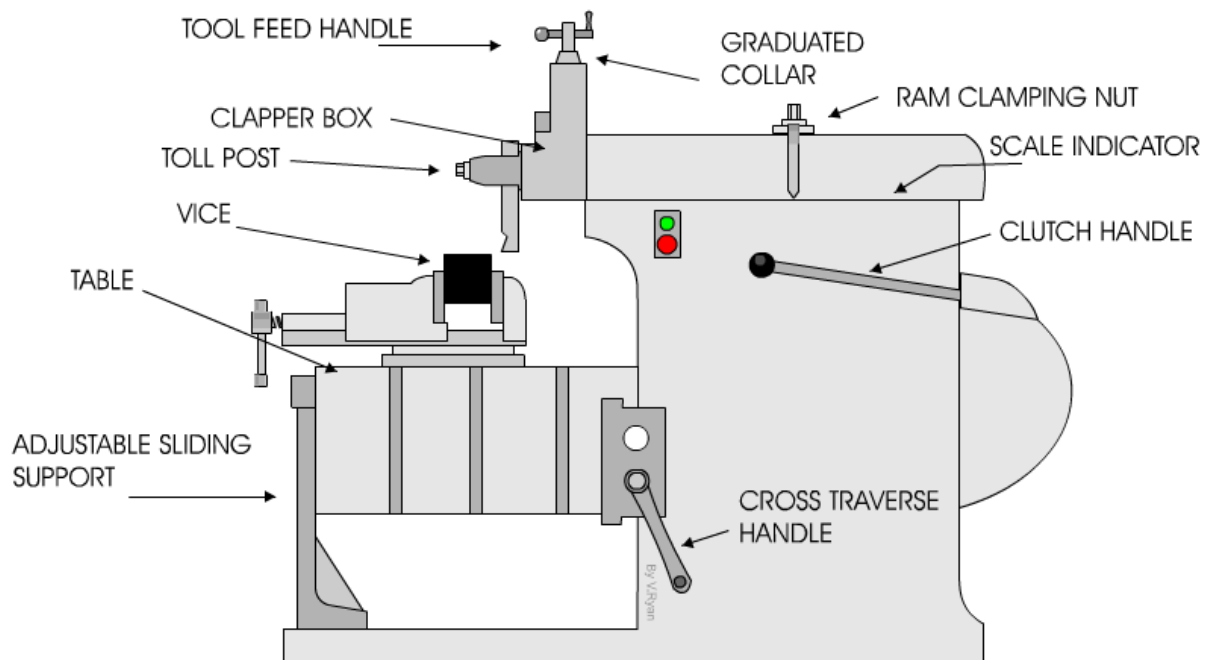


Lab Session: 01

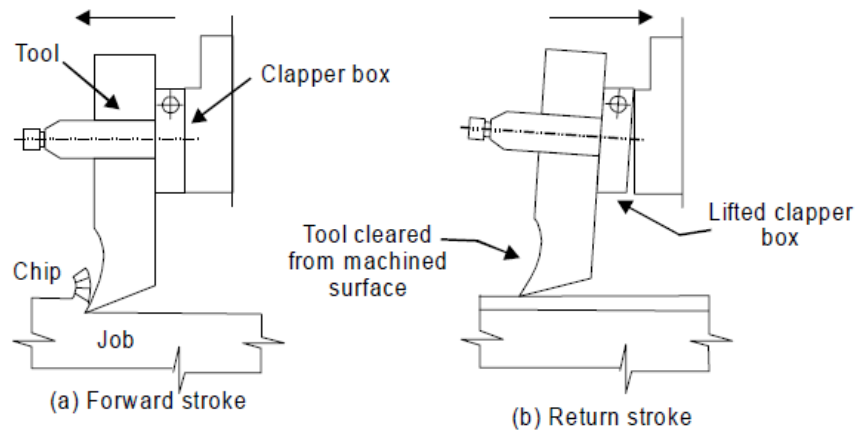
INTRODUCTION TO SHAPER MACHINE

Shaper is a reciprocating type of machine tool in which the ram moves the cutting tool backwards and forwards in a straight line. It is intended primarily to produce flat surfaces. These surfaces may be horizontal, vertical, or inclined. In general, the shaper can produce any surface composed of straight-line elements. Modern shapers can also generate contoured surface. A shaper is used to generate flat (plane) surfaces by means of a single point cutting tool similar to a lathe tool.



