultimately turns the back wheel with the aid of a chain, propelling the motorcycle forwards.

Tap the image for further information and animations

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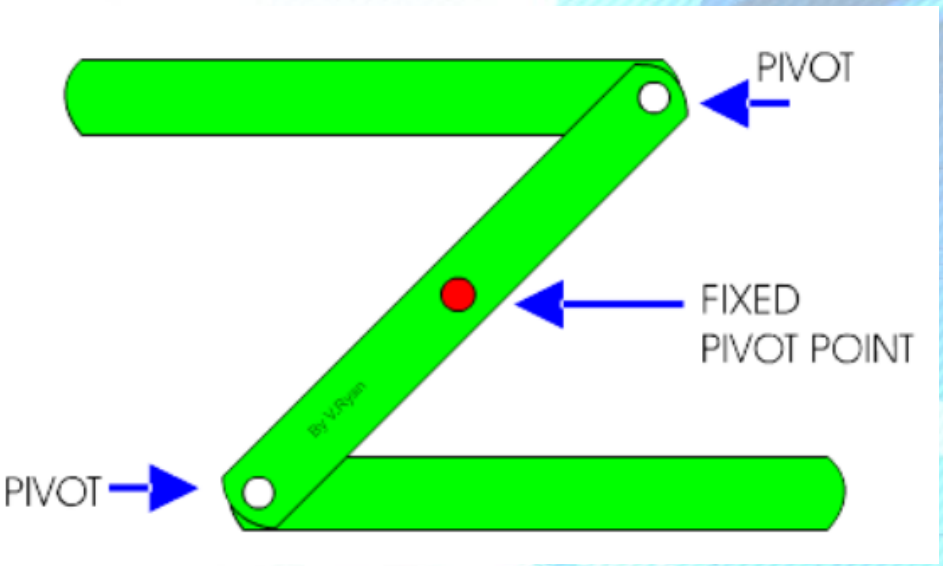
REVERSE MOTION LINKAGE

As the top rod moves to the left the bottom rod moves to the right. The bars move in opposite directions. Another way of describing this linkage is the direction of movement in one rod is reversed in the other rod. The fixed pivot is the centre of rotation.

Tap the images for further information and animations



Tap the image for a practical application of this linkage

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PARALLEL MOTION LINKAGE

As the large rod at the top of the diagram moves to the left the two small rods at the bottom move to the right. All the rods are parallel to each other.

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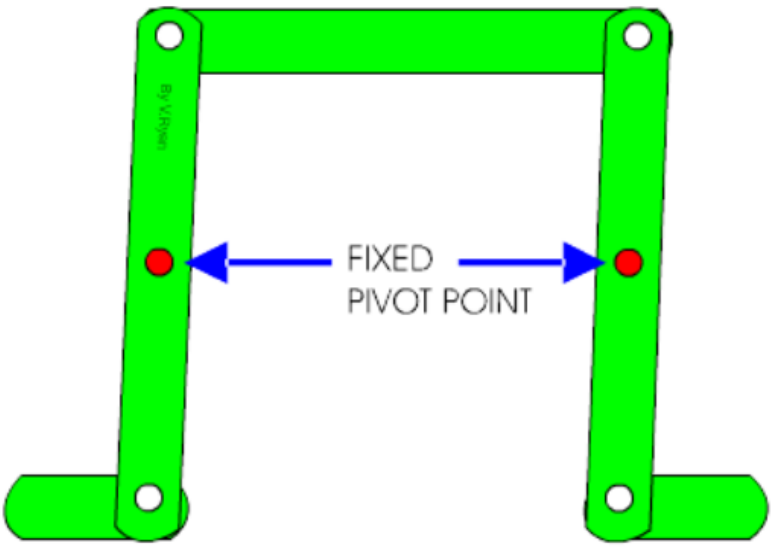

Tap the image for a practical application of this linkage

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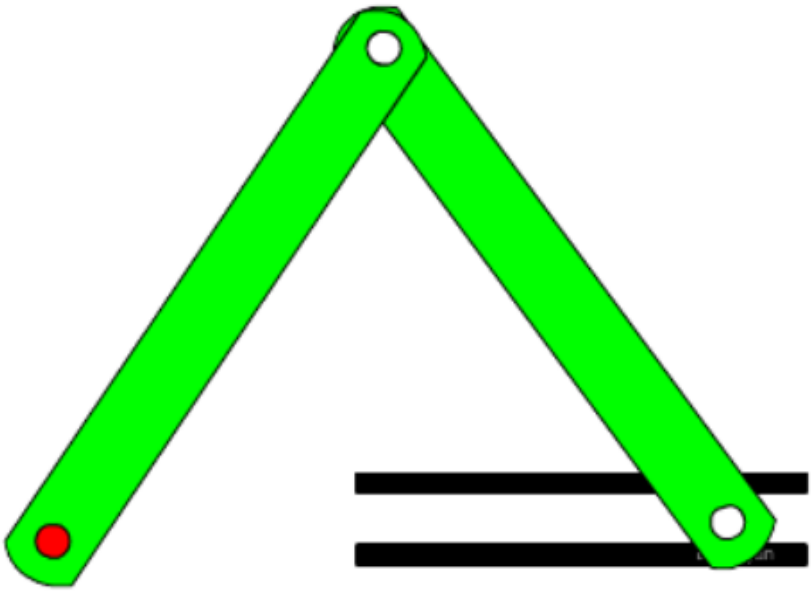
CRANK AND SLIDER LINKAGE

The rods move forwards and backwards in slider. The fixed pivot anchor the linkages to one place

Tap the image for further information and animation



Tap the image for a practical application of this linkage

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BELL CRANK LINKAGE

This linkage allows horizontal movement to be converted to vertical movement. It also works the opposite way round. A practical example of this is the brake mechanism on a bicycle.

