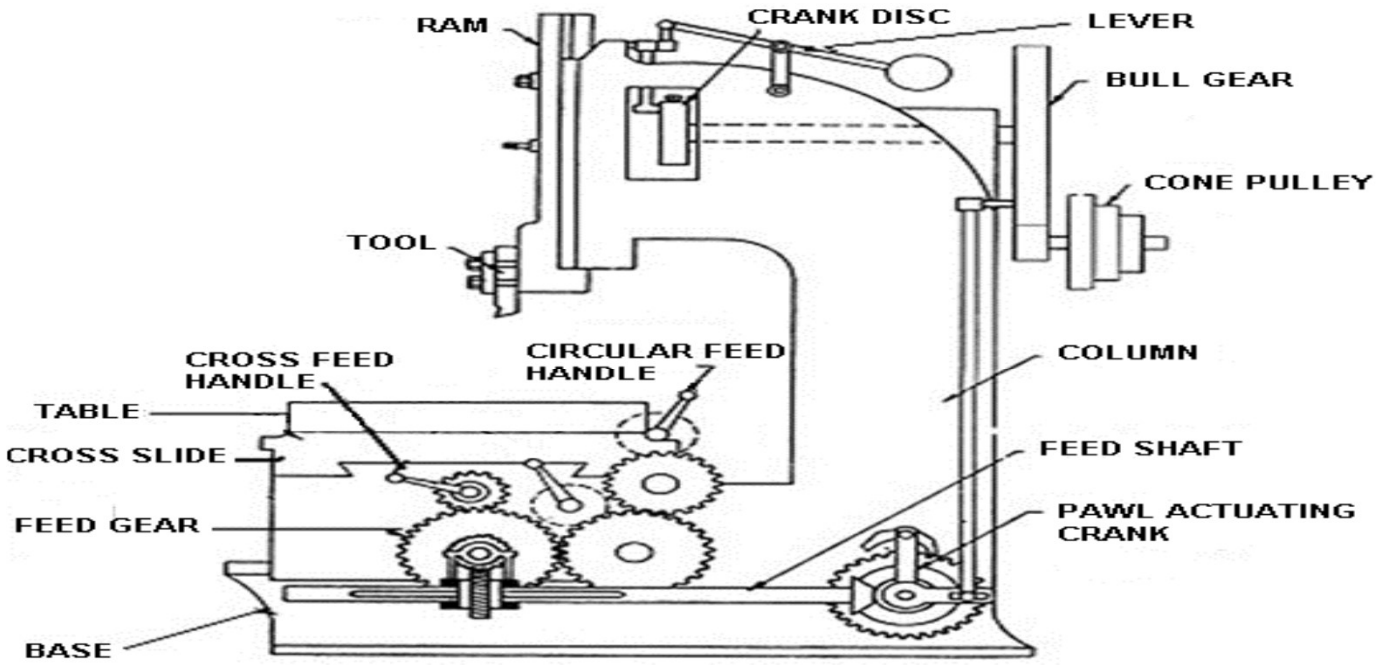
SLOTTING MACHINE

Slotting Machine

- The slotter or slotting machine is a reciprocating type of machine tool similar to a shaper or a planer.
- It may be considered as a vertical shaper.
- The chief difference between a shaper and a slotter is the direction of the cutting action.
- The machine operates in a manner similar to the shaper, however, the tool moves vertically rather than in a horizontal direction. The job is held stationary.
- The slotter has a vertical ram and a hand or power operated rotary table.

Principal Parts of a Slotting Machine



SLOTTER MACHINE

Principal Parts of Slotting Machine

❖**Base or Bed**

- The base is rigidly built to take up all the cutting forces and the entire load of the machine.
- The top of the bed is accurately finished to provide guideways on which the saddle is mounted.
- The guide ways are perpendicular to the column face.

❖**Column**

- The column is the vertical member which is cast integrally with the base and houses driving mechanism of the ram and feeding mechanism.
- The front vertical face of the column is accurately finished for providing ways in which the ram reciprocates.

Principal Parts of Slotting Machine Contd…

❖**Table**

- It holds the work piece and is adjustable in longitudinal and cross-wise directions.
- The table can be rotated about its centre.

❖**Hand wheels**

- They are provided for rotating the table and for longitudinal and cross traverse.

Principal Parts of Slotting Machine Contd…

❖**Saddle**

- The saddle is mounted upon the guideways and may be moved toward or away from the column either power or manual control to supply longitudinal feed to the work.
- The top face of the saddle is accurately finished to provide guideways for the cross-slide. These guideways are perpendicular to the guideways on the base.

❖**Cross-slide**

- The cross-slide is mounted upon the guideways of the saddle and maybe moved parallel to the face of the column.
- The movement of the slide may be controlled either by hand or power to supply cross feed.