WORKING PRINCIPLE OF SHAPER

A single point cutting tool is held in the tool holder, which is mounted on the ram. The work piece is rigidly held in a vice or clamped directly on the table. The table may be supported at the outer end. The ram reciprocates and thus cutting tool held in tool holder moves forward and backward over the work piece. In a standard shaper, cutting of material takes place during the forward stroke of the ram. The backward stroke remains idle and no cutting takes place during this stroke. The feed is given to the work piece and depth of cut is adjusted by moving the tool downward towards the work piece. The time taken during the idle stroke is less as compared to forward cutting stroke and this is obtained by quick return mechanism. The cutting action and functioning of clapper box is shown in Figure during forward and return stroke.

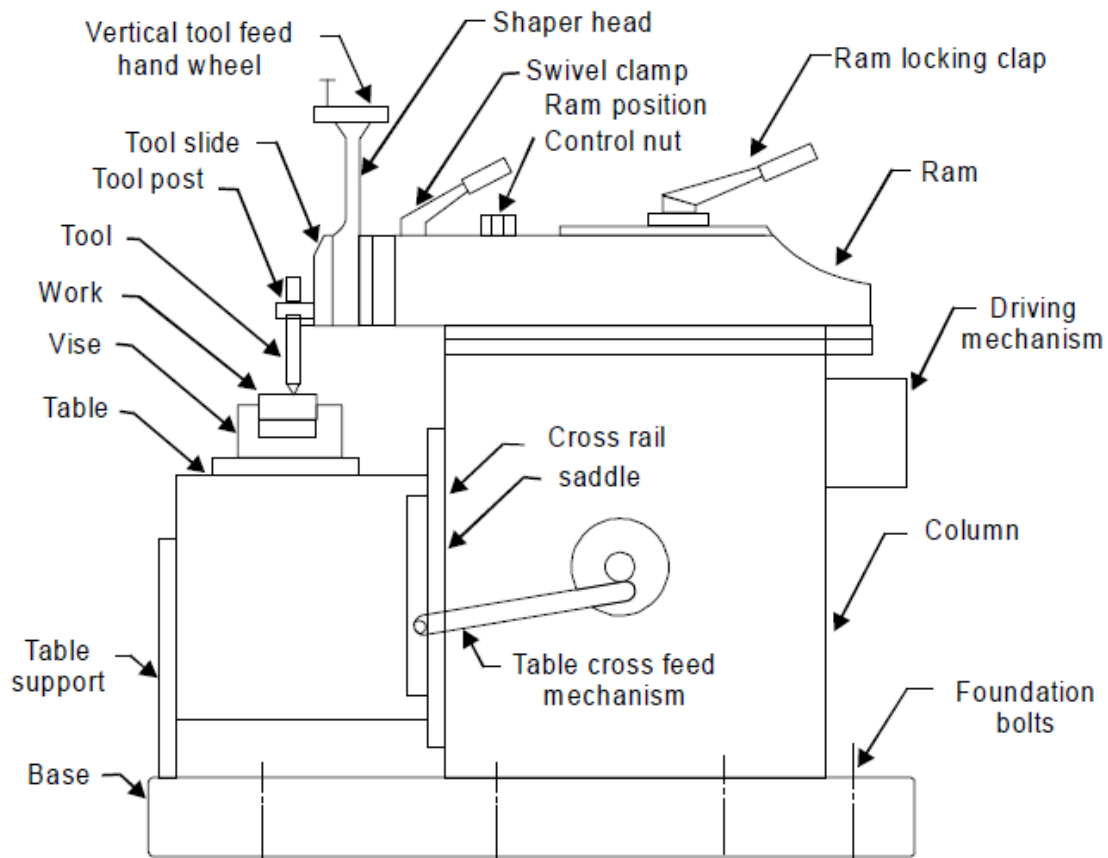


PRINCIPAL PARTS OF SHAPER

The main parts are given as under.