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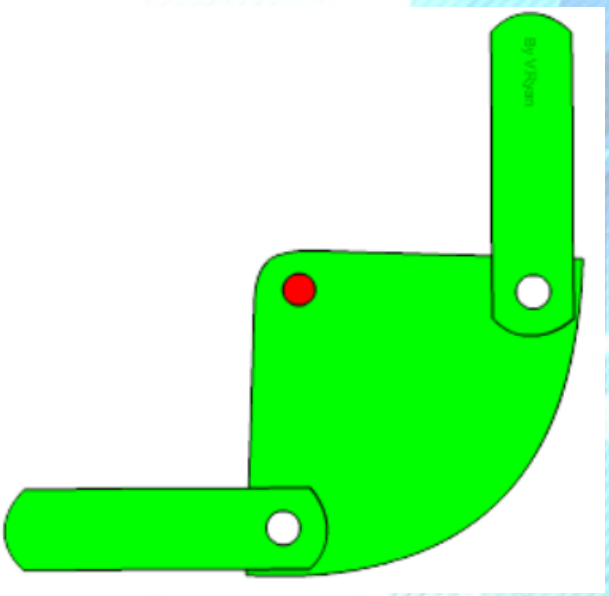

Tap the image for a practical application of this linkage

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TREADLE LINKAGE

A treadle linkage mechanism, converts rotary motion into an oscillating motion OR vice versa.

Treadle linkages are not new and can be found on machines, dating back hundreds of years.

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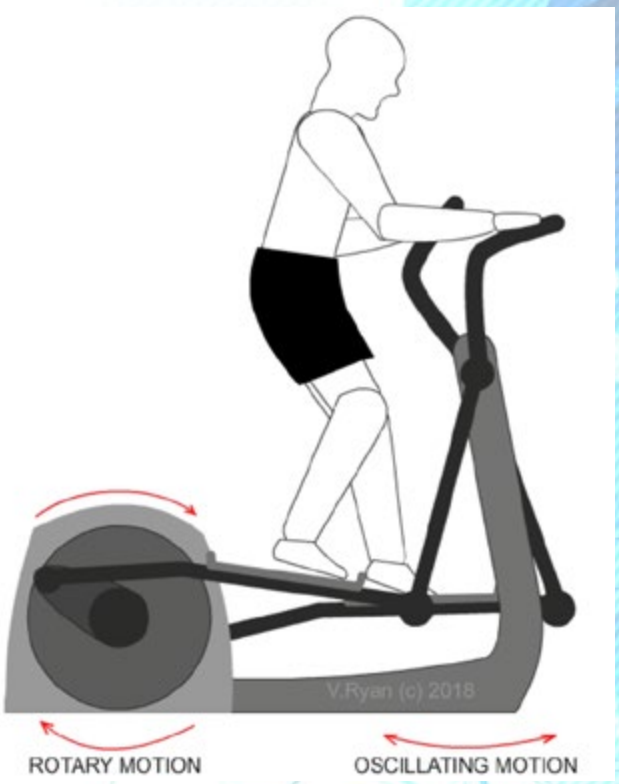

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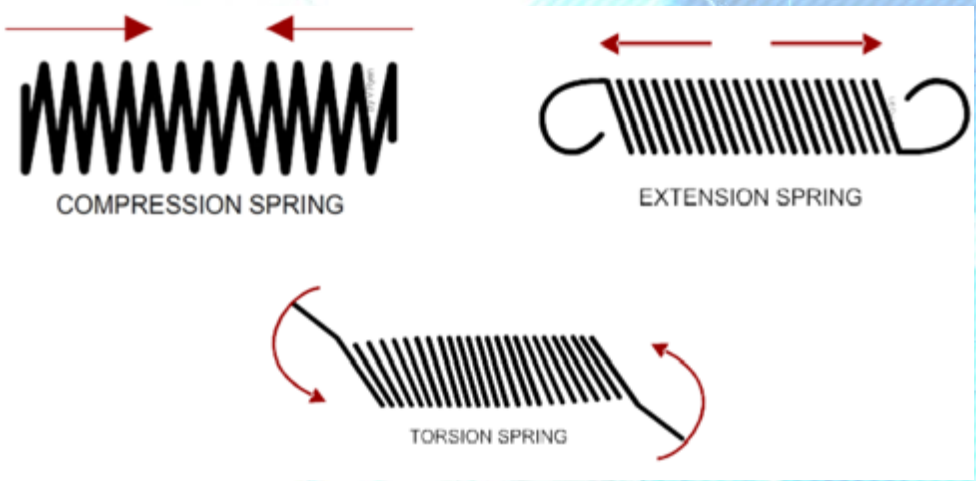
SPRINGS

Springs are available in a large variety of shapes and sizes.
Springs perform different actions. Some restrict stretching whilst others restrict compression.

