

## Shaper Machine

Today we will study the shaper machine in detail. In this article, you will find everything about the shaper machine to the point. You need not go anywhere else. Let's embark:

### **1.) INTRODUCTION**

Shaper Machine is the simplest and the important machine used in the machine shops and the tool rooms since it is easy to set up and operate.

The shaper makes use of a single point tool that transverse the work and feed over the end of each stroke.

It is used mainly to machine flat or plane surfaces in horizontal, vertical, and angular planes.

The cutting tool is present on the shaper head to the ram. The ram imparts a reciprocating motion to the tool which operates over the shaper table.

### **2) DISCOVERER**

The shaper machine was invented by "Samuel Bentham" close to the end of the 17<sup>th</sup> century.

### **3) Brief History**

The basic structure of the Shaper machine came into existence in the 17<sup>th</sup> century (1793).

This was made by **Samuel Bentham**. Further, the machine was made more better and efficient by **James Nasmyth** in the 18<sup>th</sup> century (1836).

Shaper machines are best suited for a small job and for surface composed of straight-line elements and for batch production.

As time passed over the year's we now have the most advanced form of the shaper Machine which is a CNC shaper machine.

### **4) DEFINITION OF SHAPER MACHINE**

Shaper Machine is a type of single point cutting tool in which the tool moves back and forth over the workpiece through a 'quick return mechanism' or crank-slider mechanism for the machining of flat surfaces and to get all types of surface finishes.

The shaper machine is very well suited for machining complex configurations like deep internal slots and different contours.

Shaper machine is popular because of the ease of the operation, short setup time, and inexpensive tooling.

## **5) PRINCIPLE PARTS OF SHAPER MACHINE**

The principle parts of the shaper machine are as follows:

- i) RAM.
- ii) Shaper head (Tool Head assembly).
- iii) Column.
- iv) Base.
- v) Cross-rail.
- vi) Saddle and Table.

Now, let's discuss each of the parts in detail:

i) **Base:** The base is the part on which the whole machine is mounted. It is bolted to the floor with the help of the foundation bolts.

The base is made by casting and consists of cast iron so it has high compressive strength and good shock absorption capacity.

ii) **Column:** The column is mounted on the base and is made up of cast iron through the Casting process.

The column is a rigid structure to the ram on its top ways and on the front side of the column guideway is present through which the table can move in an upward and downward direction.

In one of the two vertical walls, a hole is made to inspect the driving mechanism of the ram located on it.

iii) **Shaper Head( Tool head Assembly)**

The tool head assembly is clamped firmly to the front of the ram and consists of a **tool slide, tool post, and clapper box.**

The head can be swiveled to any angle to enable the tool to take angular cuts. The other major parts of the shaper head are:

a) **Vertical tool feed screw:**

A vertical tool feed screw is used to give the vertical feed to the tool and the slide movement can be measured by means of a micrometer dial near to the handle.

b) **Clapper Box**

The tool holder rests in a clapper block which is fitted on the clapper box which in turn is fastened to the front of the shaper head slide.

The fit between the clapper block and the clapper box is very close, although the clapper box is free to pivot forward and on a **Taper Pin** which holds it in place.

This provision allows the tool to swing up on the return stroke, otherwise, the workpiece is likely to be badly gouged and the tool will get damaged by wear.

c) **Slotted Arc**

The clapper box is also provided with a slotted Arc in order to permit to be swiveled away from the work surface which is particularly important when vertical and angular cuts are made.

d) **Cross-rail:**

Cross rail is a box-like structure over which the saddle slides horizontally. The cross rail is maintained accurately square to the column.

For supporting it and guiding its movement, the front vertical ways of the column are machined properly.

e) **Saddle and Table**

The table is bolted on the saddle and is capable of moving in horizontal and vertical directions.

It can be fitted in the inclined positions also. The **Job** is **supported** on the table with the help of vise or some special fixtures.

**T-slots** are provided on the table for clamping vise, fixtures, and another tooling on it.

The shaper table may be either plain type with vertical and cross feed motions or universal type to permit machining of complex angles.

f) **Ram:**

Ram is a part of the shaper machine which carries the shaper head in its front, on which the cutting tool is mounted.

Ram moves in a reciprocating motion and slides on the accurately machined guideways on the top of the column.

It is designed to be as rigid as possible. A ram can change its position relative to the job by making use of a mechanism.

It gets its drive from the quick return mechanism which makes it faster while returning and slower while cutting.

g.) **Shaper gibs**

Gibs are provided in shaper due to:

- a) To adjust the saddle on the cross rail.
- b) To adjust the ram on the column.
- c) To adjust the tool head slide on the swivel head plate.

These gibs need to be adjusted properly and the bearing should be oiled properly.

