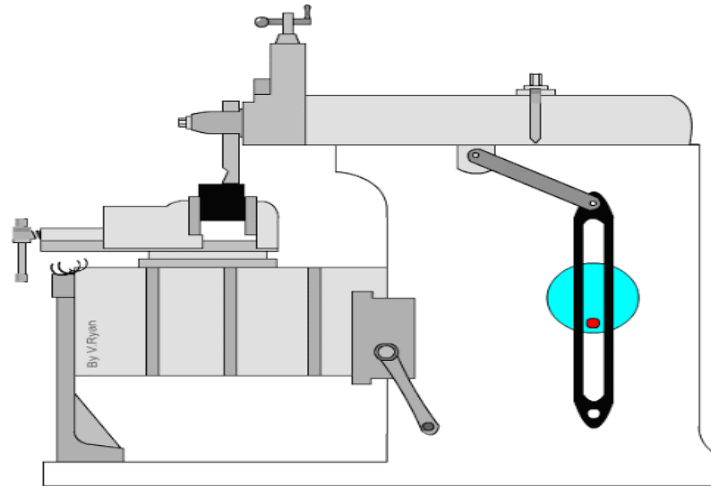




COLLEGE OF ENGINEERING & TECHNOLOGY

Ch-6

Shaper Machine



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Shaper Machine



Introduction

- The shaping machine is used to machine flat metal surfaces especially where a large amount of metal has to be removed. Other machines such as milling machines are much more expensive and are more suited to removing smaller amounts of metal, very accurately.
- The reciprocating motion of the mechanism inside the shaping machine can be seen in the diagram. As the disc rotates the top of the machine moves forwards and backwards, pushing a cutting tool. The cutting tool removes the metal from work which is carefully bolted down.

Working Principal

The job is rigidly fixed on the machine table. The single point cutting tool held properly in the tool post is mounted on a reciprocating ram. The reciprocating motion of the ram is obtained by a quick return motion mechanism. As the ram reciprocates, the tool cuts the material during its forward stroke. During return, there is no cutting action and this stroke is called the idle stroke. The forward and return strokes constitute one operating cycle of the shaper.

Classification

There are mainly two types of **shapers**:-

❖ Horizontal Shapers.

I) Plain Shapers

II) Universal Shapers.

❖ Vertical Shapers.

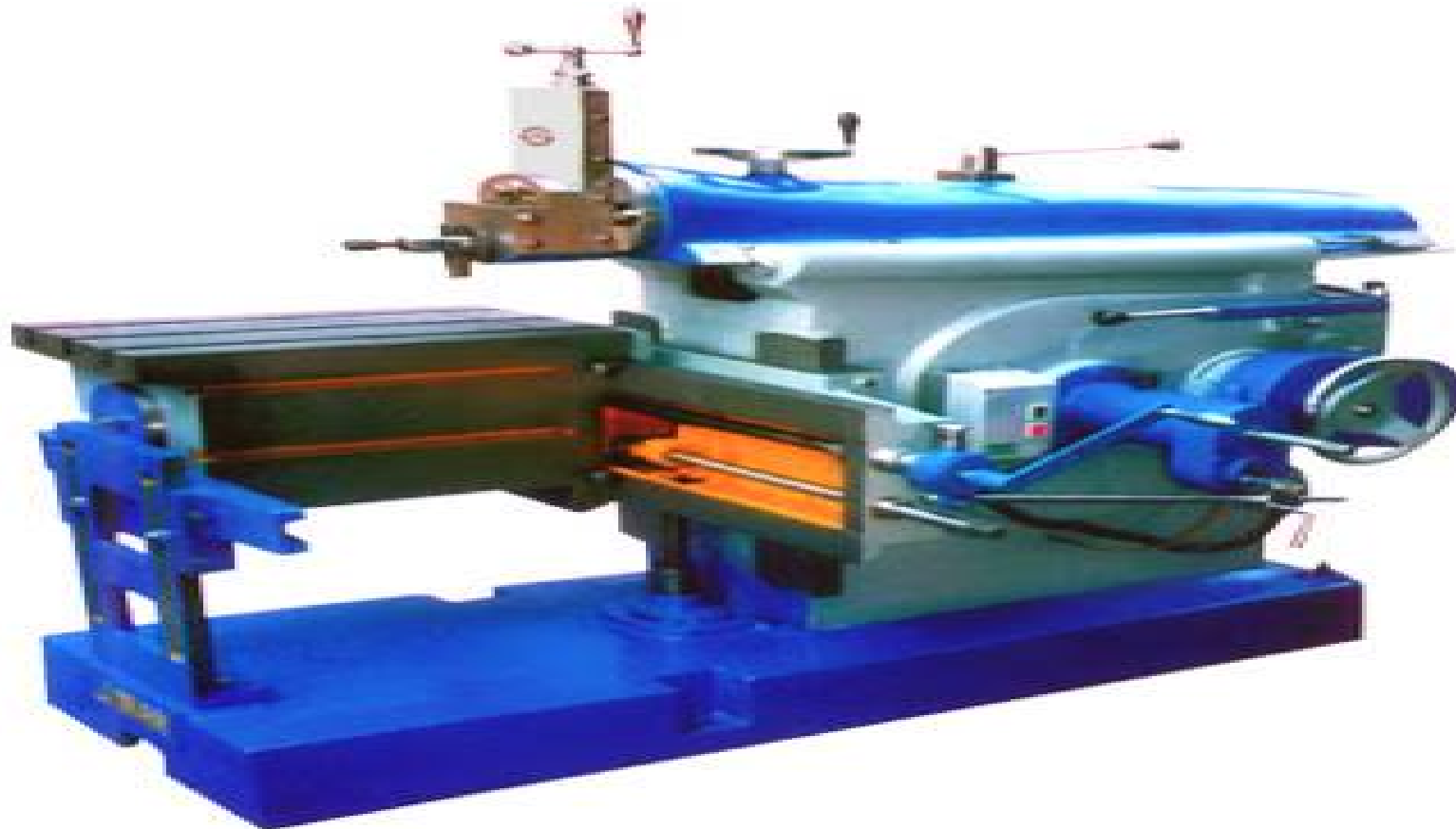
I) Crank Shapers.

