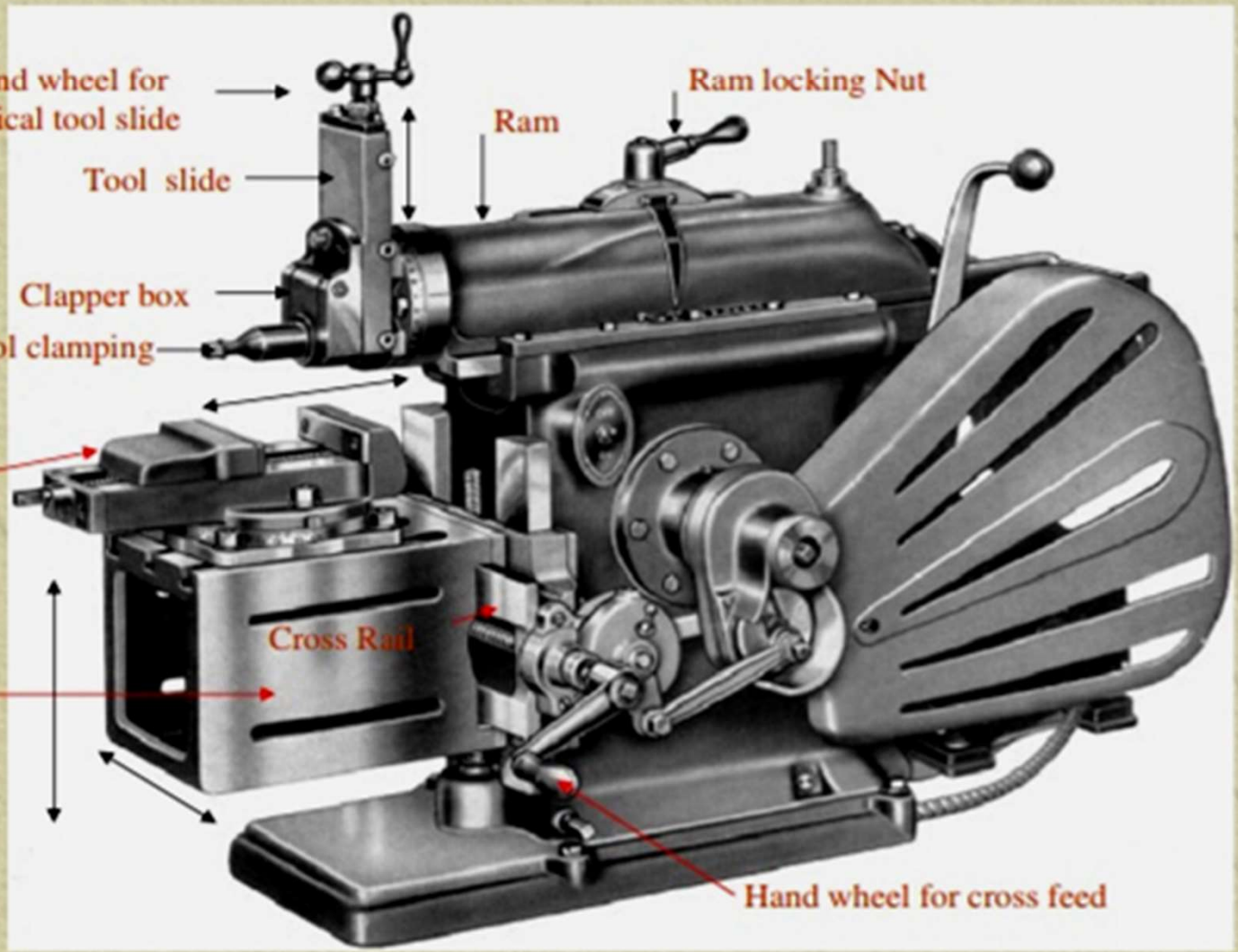
SHAPING MACHINE

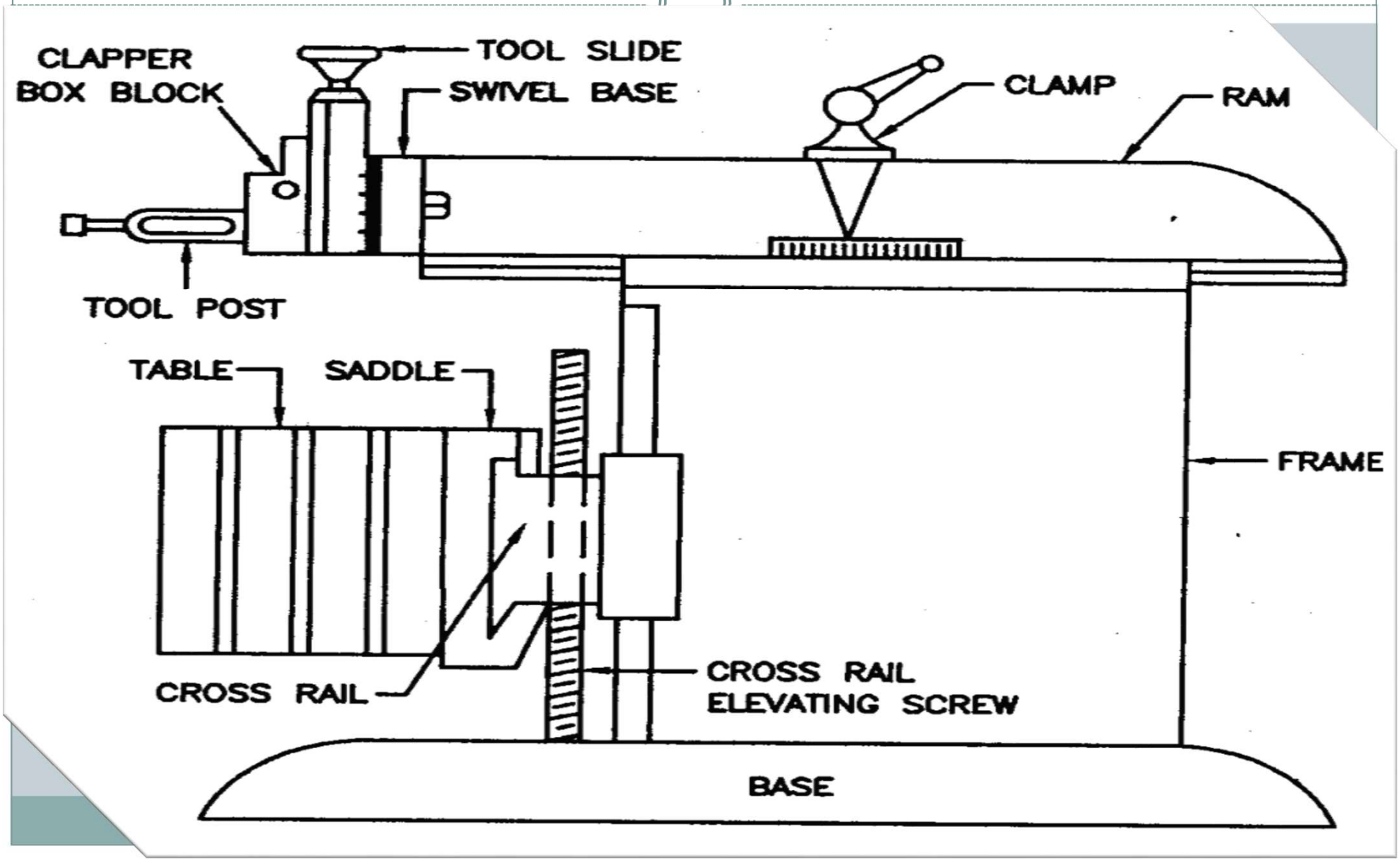
INTRODUCTION

- It is used single point cutting tool. It is reciprocating type of machine tool used for producing flat surfaces.
- Surfaces may be horizontal, vertical or inclined.
- Modern shapers can produce contoured surfaces.
- It uses reciprocating straight line motion of the tool and a perpendicular feed of the job or the tool.
- By moving the work piece across the path of the reciprocating tool, a flat surface is generated regardless of the shape of the tool.

