

## Shaper, Slotter and Planning Machine Tool

The **shaper** also called **shaping machine**, is a reciprocating type of **machine tool** in which the ram moves the cutting tool backward and forward in a straight line to generate the flat surface. The flat surface may be horizontal, inclined or vertical.

### Working Principle and Operation

In a **shaper machine**, a single point cutting tool reciprocates over the stationary workpiece. The workpiece is rigidly held in a vice or clamped directly on the table. The tool is held in the tool head mounted on the ram of the machine. When the ram moves forward, cutting of material takes place. So, it is called cutting stroke. When the ram moves backward, no cutting of material takes place so called idle stroke. The time taken during the return stroke

is less as compared to forward stroke and this is obtained by quick return mechanism. The depth of cut is adjusted by moving the tool downward towards the workpiece.

### Principal Parts of a Shaper machine or shaper

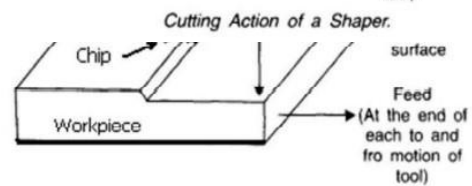
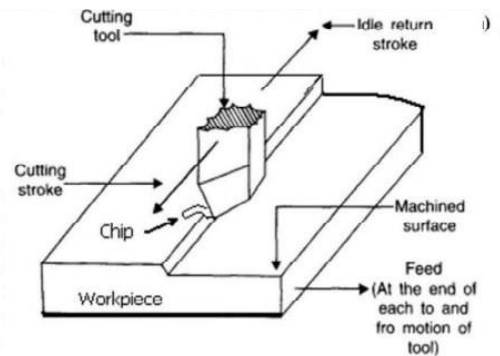
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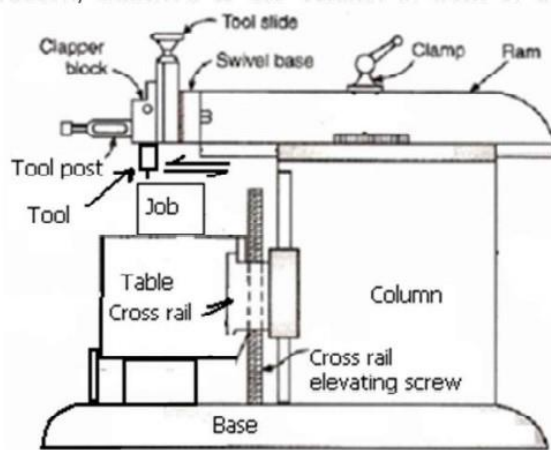
**Base:** It is a heavy and robust cast iron body which acts as a support for all other parts of the machine which are mounted over it.

**Column (Body or frame):** It is a box type iron body mounted upon the base. It acts as housing for the operating mechanism of the machine, electrical motor, **quick return mechanism**, cross rail and ram. On the top it is having two guide-ways on which the ram reciprocates.

**Cross-rail:** It is a heavy cast iron construction, attached to the column in front of the



Cutting Action of a Shaper.



Shaper Machine

machine & on the vertical guide-ways. It carries two mechanisms, one for elevating the table and the other for cross travel of the table.

**Table:** It is made of cast iron and used for holding the workpiece. T slots are provided on its top and sides for securing the work on to it. It slides along the cross rail to provide feed to the work.

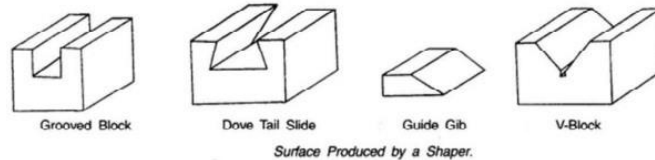
**Ram:** It reciprocates on the guide-ways provided above the column. It carries the tool head and mechanism for adjusting the stroke length.

**Tool Head:** It is attached to the front portion of the ram and is used to hold the tool rigidly. It also provides the vertical and angular movement to the tool for cutting.

**Vice:** It is job holding device and mounted on the table, job can be directly clamped to table also

**Operations** performed or Surfaces Produced by a Shaper machine

All type of flat surfaces which may be horizontal, inclined or vertical can be produced by shaper machine. Some of the products are shown in the figure.