II) Gear shapers.

III) Hydraulic Shapers.

Both **shapers** depending upon whether the ram and the cutting tool reciprocates in the horizontal plane or in the vertical plane.

Horizontal Shaper Machine

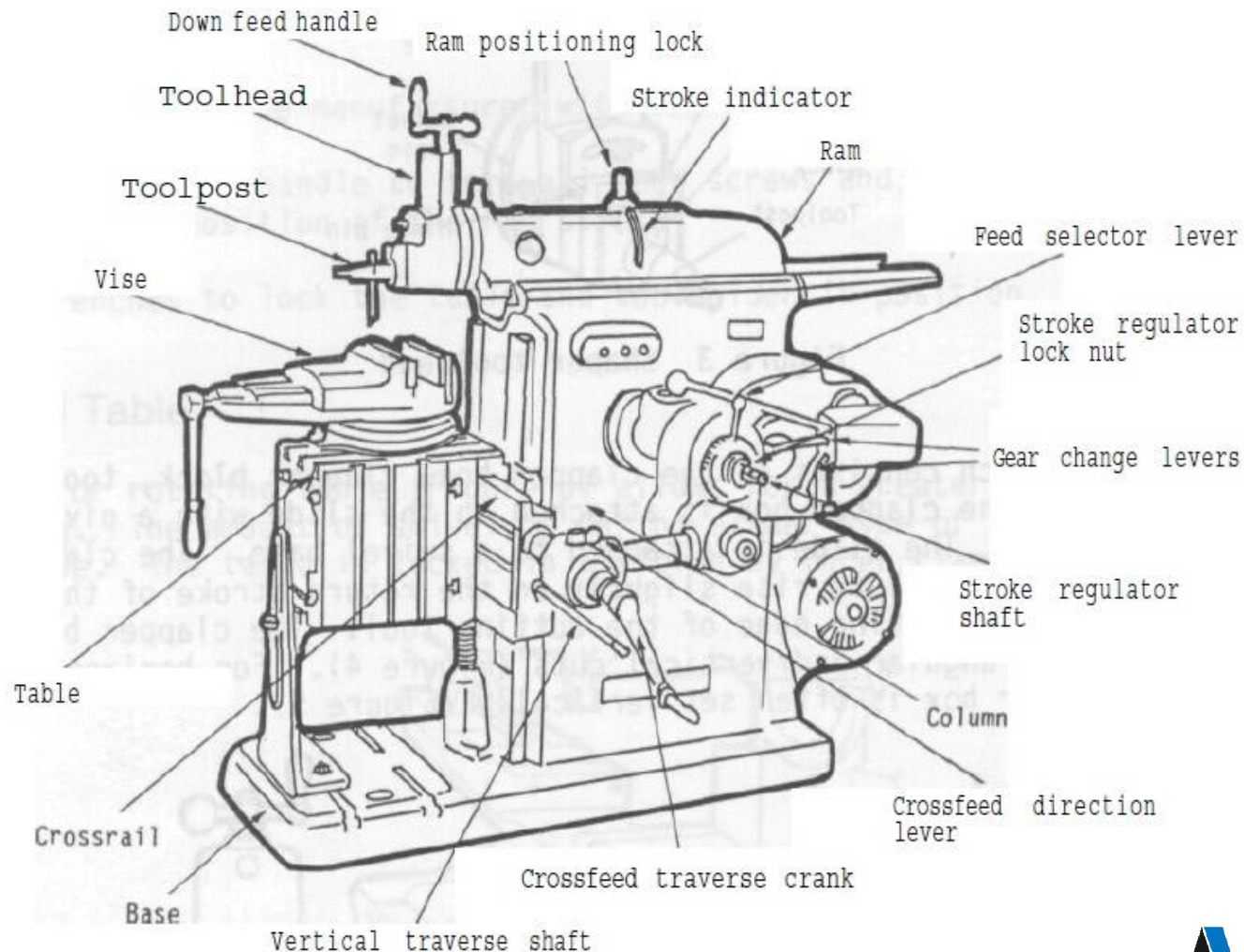


Vertical Shaper Machine

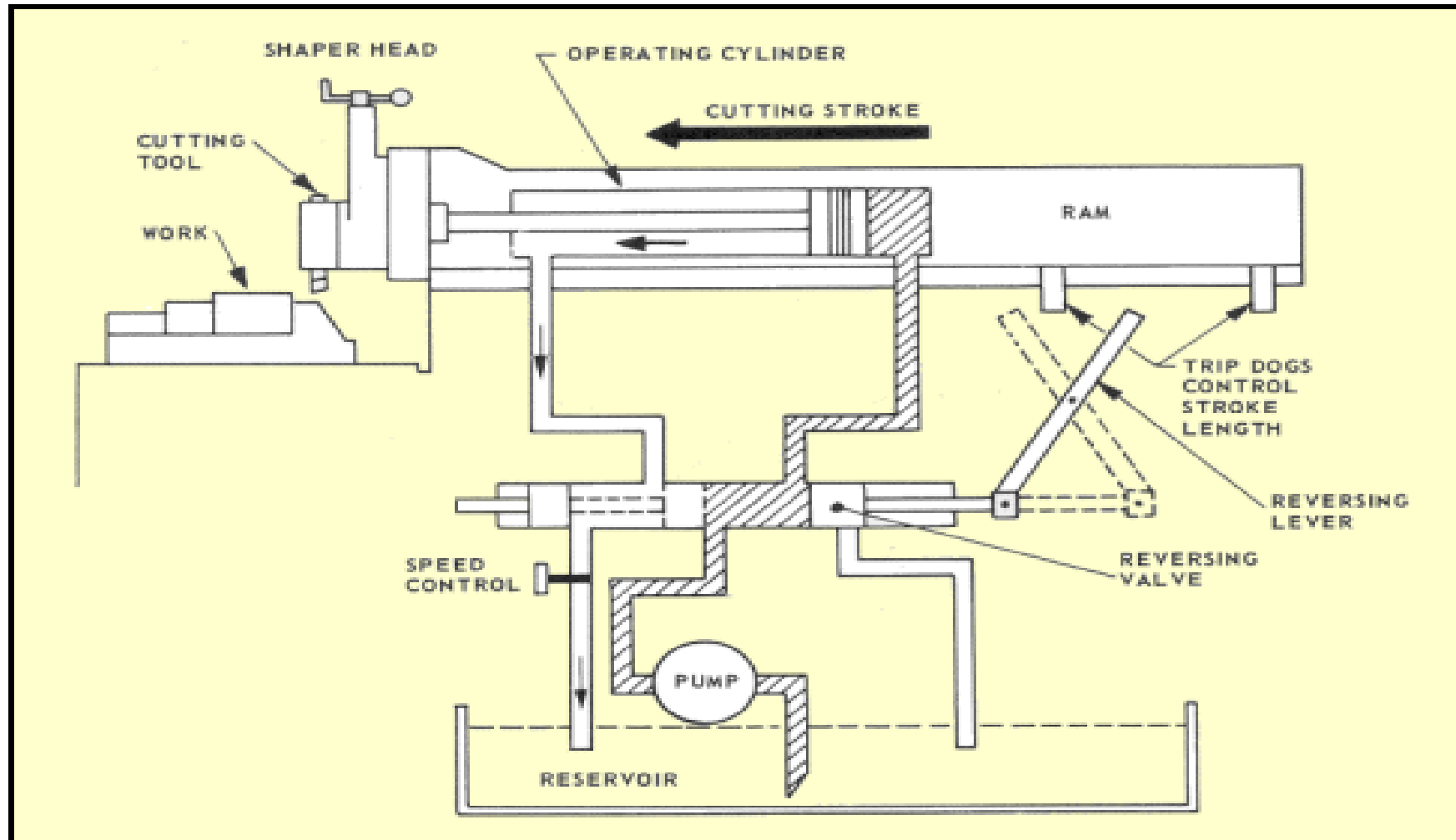


- **Crank shapers** are most commonly used. A rocker arm, operated by a crank pin from the main driving gear, gives the ram of the crank shaper a back-and-forth (reciprocating) motion.
- **Gear shapers** are driven by a gear and rack assembly. Gear shapers have a reversible electric motor or mechanical mechanism which quickly returns the ram, in readiness for another cut.
- **Hydraulic shapers** are driven by movement of a piston in an oil-filled cylinder. Mechanical features on these shapers are the same as those on crank shapers.