Tap the image for further information and animations



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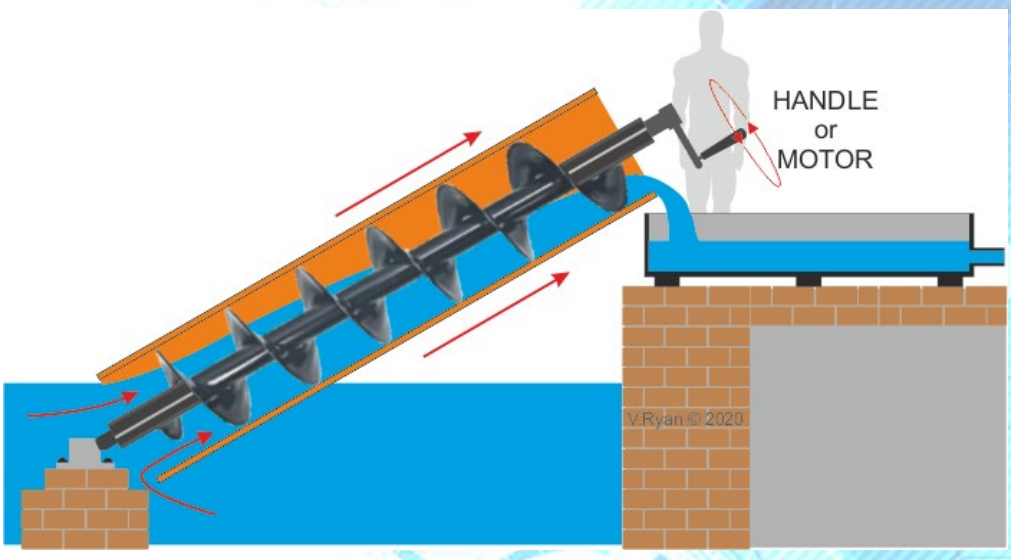
THE ARCHIMEDEAN SCREW
BASIC WORKING PRINCIPLE

The Archimedean Screw seen below, is enclosed within a cylinder. As the screw is turned by hand or by a motor (in modern times), the water moves upwards, until it spills from the top. This supplies water efficiently.

Tap on the image for further detail.



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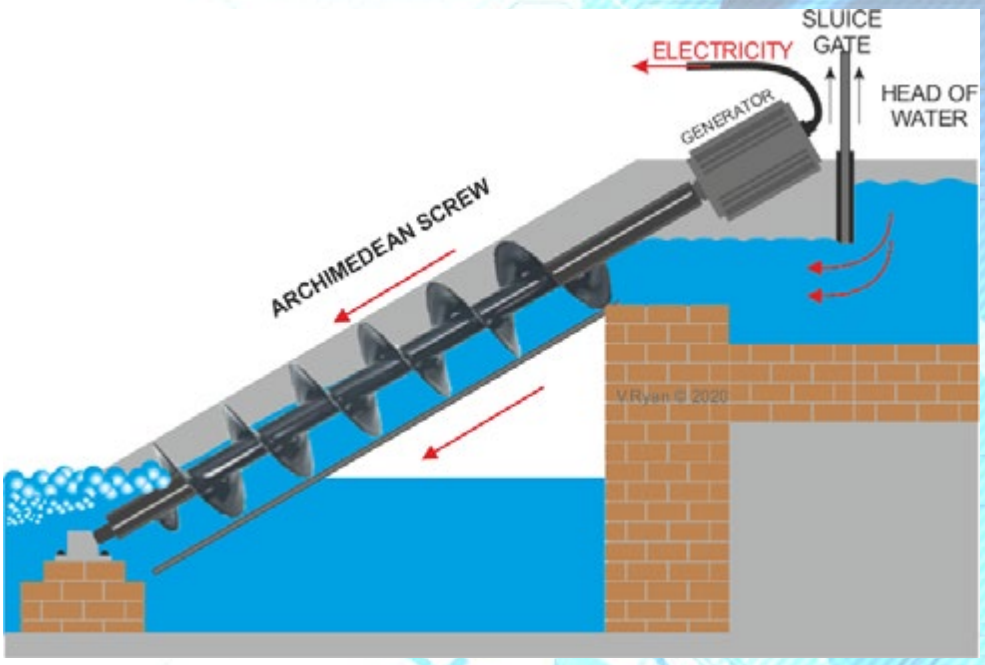
THE ARCHIMEDEAN SCREW ENERGY PRODUCTION

Modern Archimedean Screw systems can generate between 1Kw to 350Kw. Normally, Archimedean Screw systems are used to lift water up hill. However, to generate electricity, the water flows down hill, turning the screw. As the screw turns, a generator converts the movement to electricity.

Tap on the image for further detail.



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