Construction of the Shaper



FIGTURE OF SHAPER MACHINE



PRINCIPAL PARTS

- Base: Shaper base is a heavy structure of cast iron. It supports all the other parts and assemblies (described in the following). It resists vibration and high compressive loads being of cast iron. Base is bolted down to the shop floor through foundation bolts .

PRINCIPAL PARTS

- Column: It is a box structure of cast iron and houses the operating mechanisms of the machine. It also provides support for other parts of the machine, such as ram, cross-rail, etc. Column consists of two vertical walls which are supported on the shaper base.

PRINCIPAL PARTS

- Cross-rail: The cross rail is mounted on the front of the body frame and can be moved up & down. The vertical movement of the cross rail permits jobs of different heights to be accommodated below the tool by rotating an elevating screw thus causing the cross rail to slide up and down. Sliding along the cross rail is a saddle which carry the work table.

PRINCIPAL PARTS

- Saddle: The saddle moves on the cross-rail block and carries the table (or work table) on it such that crosswise movement of the saddle by rotating the cross feed screw by hand or by power makes the table to move sideways.

PRINCIPAL PARTS

- Table: The table is firmly connected on to the saddle. It gets its crosswise and vertical movements from the saddle and cross-rail, respectively (as explained above in case of saddle). Table is a box structure casting having T-slots both on top and sides for clamping the job.

PRINCIPAL PARTS

- Clapper Box: The clapper box is needed because the cutter drags or the work on the return stroke. The clapper box is hinged so that the cutting tool will not dig in. It is automatically raised by mechanical air or hydraulic action.

PRINCIPAL PARTS

- Ram: It is reciprocating member of the shaper which holds the tool and the reciprocates on the guide ways on the top of the column by means of quick return motion mechanism.

PRINCIPAL PARTS

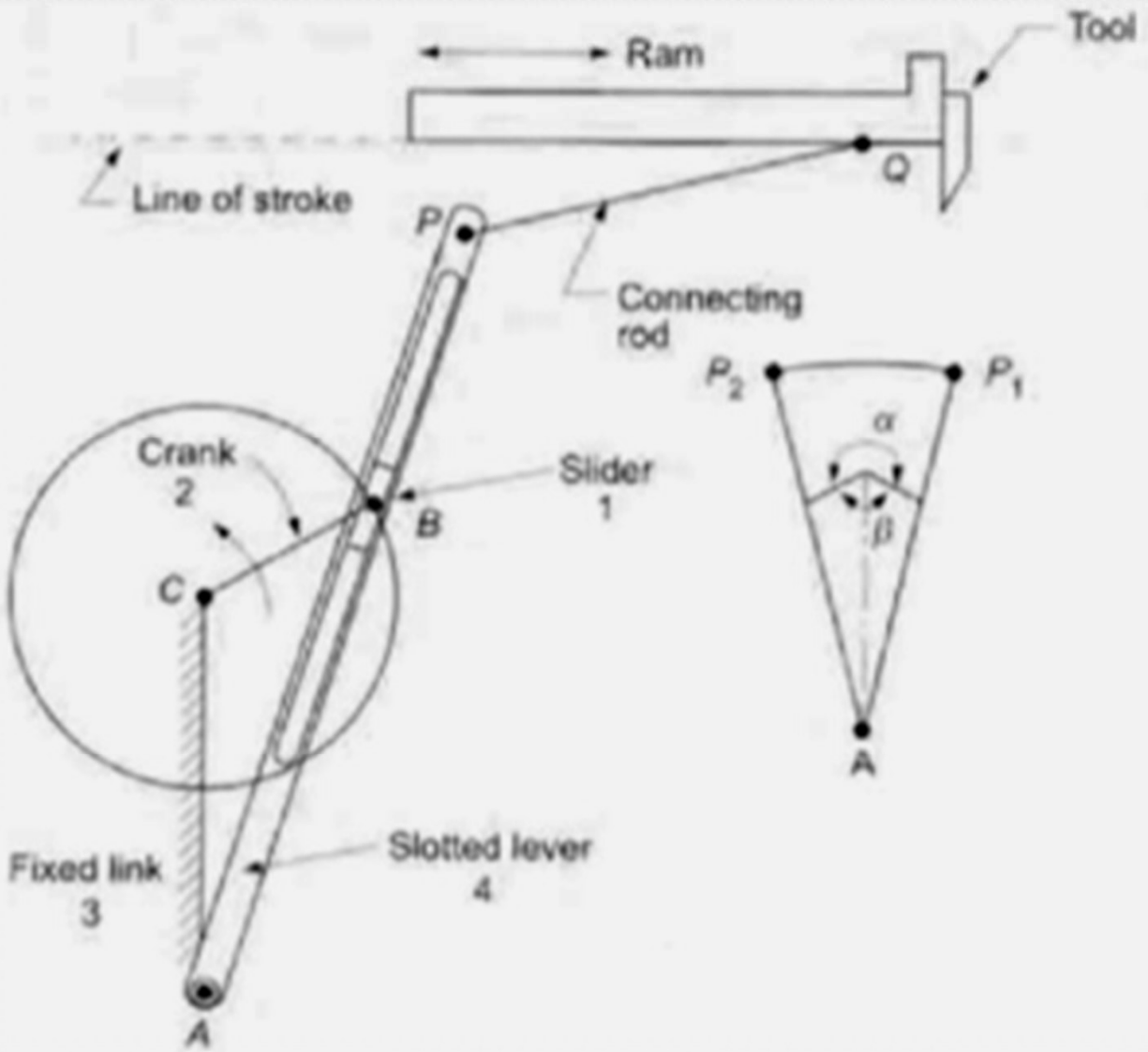
- Tool Head: The tool head holds the cutting tool firmly and provides both vertical and angular movement to the tool with the help of a down feed screw handle.