Crank Shaper Machine

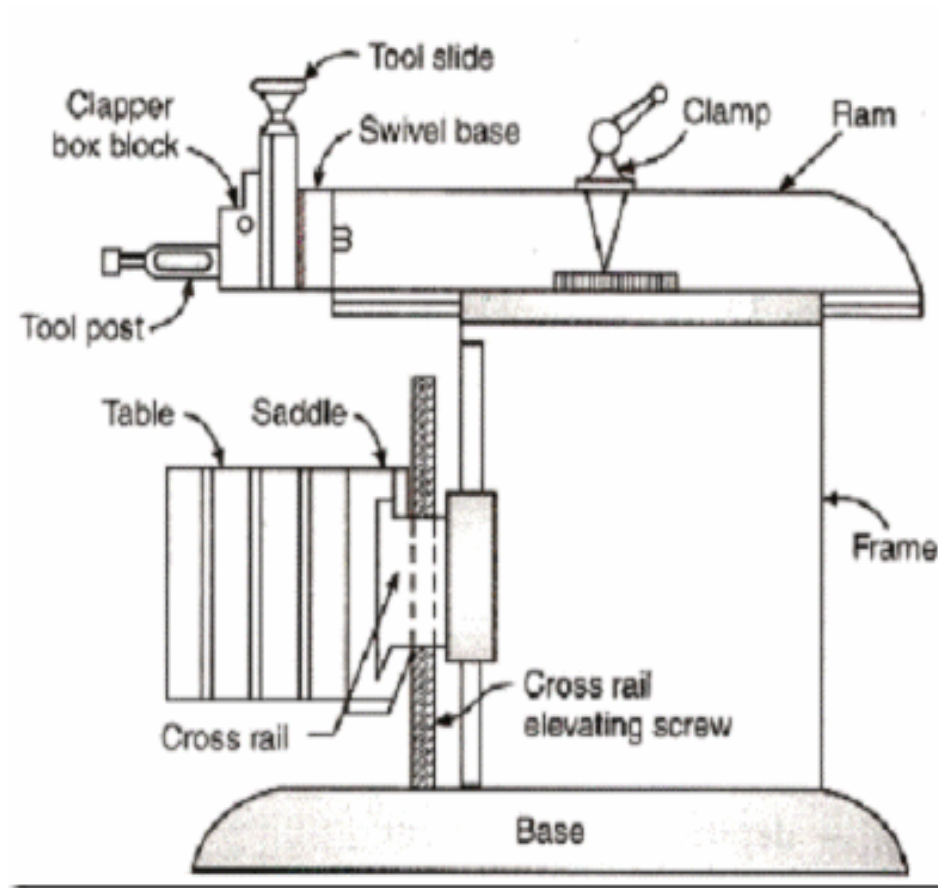


Hydraulic Shaper Machine



Main Parts of Shaper

- Base
- Column
- Table
- Cross Rail
- Ram
- Tool Head



- **Base**- The base is the necessary bed or support required for all machines tools. All other parts are mounted on and above the base. The bed takes up the total dead weight of the machine as well as the dynamic load during machining operations.
- **Cross rail**-The cross rail is mounted on the front of the body frame and can be moved up and down. The vertical movement of the cross rail permits jobs of different heights to be accommodated below the tool. Sliding along the cross rail is a saddle which carries the work table.
- **Column**-The column of the shaper is a hollow casting and is mounted on the base. It houses the drive mechanism for the ram and the table.

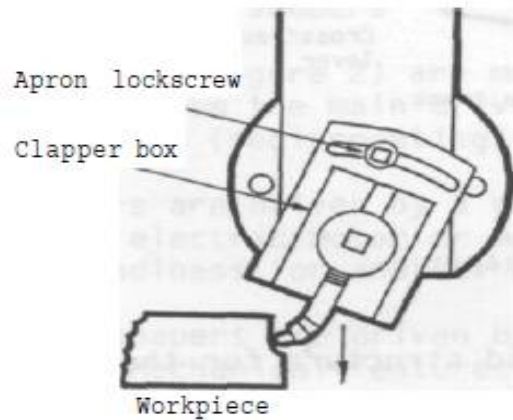