1. Base
2. Column
3. Cross-rail
4. Saddle
5. Table
6. Ram
7. Tool head
8. Clapper box
9. Apron clamping bolt
10. Down feed hand wheel
11. Swivel base degree graduations
12. Position of stroke adjustment hand wheel
13. Ram block locking handle
14. Driving pulley
15. Feed disc
16. Pawl mechanism
17. Elevating screw

Some of important parts are discussed as under.



Base: It is rigid and heavy cast iron body to resist vibration and takes up high compressive load. It supports all other parts of the machine, which are mounted over it. The base may be rigidly bolted to the floor of the shop or on the bench according to the size of the machine.

Column: The column is a box shaped casting mounted upon the base. It houses the ram-driving mechanism. Two accurately machined guide ways are provided on the top of the column on which the ram reciprocates.

Cross rail: Cross rail of shaper has two parallel guide ways on its top in the vertical plane that is perpendicular to the rail axis. It is mounted on the front vertical guide ways of the column. It consists mechanism for raising and lowering the table to accommodate different sizes of jobs by rotating an elevating screw which causes the cross rail to slide up and down on the vertical face of the column. A horizontal cross feed screw is fitted within the cross rail and parallel to the top guide ways of the cross rail. This screw actuates the table to move in a crosswise direction.

Saddle: The saddle is located on the cross rail and holds the table on its top. Crosswise movement of the saddle by rotation the cross feed screw by hand or power causes the table to move sideways.

Table: The table is a box like casting having T-slots both on the top and sides for clamping the work. It is bolted to the saddle and receives crosswise and vertical movements from the saddle and cross rail.

Ram: It is the reciprocating part of the shaper, which reciprocates on the guide ways provided above the column. Ram is connected to the reciprocating mechanism contained within the column.

Tool head: The tool head of a shaper performs the following functions-

- It holds the tool rigidly,
- It provides vertical and angular feed movement of the tool, and
- It allows the tool to have an automatic relief during its return stroke.

The various parts of tool head of shaper are apron clamping bolt, clapper box, tool post, down feed, screw micrometer dial, down feed screw, vertical slide, apron washer, apron swivel pin, and swivel base. By rotating the down feed screw handle, the vertical slide carrying the tool gives down feed or angular feed movement while machining vertical or angular surface. The amount of feed or depth of cut may be adjusted by a micrometer dial on the top of the down feed screw. Apron consisting of clapper box, clapper block and tool post is clamped upon the vertical slide by a screw. The two vertical walls on the apron called clapper box houses the clapper block, which is connected to it by means of a hinge pin. The tool post is mounted upon the clapper block. On the forward cutting stroke the clapper block fits securely to the clapper box to make a rigid tool support. On the return stroke a slight frictional drag of the tool on the work lifts the block out of the clapper box a sufficient amount preventing the tool cutting edge from dragging and consequent wear. The work surface is also prevented from any damage due to dragging.