PRINCIPLE OF WORKING

- On a shaper, job is fixed on the work table (i.e. job remains stationary) and the tool cuts while reciprocating over the job [Fig. 6.93(a)]. The tool is mounted on a reciprocating ram and the table which supports the job is fed normal to the tool motion at each stroke of the ram.
- The feed is given at the end of return stroke.
- The tool cuts in the forward stroke generally, only in case of a draw-cut shaper the tool cuts in backward stroke of the ram.
- The other stroke in both the cases remains idle as there is no cutting action in that stroke.

CRANK AND SLOTTED LEVER MECHANISM

QUICK RETURN MECHANISM contd:



MECHANISM OF SHAPING MACHINE

Quick-return mechanisms

- These types of machine tool are of rectilinear cutting motion therefore, the rotary motion of the drive is converted into reciprocating motion.
- The metal is removed in the forward cutting stroke, while the return stroke goes idle and no metal is removed during this period.
- The cutting mechanism is so designed that it moves 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*.

OPERATION PARAMETER

- Cutting velocity = 2*Average forward velocity
- Cutting Speed (v) = 2*l*N/Rs
- Cutting Speed = Length of cutting stroke/ time taken by cutting stroke
- Cutting time = width/N*feed
- RPM of the bull gear(N) = 100v/l(1+m)
- l = Length of stroke
- N = Rotational Speed of the bull gear (RPM)
- Rs = Stroke Ratio
- m = return stroke time/cutting stroke time

STROKE LENGTH

Forward stroke is the cutting stroke. Return stroke the tool does not cut.
Double stroke= cutting stroke + return stroke