Figure 4 Clapper box set for vertical cut

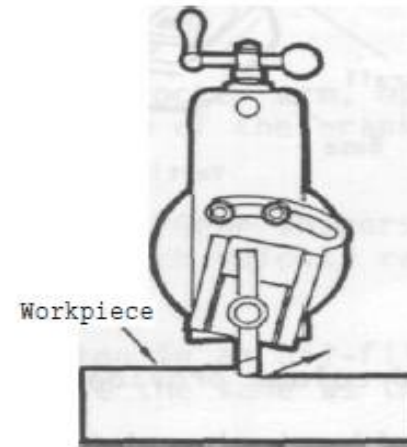


Figure 5 Clapper box set for horizontal cut

- **Table-** The worktable of a shaper is fastened to the front of the column. The table moves across the column on crossrails to give the feed motion to the job.
- **Ram-** The ram carries the tool head at its front end and travels in “guideways” to give straight line reciprocating motion to the tool. The ram is either mechanically driven or hydraulically operated. A single point tool is fastened in the tool post.

➤ Tool Head:

➤ It holds the cutting tool and is fastened to the front of the ram. The tool is held in a tool holder/tool post similar to the lathe tool post. The tool post and the tool block fit snugly in the clapper box and is hinged at the upper edge.

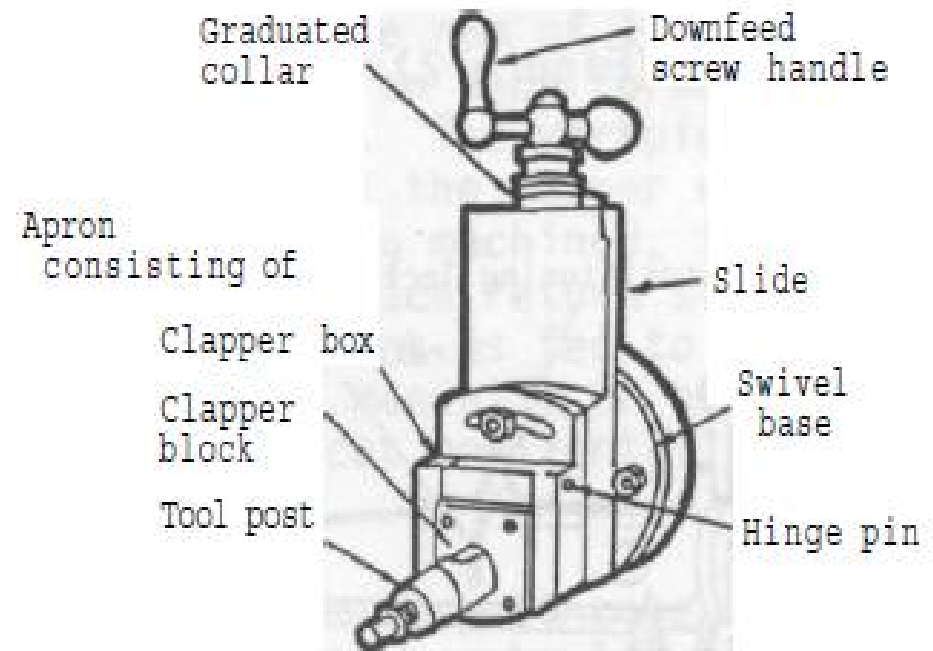
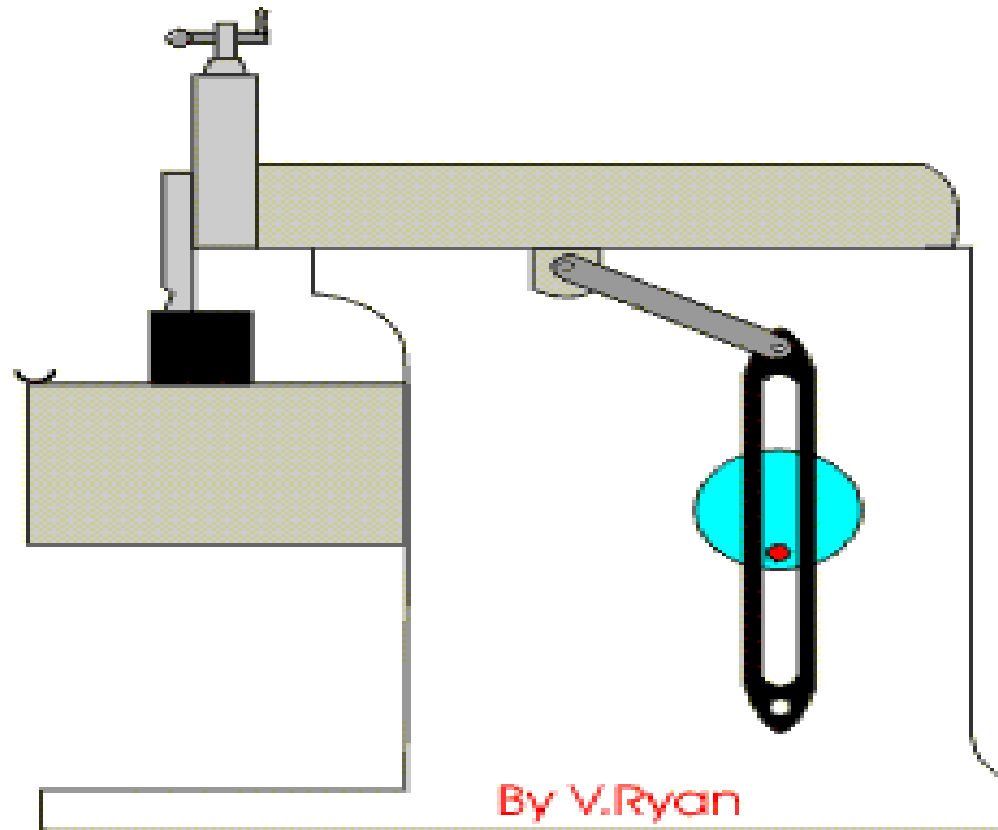