SHAPER MECHANISM

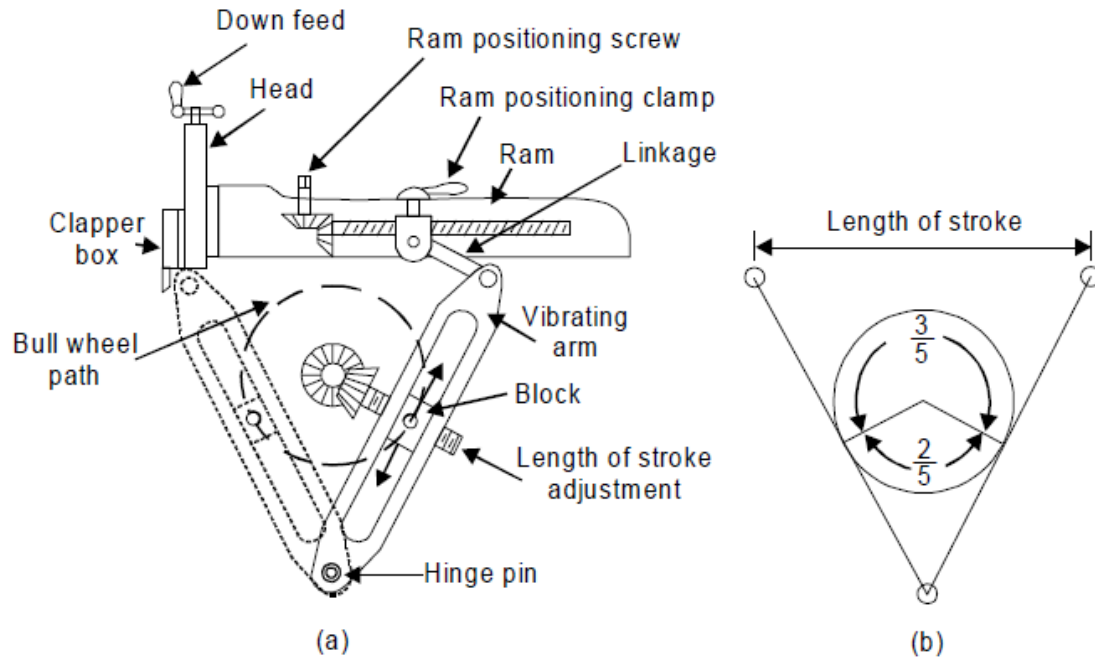
In a shaper, rotary motion of the drive is converted into reciprocating motion of the ram by the mechanism housed within the column or the machine. In a standard shaper metal is removed in the forward cutting stroke, while the return stroke goes idle and no metal is removed during this period. The shaper mechanism is so designed that it moves the ram holding the tool at a comparatively slower speed during forward cutting stroke, whereas during the return stroke it allow the ram to move at a faster speed to reduce the idle return time. This mechanism is known as quick return mechanism. The reciprocating movement of the ram and the quick return mechanism of the machine are generally obtained by anyone of the following methods:

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

The crank and slotted link mechanism is discussed as under.

Crank and Slotted Link Mechanism

In crank and slotted link mechanism, the pinion receives its motion from an individual motor or overhead line shaft and transmits the motion or power to the bull gear. Bull gear is a large gear mounted within the column. Speed of the bull gear may be changed by different combination of gearing or by simply shifting the belt on the step cone pulley. A radial slide is bolted to the center of the bull gear. This radial slide carries a sliding block into which the crank pin is fitted. Rotation of the bull gear will cause the bush pin to revolve at a uniform speed. Sliding block, which is mounted upon the crank pin is fitted within the slotted link. This slotted link is also known as the rocker arm. It is pivoted at its bottom end attached to the frame of the column. The upper end of the rocker arm is forked and connected to the ram block by a pin. With the rotation of bull gear, crank pin will rotate on the crank pin circle, and simultaneously move up and down the slot in the slotted link giving it a rocking movement, which is communicated to the ram. Thus the rotary motion of the bull gear is converted to reciprocating motion of the ram.