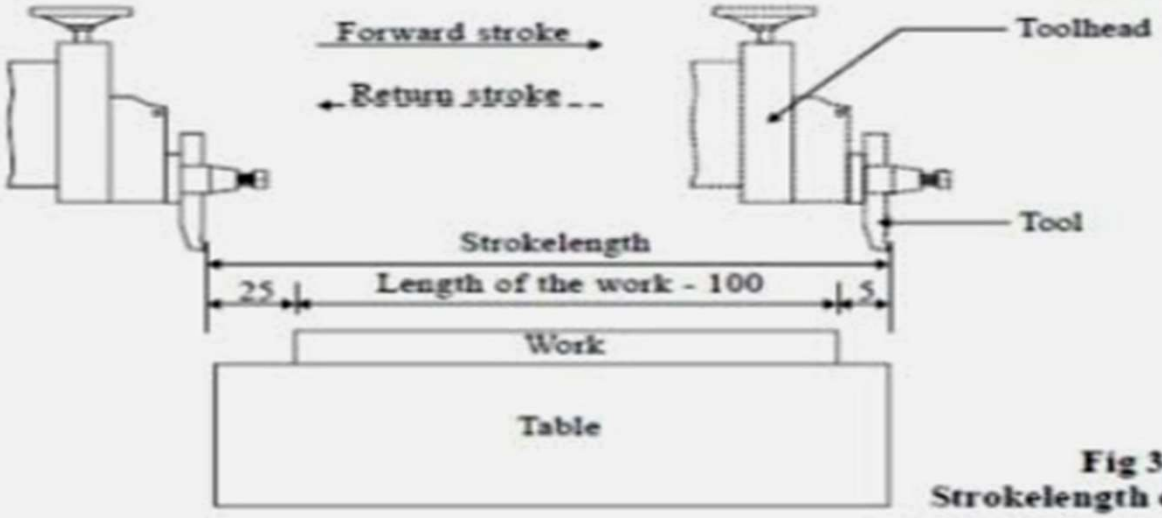


Fig 3.5
Strokelength calculation

Stroke starts slightly before the work piece (a) and ends after the work piece (b)

Total stroke length = l+a+b

CLASSIFICATION OF SHAPER

- According to the type of mechanism used for giving reciprocating motion to the ram

  a) Crank type
  b) Gear type
  c) Hydraulic type

- According to type of ram

  a) Horizontal

  b) Vertical

  c) Travelling head type

CLASSIFICATION OF SHAPER

- According to the design of table
  - a) Standard shaper
  - b) Universal shaper
- According to the cutting stroke
  - a) Push type
  - b) Draw type

- Horizontal Shaper:- Ram is horizontal.
- Vertical Shaper:- Ram is vertical. Machine is similar to a slotter.
- Push Cut Type:- Cutting action in outward strok.
- Pull Cut Type:- Cutting action in inward stock.

(a) Standard or Plain Shaper:

In this machine, the table has only two motion: crosswise in the horizontal plane and vertical movement(up and down).

(b) Universal Shaper:

this machine is similar to plain shaper expect that the table can be tilted at a various angle, making it possible to inclined flat surfaces.

the table can be swiveled about 360 degrees about a central axis parallel to the cutting stroke direction and also perpendicular to it, that is, around two horizontal axes.

UNIVERSAL SHAPER

OPERATIONS PERFORMED ON SHAPER

- Operations involved in shaping a rectangular job on shaper.
- Machining a thin job on shaper.
- Cutting an angle on a large job.
- Cutting a dovetail bearing on a shaper.
- Shaping a V or keyway in a block.
- Shaping regularly angled component.
- Shaping an irregularly curved surface.
- Cutting a keyway on a shaper when the keyway does not extend the entire length of the shaft.
- Machining angular surfaces on shapers.
- Sequence of machining sides of a rectangular piece square and parallel.