Figure 3 Shaper toolhead

Mechanism of Shaper Machine



THE SHAPING MACHINE

Quick-Return Mechanism

These types of machine tool are of rectilinear cutting motion therefore, the rotary motion of the drive is converted into reciprocating motion.

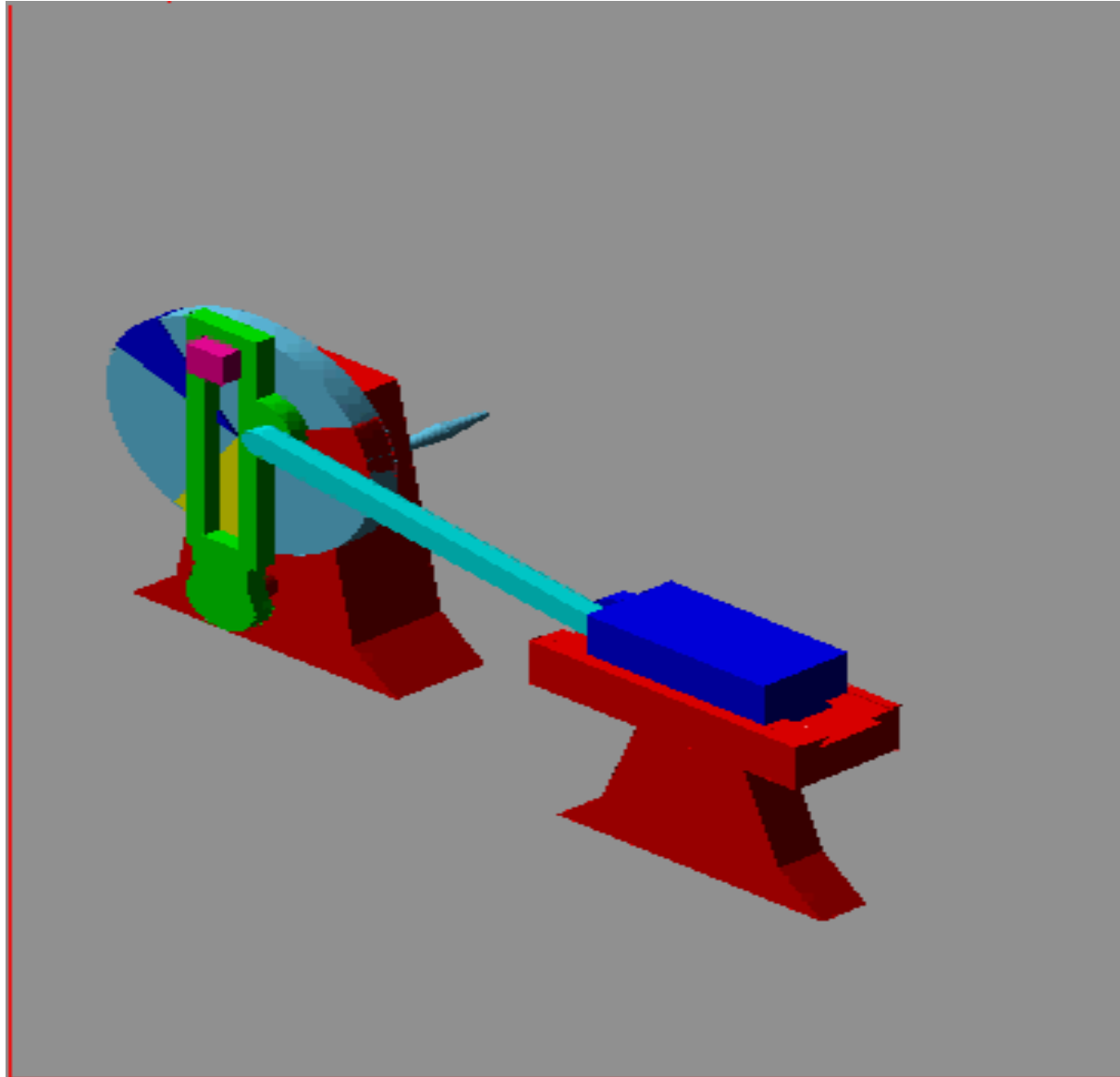
The metal is removed in the forward cutting stroke, while the return stroke goes idle and no metal is removed during this period.