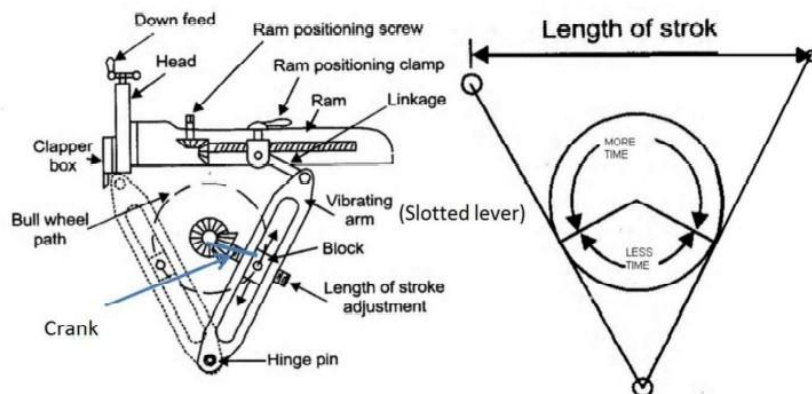
### Drive mechanisms

The reciprocating movement of ram and quick return mechanisms of the shaper machine is obtained by any of the following mechanisms:

1. Crank and slotted link mechanism
2. Whitworth quick return mechanism
3. Hydraulic

### Crank and slotted link mechanism

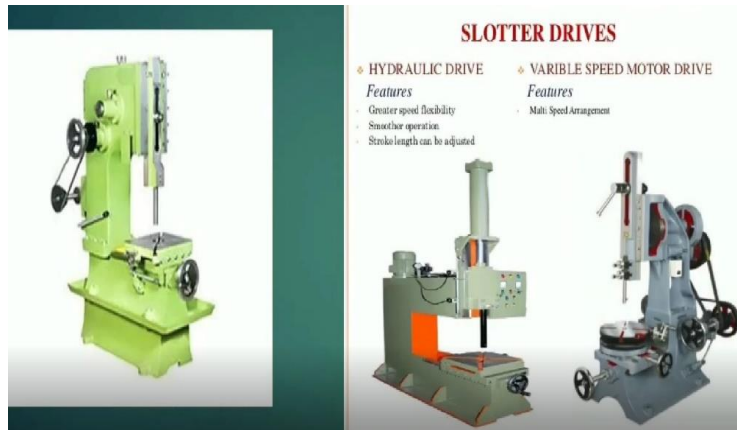
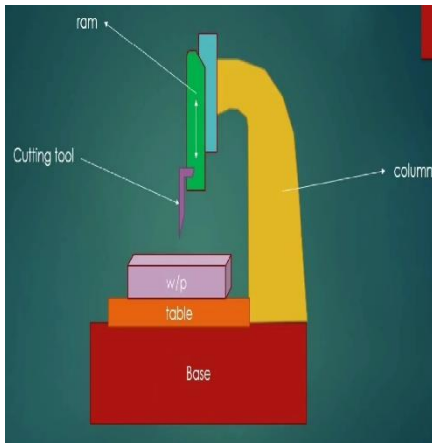
The figure shows the crank and slotted link mechanism, the motor drives the crank and crank is connected to sliding block, engaged in the slotted lever. The block can slide in the slotted lever.



Let us consider that the arm is in the right side end and the crank is rotating anti-clock-wise with uniform angular speed. The time taken by the arm or the slotted lever to reach towards left side will be more (Forward stroke), and the further rotation of the crank will bring the arm back in less time (Return stroke). The rotation angle for forward stroke is more and for return stroke is less.

## Slotting Machine

- ▶ The work is held stationary and the tool on the ram is moved up and down across the work.
- ▶ It is used for making slots in smaller jobs.
- ▶ Slotting is light machine.
- ▶ Can employ light cuts and finer feed.
- ▶ Shaper uses one cutting tool at a time.
- ▶ The rams are either crank-driven or hydraulically driven.
- ▶ It is less rigid.



## Planing Machine Tool

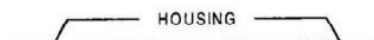
### Planer or planer machine

The planer (also called **planning machine**) is used to produce plane and flat surfaces by a single point cutting tool when the workpiece is **very large** in size. It is similar to shaper but its size is very large so used for producing flat surfaces on much larger work than a shaper. The major difference between shaper and planer is that in a planer, the tool remains stationary and the work reciprocates whereas in the shaper, the work remains stationary and the tool reciprocates.