REFERENCES

- Singh, Rajender (2006), *Introduction to basic manufacturing processes and workshop technology*, New Delhi: India.
- Retrieved from <http://www.technologystudent.com/equip1/shape1.htm>

CLASSIFICATION OF SHAPER MACHINE

Shapers are classified under the following headings:

- (1) According to the type of mechanism used for giving reciprocating motion to the ram
 - a) Crank type
 - b) Geared type
 - c) Hydraulic type
- (2) According to the type of design of the table:
 - a) Standard shaper
 - b) Universal shaper
- (3) According to the position and travel of ram:
 - a) Horizontal type
 - b) Vertical type
 - c) Traveling head type
- (4) According to the type of cutting stroke:
 - a) Push type
 - b) Draw type.

Crank Shaper: This is the most common type of shaper. It employs a crank mechanism to change circular motion of a large gear called “bull gear” incorporated in the machine to reciprocating motion of the ram. The bull gear receives power either from an individual motor or from an overhead line shaft if it is a belt-driven shaper.

Geared Shaper: Geared shaper uses rack and pinion arrangement to obtain reciprocating motion of the ram. Presently this type of shaper is not very widely used.

Hydraulic Shaper: In hydraulic shaper, reciprocating motion of the ram is obtained by hydraulic power. For generation of hydraulic power, oil under high pressure is pumped into the operating cylinder fitted with piston. The piston end is connected to the ram through piston rod. The high pressure oil causes the piston to reciprocate and this reciprocating motion is transferred to the ram of shaper. The important advantage of this type of shaper is that the cutting speed and force of the ram drive are constant from the very beginning to the end of the cut.

Standard Shaper: In standard shaper, the table has only two movements, horizontal and vertical, to give the feed.

Universal Shaper: A universal shaper is mostly used in tool room work. In this type of shaper, in addition to the horizontal and vertical movements, the table can be swiveled about an axis parallel to the ram ways, and the upper portion of the table can be tilted about a second horizontal axis perpendicular to the first axis.

Horizontal Shaper: In this type of shaper, the ram holding the tool reciprocates in a horizontal axis.

Vertical Shaper In vertical shaper, the ram reciprocates in a vertical axis. These shapers are mainly used for machining keyways, slots or grooves, and internal surfaces.

Travelling Head Shaper In this type of shaper, the ram while it reciprocates, also moves crosswise to give the required feed.

Push Type Shaper This is the most general type of shaper used in common practice, in which the metal is removed when the ram moves away from the column, i.e. pushes the work.

Draw Type Shaper In this type of shaper, the cutting of metal takes place when the ram moves towards the column of the machine, i.e. draws the work towards the machine. The tool is set in a reversed direction to that of a standard shaper.

DIFFERENCE BETWEEN SHAPER AND PLANAR

S.No.	SHAPER	PLANAR
1.	The work is held stationary and the cutting tool on the ram is moved back and forth across the work.	In a planer, the tool is stationary and the work piece travels back and forth under the tool.
2.	It is used for shaping much smaller jobs.	A planer is meant for much larger jobs than can be undertaken on a shaper. Jobs as large as 6 meter wide and twice as long can be machined on a planer.
3.	A shaper is a light machine.	It is a heavy duty machine.
4.	Shaper can employ light cuts and finer feed.	Planer can employ heavier cuts and coarse feed.
5.	A shaper uses one cutting tool at a time.	Several tools can cut simultaneously on a planer.
6.	The shaper is driven using quick- return link mechanism.	The drive on the planer table is either by gears or by hydraulic means.
7.	It is less rigid and less robust.	Because of better rigidity of planer, as compared to that of a shaper, planer can give more accuracy on machined surfaces.

MANUFACTURING PROCESS LAB – I

Lab Report On:

SHAPER MACHINE



Name: **Aaqib Zaman**
Roll No: **BSME-14-006**
Instructor: **Engineer Abdul Raheem**
Department: **Mechanical Department**

University Of Lahore, Islamabad Campus.

MANUFACTURING PROCESS LAB – I

ASSIGNMENT



Name: **Aaqib Zaman**

Roll No: **BSME-14-006**

Instructor: **Engineer Abdul Raheem**

Department: **Mechanical Department**

University Of Lahore, Islamabad Campus.