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.

The reciprocating movement of the ram and the quick return mechanism of the machine are generally obtained by anyone of the following methods:

1. Lever rocker arm mechanism (shaper).
2. Slider crank mechanism (slotter).
3. With worth quick return mechanism (shaper and slotter).
4. Hydraulic system (all the 3 types).
5. Variable speed reversible motor (slotter and planer).
6. Rack and pinion mechanism (planer).



Different Types of Cutting Tools Used in 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.

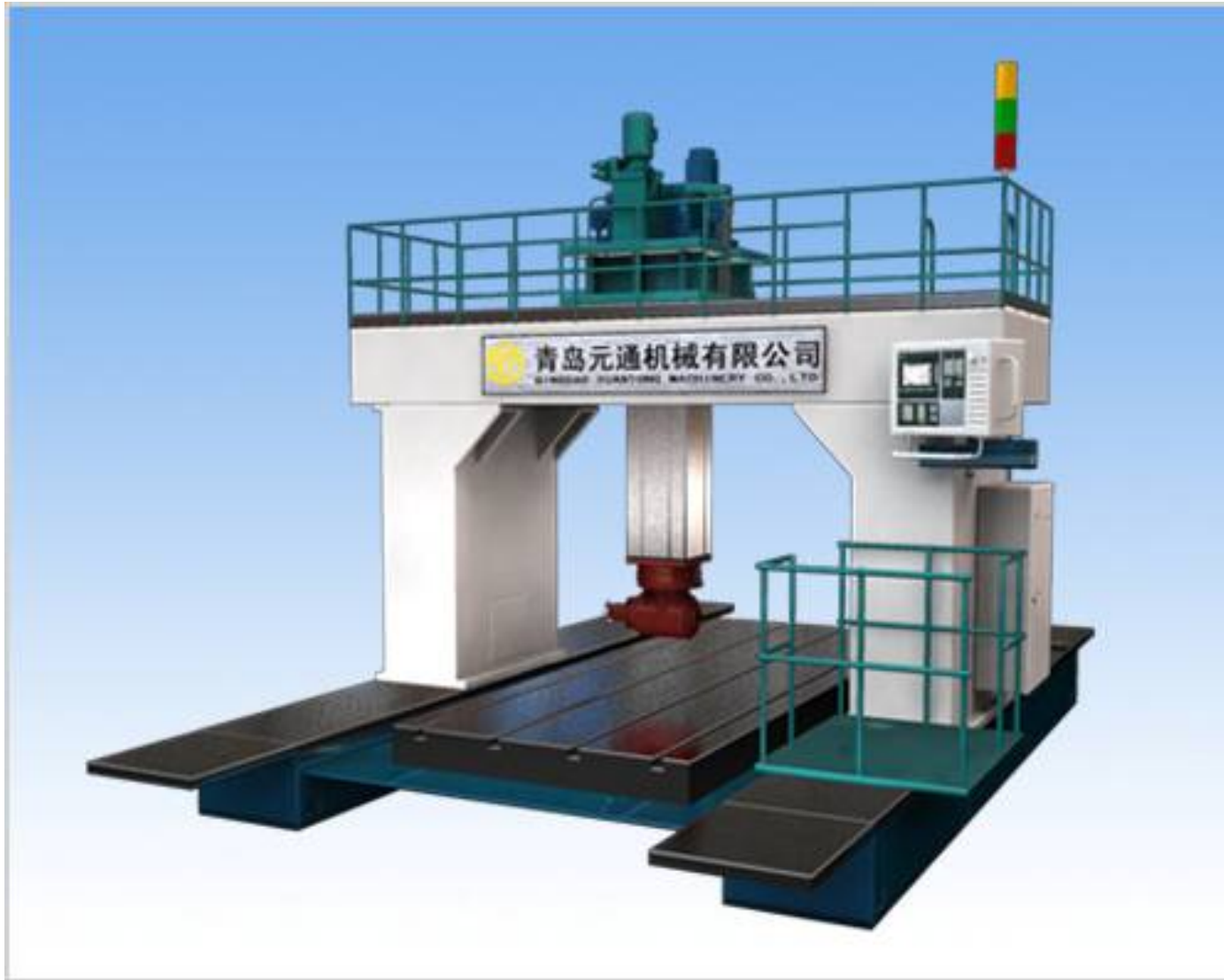
Advantage of Shaper

- 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 conveniently machined on shapers because of lower cutting forces.

Limitation

- ❑ Shape only one piece of stock at a time.
- ❑ Shape stock only if longer than 25 cm (10 in).
- ❑ Support long pieces of wood with extension tables or roller supports.

Planner Machine



Principal parts of Planner

There are five principal parts of lathe:-

- 1. Bed*
- 2. Table*
- 3. Housing*
- 4. Cross Rail*
- 5. Tool head*

- Bed:**
- The bed is a large ,heavy casting.
 - Very large beds consists of two or more castings , carefully machined and bolted together.
 - Provides ways for table to run on houses the drive mechanism.