**6) Principle of the working of the shaper:**

- For getting the best result from the shaper machine one should ensure the following things are properly done:

**Before working on the shaper make sure:**

- i) Worktable should be parallel with the movement of the Ram.
- ii) For vertical facing, the tool movement should be exactly perpendicular to the table.
- iii) For the proper setting of a job for parallelism use a dial indicator, try-square, and feeler gauges can be used.

**Working Principle:**

- Shaper is a very simple machine as it is easy to set-up and operates.
- The workpiece is placed on the table by making use of fixtures and other tools.
- The shaper machine makes use of a single-point cutting tool which is mounted in the ram.
- The cutting tool mounted on the ram moves in a reciprocating motion.
- During the forward motion of the cutting tool, it removes a small amount of material from the workpiece. It is called forwarding stroke.
- While returning back no metal is being removed from the job so it acts as idle stroke.
- The speed of the returning or idle stroke is more than the forward stroke this is mostly managed with the help of Quick Return Mechanism.

## 7) Types of Shaper Machine:

Shapers can be classified in the following ways:

A) Shapers are generally classified with respect to the plane of Ram which is:

- a) Vertical
- b) Horizontal.

Now let's discuss them in brief:

### A) Horizontal Machines

The horizontal machines can be further classified on the basis of the action of the cutting stroke as:

i) Push Cut ii) Draw cut.

#### i) Push Cut

- The Push cut type cuts in the forward stroke.
- Generally, most of the shaper machines are push cut type only.
- If the shaper machine is not specified then we assume it as Push Cut type Shaper.

#### ii) Draw Cut

- Draw cut type shaper is used where heavier cut is required with less strain on the work table.
- The Ram of the Draw cut type shaper machine is very heavy. B) The Horizontal shaper machine can further be classified as a **Universal or Plain Shaper Machine**.

In a universal type of shaper machine, angular cutting is possible because the table can be swiveled around the horizontal Axis.

c) Depending upon the accuracy and attachment the shaper can be classified as production or tool room type.

### B) Vertical shaper Machine

In vertical shaper machines, the cutting thrust acts directly on the table bed, and also there is no possibility of the deflection of the table.

Simple holding fixtures are needed as the cut tends to force the work onto the table.

For accurate positioning of the work, the table is provided with the movements in the three directions.

2) The shaper machine can be classified on the basis of the type of drive as:

- a) Crank Driven Shaper.
- b) Geared shaper or hydraulic shaper.

### 8) Important angles While using shaper Machine:

#### a) Clearance angles

Clearance Angle is an important part of the machining through a shaper machine. The following angles should be kept in mind for getting good results:

##### i) Front Clearance Angle:

A front clearance angle of 4 degrees should be provided.

If the front clearance angle is *high*, then the cutting edge will not be strong because of the lack of supporting metal, and the tool may dull quickly or crumble.

If the front cutting edge angle is *low*, then it will result in the spoiling of the workpiece, leaving behind grooves and tool marks.

##### ii) Side Clearance Angle:

Side clearance Angle of 2 or 3 degrees should be provided for a better machining process.

### 9) Power Transmission

The V-belt drive is used for the transmission of power from the electric motor to the shaper.

A gear train is used to provide the different speeds, or strokes per minute, of the ram.

The speed change levers are used for the shifting of the gears.

**Bull gear or Crank gear:** The last gear in the train of the gears is large gear and is called bull gear or Crank gear.

### 10) Specifications of shaper Machine

The size of the shaper machine is given by the maximum length of the stroke or ram movement.

Shaper machines are built-in a wide range of sizes varying from the 175 to 900 mm stroke.

These are provided with the power feeds ranging from 0.2 to 5mm per stroke. The down feed is mostly manual but sometimes power feed can be used.

Other specifications required for the Shaper machine are:

- i) Type of speed reduction.
- ii) Power input.
- iii) Type of drive.
- iv) Cutting to return stroke ratio.
- v) Number and amount of feeds.
- vi) weight.
- vii) Total floor Requirement.

### **11.) Lubrication of shaper machine**

The trouble-free operation and the life of any machine tool to a very great extent depend on the proper lubrication and strictly following the daily, weekly, and monthly oiling schedule recommended by the manufacturer.

- **Daily Lubrication**) The surface of the table and the sliding surface of the rail.ii) Clean and oil the sliding surface of the tool head and lubricate feed screw, bearing, and clapper pin.
- **Monthly Lubrication:** In monthly lubrication, we need to remove the plug and add oil to the feed box.

### **12.) Quick Return Mechanism of Ram:**

A shaper does the cutting operation only in the forward stroke, and backward stroke is idle, therefore wastage of time is there, I

In order to minimize this wastage of time, the return stroke should be completed as quickly as possible.

That's why its name is Quick Return Mechanism.

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