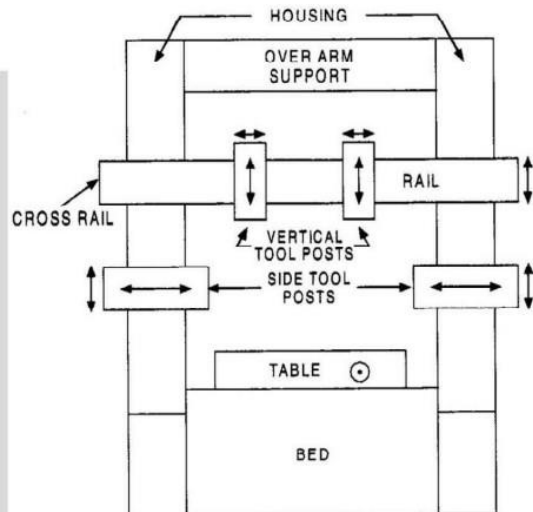
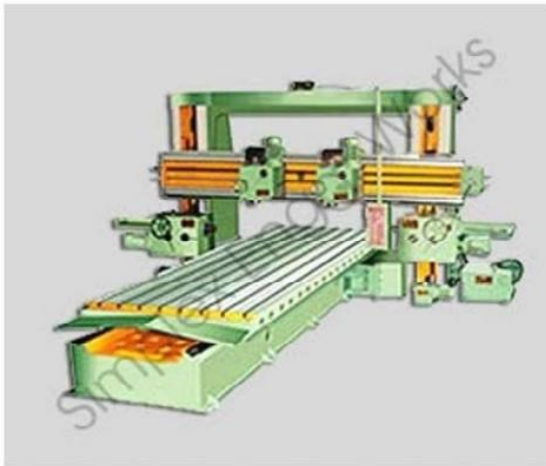
A **planer** consisting of following main parts is shown in block diagram below.

**Bed:** The bed of the planer is the heavy cast iron structure which provides the foundation for the machine and supports the housing and all other moving parts. At its top, V-type guide-ways are provided on which the table slides.

**Table:** It is a box type structure made up of cast iron. It reciprocates along the ways of the bed and supports the work. At its top, it carries longitudinal T-slots and holes to accommodate the clamping bolts and other devices.



devices.



**Housing or Columns:** The housings are rigid castings placed on each side of the bed in case of double housing planer and on one side only in case of open side planer. It carries cross rail elevating screws, vertical feed shaft and cross feed bar to transmit the power to the upper parts of the machine. The front face carries the vertical ways along which the cross rail slides up and down.

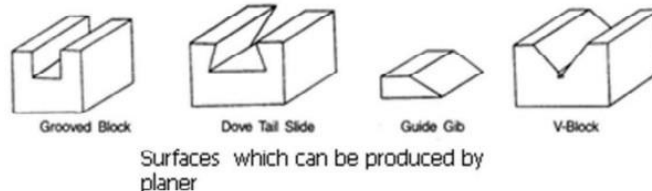
**Cross Rail:** The cross rail is mounted on the vertical guide-ways of the two housings. It can be raised or lowered. Accurately finished ways are provided at the front of the cross rail for two vertical tool heads.

**Tool Heads:** Two tool heads are mounted on the cross rail and the other two on the vertical columns. Each column carries one side tool head. All the four tool heads work independently, such that they can operate separately or simultaneously, as desired.

#### Operations performed on planer

The common operations performed on planer are as follows:

- a) Machining horizontal flat surfaces.
- b) Machining vertical flat surfaces.
- c) Machining angular surfaces, including dovetails.
- d) Machining different types of slots and grooves.
- e) Machining curved surfaces.
- f) Machining along contours.



### Differences between shaper and planer

PLANER	SHAPER
1. It is heavier, more rigid and costlier machine.	1. It is a comparatively lighter and cheaper machine.
2. It requires more floor area.	2. It requires less floor area.
3. It is adopted for large works.	3. It is used for small works.
4. Tool is fixed and work moves.	4. Work is fixed and the tool moves.
5. More than one cutting tool can be used at a time.	5. Only one cutting tool is used at a time.
6. The tools used on a planer are larger, heavier and stronger.	6. The tool used on a shaper is small in size as compared to planer tool.
7. Heavier feeds are applied.	7. Lighter feeds are applied.
8. It can take deep cut.	8. It cannot take deep cuts.
9. Work setting requires much of skill and time.	9. Work may be clamped easily and quickly.
10. Indexed feed is given to the tool during the idle stroke of the work table.	10. Indexed feed is given to the work during the idle stroke of the ram.

### References:

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3. Workshop Technology by Hajara Choudhary
4. Ghosh A. and Mallik A. K., Manufacturing Science, EWP Pvt. Ltd