- Table:**
- It is the part on which workpiece is clamped.
 - It reciprocates along the ways of beds
 - Powered from variable speed motor
 - Other drives can be hydraulic

HOUSING:

- They are rigid & upright column like casting.
- Located near the centre on each side of the base.

CROSS RAIL:

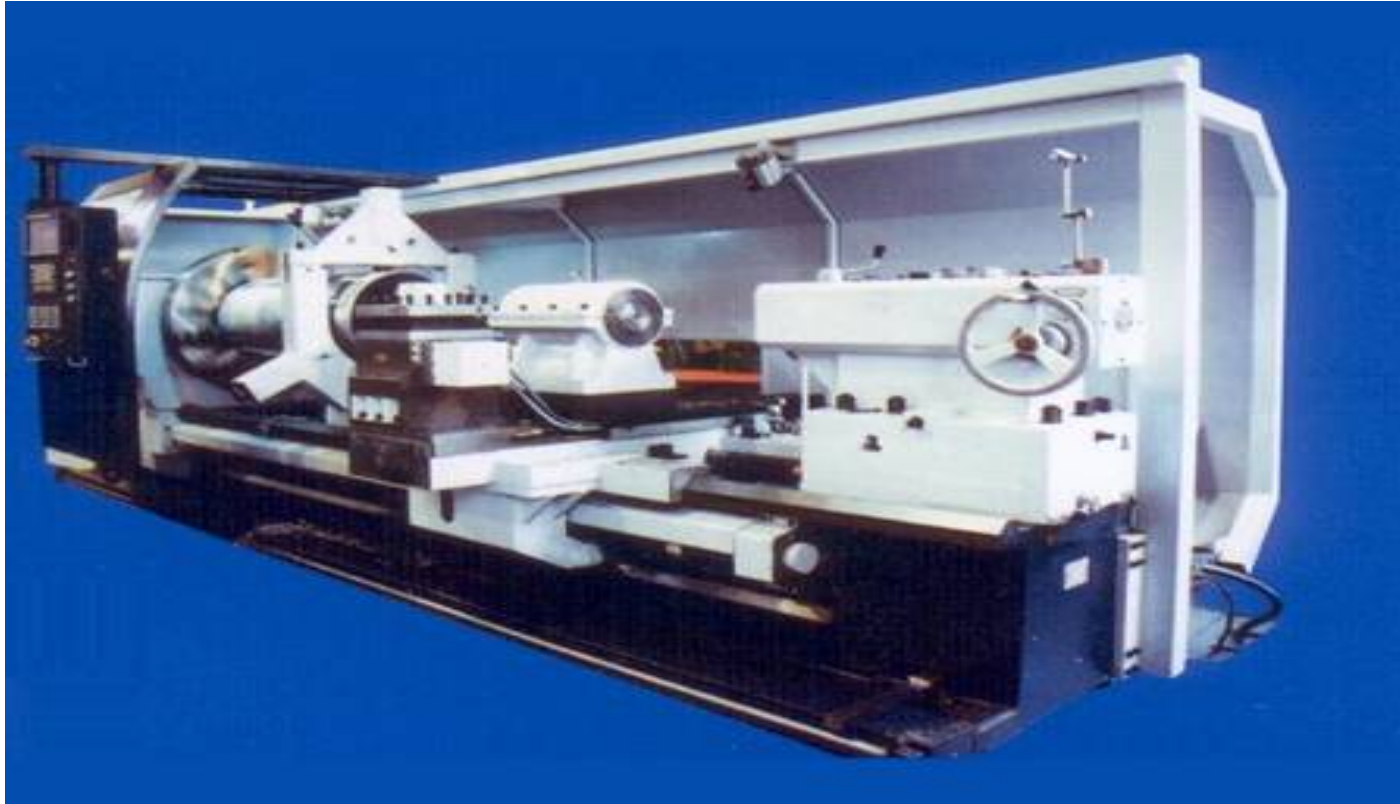
- It is horizontal member supported on machined ways of upright column.
- Vertical movement of cross rail allows to accommodate work piece of different heights.

Types of Planner

There are Five types of planers:-

- 1. Double Housing*
- 2. Open slide*
- 3. Pit Type Planer*
- 4. Plate Planer*
- 5. Latching Table Planer*
- 6. Planer Miller or Grinder*

Double Housing Planer



- *Most commonly used planer machine.*
- *One drawback-Limits the width of workpiece due to presence of two housing on each side of bed.*

Open Slide Planner



- *Maximum number of tool heads is 3.*
- *Advantage:- Accommodate Jobs which are too wide to fit between columns of double housing planer.*
- *Not strong and rigid as Double Housing Planer.*

Planner Miller or Grinder



- *Same as Double Housing Planer .*
- *It has milling cutter or a grinding head in place of one or more conventional tool heads on cross rails.*