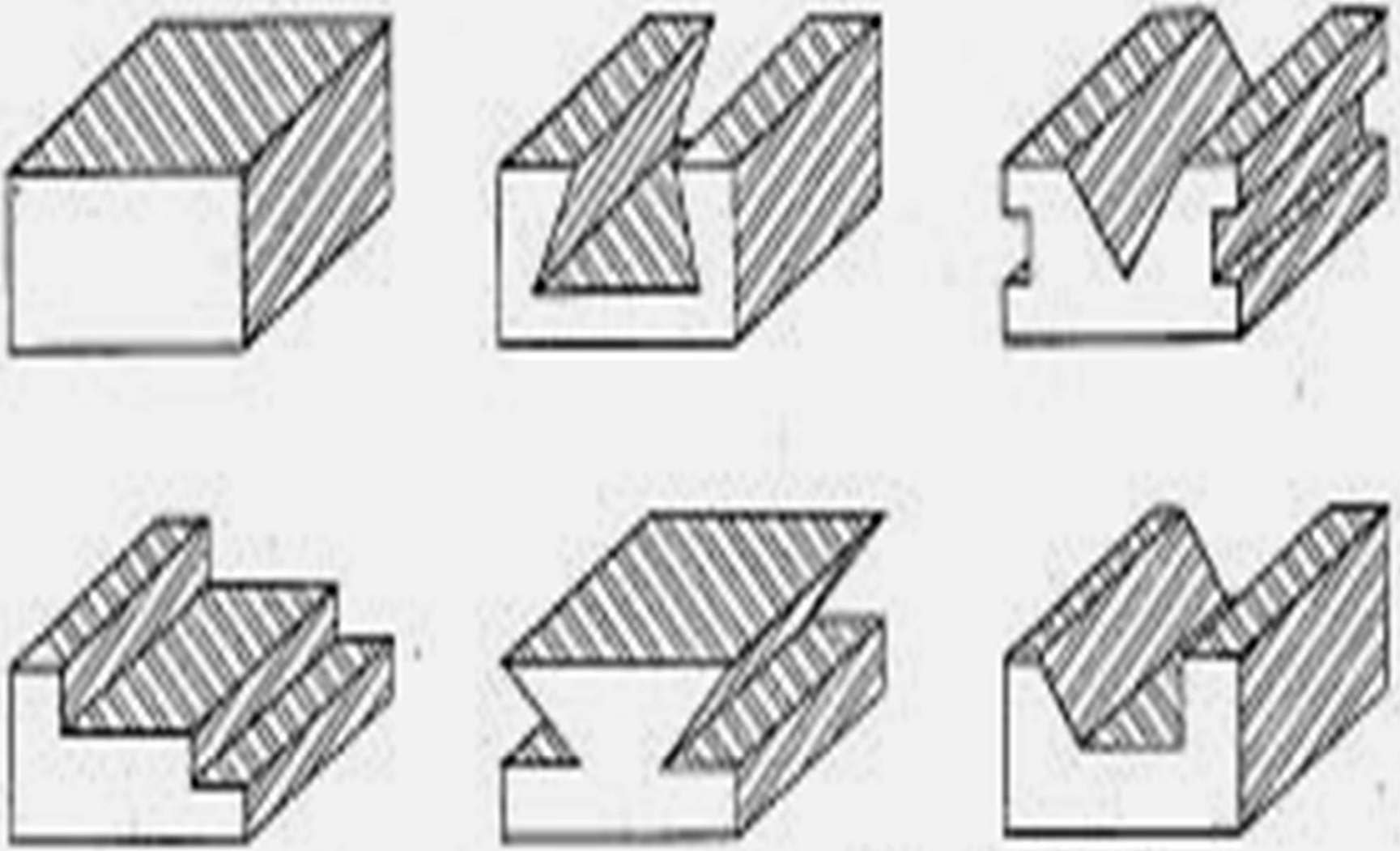


Figure 7.2 Components manufactured by the shaping process.

ADVANTAGES OF SHAPERS

- The single point cutting tools used in shapers are inexpensive, these tools can be easily grounded to any desirable shape.
- The simplicity and ease of holding work, its easy adjustment, and the simple tool give the shaper its great flexibility.
- Shaper set up is very quick and easy and can be readily changed from one job to another.
- Thin or fragile jobs can be conviniently machined on shapers because of lower cutting forces.

LIMITATIONS

- Shape only one piece of stock at a time.
- Not suitable for large parts as stroke length is limited and overhanging of the ram.
- Shape stock only if longer than 25 cm (10 in).

	Shaper	Planer	Slotter
1	The work is held stationary and the tool on the ram is moved back and forth across the work.	The tool is stationary and the workpiece on the table travels back and forth under the tool	The work is held stationary and the tool on the ram is moved up and down across the work.
2	Used for shaping much smaller jobs	Meant for much larger jobs. Jobs as large as 6 metre wide and twice as long can be machined.	It is used for making slots in smaller jobs.
3	Is a light machine	It is a heavy duty machine.	Slotting is light machine
4	Can employ light cuts and C finer feed.	Can employ heavier cuts and coarse feed.	Can employ light cuts and finer feed.
5	Uses one cutting tool at a time	Several tools can cut simultaneously.	Shaper uses one cutting tool at a time
6	Driven using quick- return link mechanism	The drive on the planer table is either by gears or by hydraulic means	The rams are either crank-driven or hydraulically driven.
7	It is less rigid and less robust	Better rigidity that give more accuracy on machined surfaces.	It is less rigid and less robust


Thank You!