Principal Parts of Slotting Machine Contd…

❖**Rotary Table**

- The rotary table is a circular table which is mounted on the top of the cross-slide.
- The table may be rotated by rotating a worm which meshes with a worm gear connected to the underside of the table.
- The rotation of the table may be effected either by hand or power.
- In some machines, the table is graduated in degrees that enable the table to be rotated for indexing or diving the periphery of a job in the equal number of parts.
- T-slots are cut on the top face of the table for holding the work by different clamping devices. The rotary table enables a circular or contoured surface to be generated on the workpiece.

Principal Parts of Slotting Machine Contd…

❖**Ram and Tool head Assembly**

- The ram is the reciprocating member of the machine mounted on the guideways of the column.
- It supports the tool at its bottom end on a tool head.
- A slot is cut on the body of the ram for changing the position of the stroke.
- In some machines, special type for tool holders is provided to relieve the tool during its return stroke.

Principal Parts of Slotting Machine Contd…

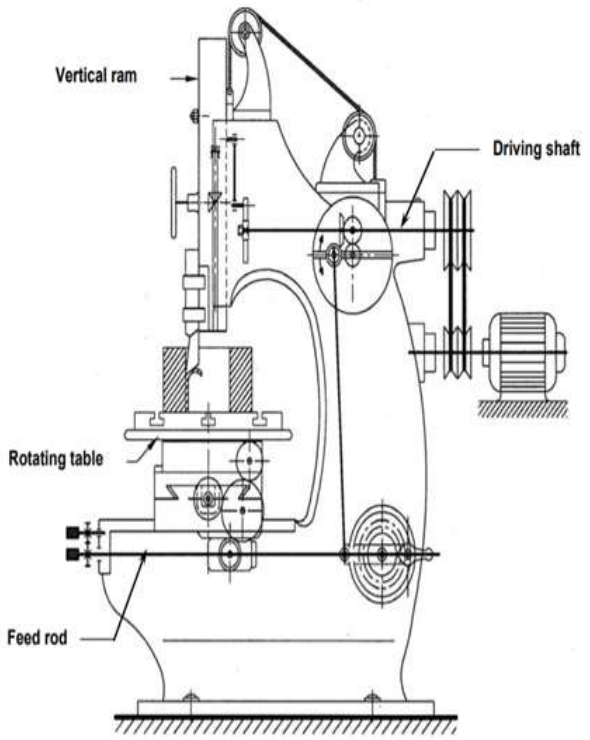
❖**Ram Drive Mechanism**

- A slotter removes metal during downward cutting stroke only whereas during upward return stroke no metal is removed. The reduce the idle return time quick return mechanism is incorporated in the machine. The usual types of ram drive mechanism are,

1. Whitworth quick return mechanism
2. Variable speed reversible motor drive mechanism
3. Hydraulic drive mechanism

Working Principle Of Slotting Machine

- The vertical slide holding the cutting tool is reciprocated by a crank and connecting rod mechanism, so here quick return effect is absent. The job, to be machined, is mounted directly or in a vice on the work table. Like shaping machine, in slotting machine also the fast cutting motion is imparted to the tool and the feed motions to the job.
- In slotting machine, in addition to the longitudinal and cross feeds, a rotary feed motion is also provided in the work table. The intermittent rotation of the feed rod is derived from the driving shaft with the help of a four bar linkage as shown in the kinematic diagram.

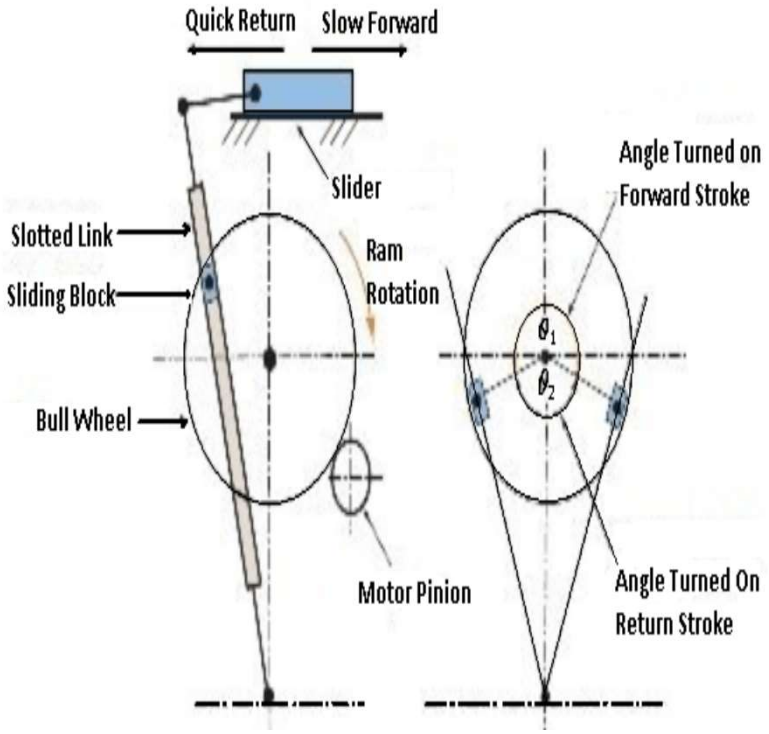


Working Principle Of Slotting Machine Contd…

- It is also indicated in Fig. how the intermittent rotation of the feed rod is transmitted to the lead scews for the two linear feeds and to the worm – worm wheel for rotating the work table.
- The working speed, i.e., number of strokes per minute, Ns may be changed, if necessary by changing the belt-pulley ratio or using an additional “speed gear box”, whereas, the feed values are changed mainly by changing the amount of angular rotation of the feed rod per stroke of the tool. This is done by adjusting the amount of angle of oscillation of the paul as shown in Fig.
- The directions of the feeds are reversed simply by rotating the tapered paul by 180º as done in shaping machines.