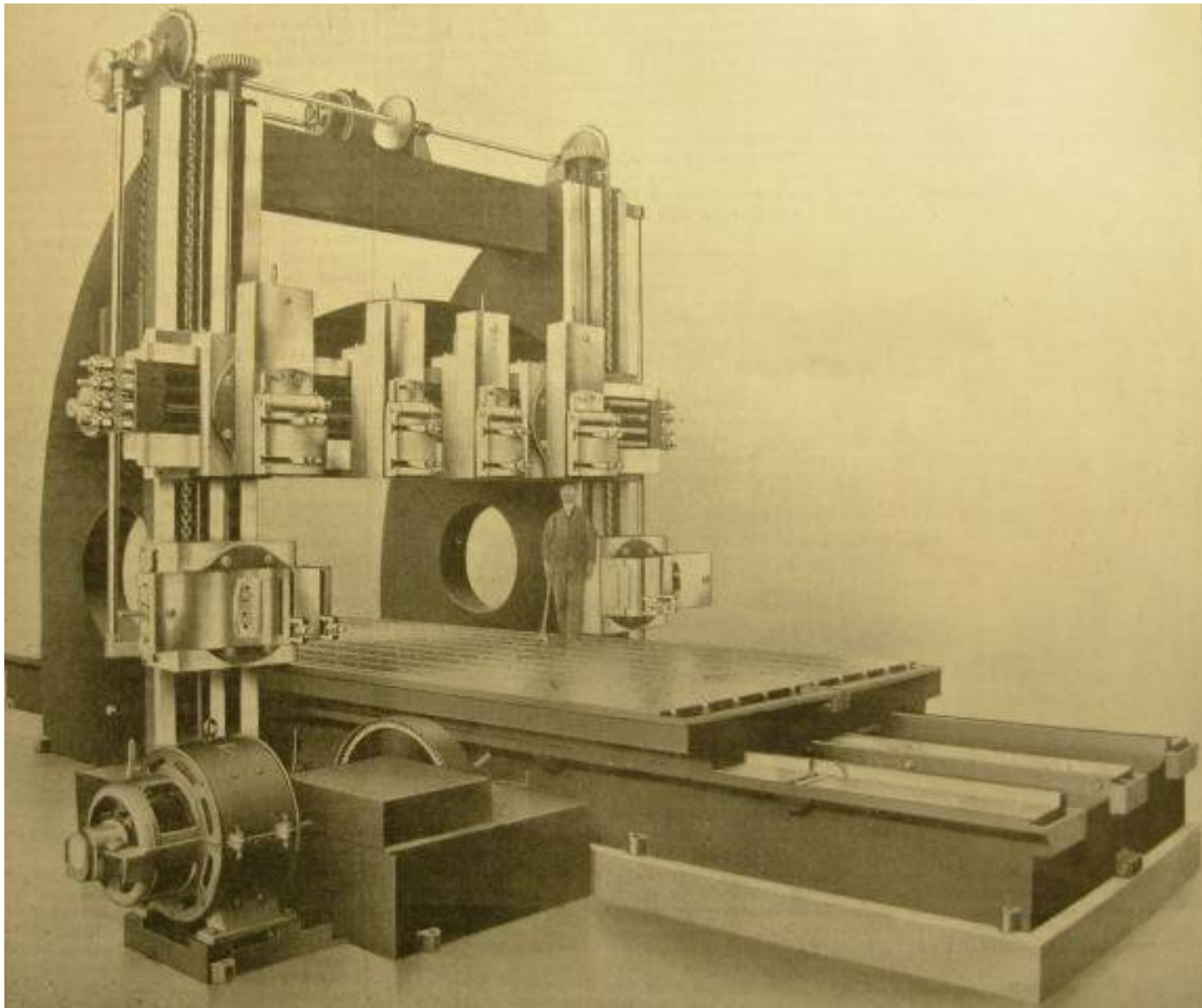
Pit type Planner



- *Used when work becomes extremely heavy.*
- *Table is kept stationary and tool reciprocates.*
- *Design is used to plane the largest kind of works.*
- *It is convenient and economical to move machine than work piece.*

Plate Planner

- *Special purpose machine tool designed specially for squaring or leveling edges of heavy steel plates.*
- *Job/table is stationary, while tool and operator move back and forth along the work for feed and cut.*
- *The plate is clamped to a bed and the side mounted carriage is move back and forth.*



Latching Table Planner



- *Lot of time is taken in setting up the work.*
- *When many identical pieces are machined at the same time ,any type of planer may be provided with divided table.*
- *Work on one table is setup while on other is machined.*

Driving & Feed Mechanism

- ❖ Tool Heads maybe fed in crosswise or vertical direction.
- ❖ Motor drive is usually at one side of planar & drive mechanism is located under the table.
- ❖ $V = LN(1+K)/1000$ m/min

where, V = speed of cut

L = length of ram stroke

N = no. of full stroke

K = ratio of return time to cutting time

Slotter Machine



Introduction

- Basically slotting machine is a vertical axis shaper
 - The tool moves vertically rather than in a horizontal direction
- It has a vertical ram and a hand or power operated rotary table
- The stroke of ram is smaller in slotting machines than in shapers

➤ **Base:** It is also known as bed and it is a heavy cast iron construction'

It acts as a support for the column, the driving mechanism of ram, table and other fittings

➤ **Column:** It is made of cast iron & it acts as a housing for the complete driving mechanism

➤ **Table:** Usually a circular table is provided in slotter.

T –slots are provided on top of the table to clamp the work

➤ **Ram:** It moves in vertical direction between the vertical guideways provided in front of the column

➤ The ram supports the tool head to which the tool is attached & the cutting action takes place during the downward movement of the ram

Slotter drive mechanisms

- Slotted disc mechanisms
- Variable speed reversible motor drive
- Hydraulic drive

Types of Slotter

• *Puncher slotter*

• *General production slotters*

• *Precision tool room slotters*

• *Key seater*

• *Key seater*

• *slotting machine*

Work holding devices

1. Clamps
2. T-bolts
3. Vice
4. Parallel strips
5. Special fixtures for holding work

Slotter operations

The following operations can be performed on the slotter

- ❖ Cutting of internal grooves or key ways*
- ❖ Cutting of internal gears*
- ❖ Cutting of recesses*

	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 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