Whitworth Quick Return Mechanism

- The bull gear is mounted on a fixed hub at the rear end of the machine and it is rotated by a driving pinion from the motor. The driving plate is connected to the main shaft through the fixed hub. The main shaft is placed eccentrically with respect to the bull gear centre.
- The bull gear holds the crankpin with sliding block and slides in a driving plate. So that when the bull gear rotates, imparts rotary motion to the driving plate and shaft causing the disc to rotate at the end of the main shaft.



Whitworth Quick Return Mechanism Contd…

- The disc is connected to the lower end of the connecting rod eccentrically by means of a pin in a radial T-slots on the face of the disc, which converts the rotary motion of the disc into reciprocating motion of the ram connected to the top end of the connecting rod.

Types of Slotter Machine

❖**Puncher Slotter**

- The puncher slotter machine is a heavy, rigid machine designed for removal of a large amount of metal from large forgings or castings.
- The length of stroke of a puncher slotter is sufficiently large. It may be as long as 1800 to 2000 mm.
- The puncher slotter ram is usually driven by a spiral pinion meshing with the rack teeth cut on the underside of the ram.
- The pinion is driven by a variable speed reversible electric motor similar to that of a planer.
- The feed is also controlled by electrical gears.

Types of Slotter Machine Contd…

❖**Precision Slotter**

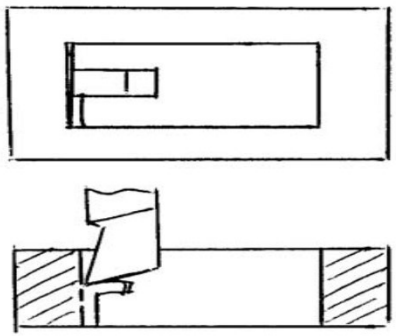
- The precision slotter machine is a lighter machine and is operated at high speeds.
- The machine is designed to take light cuts giving the accurate finish.
- Using special jigs, the machine can handle a number of works on a production basis.
- The precision slotter machines are also used for general purpose work and are usually fitted with Whitworth quick return mechanism.

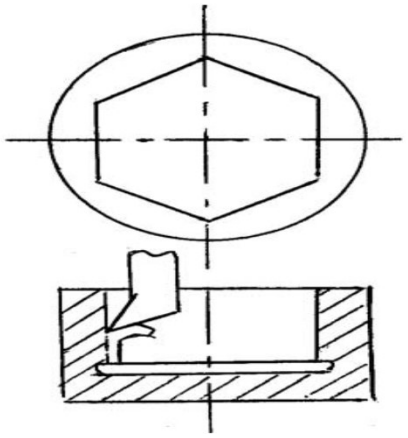
Slotting Machine Characteristics

- Vertical tool reciprocation with down stroke acting
- Longer stroke length
- Less strong and rigid
- An additional rotary feed motion of the work table
- Used mostly for machining internal surfaces.

Application of Slotting Machine

- Internal flat surfaces
- Enlargement and / or finishing non-circular holes bounded by a number of flat surfaces.
- Blind geometrical holes like hexagonal socket.





Application of Slotting Machine Contd…

- Internal grooves and slots of rectangular and curved sections.
- Internal keyways and splines, straight tooth of internal spur gears, internal curved surface of circular section, internal oil grooves etc. which are not possible in shaping machines.

Difference Between Shaping, Planing and Slotting Machine

SHAPER	PLANNER	SLOTTER
It can use light cuts and finer feed.	It can use heavier cuts and coarse feed.	It can use light cuts and improved feed.
Use for shaping greatly smaller jobs	Inevitable for much bigger jobs.	It use for make shots in smaller jobs.
Work is held at a stop and the tool on the ram is moved back with forth across the work.	The tool is fixed and the workpiece on the table movements back and forth under the tool.	The job is held at a stop and the tool on the ram is moved up and down across the work.
Driven use quick-return link mechanism.	Drive on the planer table is too by gear or by hydraulic means.	The rams are also crank-driven or hydraulically driven.
Uses single cutting tool at a time.	Some tools can cut at the same time.	Shaper uses single cutting tool at a time.
It is fewer rigid and fewer robust.	Enhanced rigidity that gives more precision on machined surfaces.	It is fewer rigid and fewer robust.
It is a light machine.	It is a heavyweight machine.	It is a light machine.

THANK YOU