UNIT-5

BASIC MACHINE TOOLS

Lecture 1

FUNDAMENTALS OF METAL MACHINE TOOLS

❖ **Metal Cutting**

Metal cutting or traditional machining processes are also known as conventional machining processes. These processes are commonly carried out in machine shops or tool room for machining cylindrical or flat jobs to a desired shape, size and finish on a rough block of job material with the help of a wedge shaped tool.

❖ **Machine Tools**

Machining processes are performed on metal cutting machines, more commonly termed as machine tools using various types of cutting tools (single or multi-point). A machine tool is a power driven metal cutting machine which assist in managing the needed relative motion between cutting tool and the job that changes the size and shape of the job material. In metal cutting (machining) process, working motion is imparted to the workpiece and cutting tool by the mechanisms of machine tool so that the work and tool travel relative to each other and machine the workpiece material in the form of shavings (or swarf) known as chips.

The machine tools involve various kinds of machines tools commonly named as lathe, shaper, planer, slotter, drilling, milling and grinding machines etc

The machine tools are basically of two types:

(1) General purpose machine tools

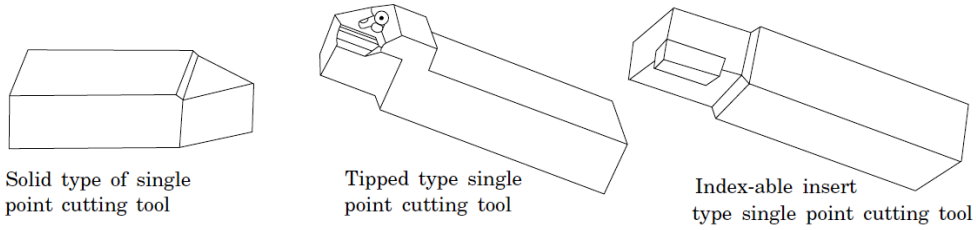
(2) Special purpose machine tools

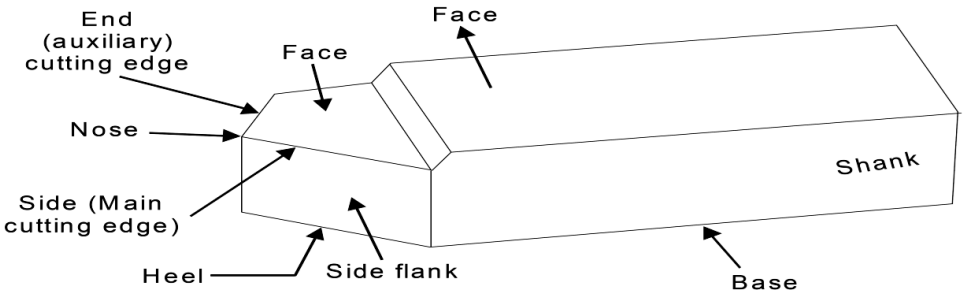
❖ **Cutting Tool**

Cutting tools performs the main machining operation. They comprise of single point cutting tool or multipoint cutting tools. It is a body having teeth or cutting edges on it. A single point cutting tool (such as a lathe, shaper and planner and boring tool) has only one cutting edge, whereas a multi-point cutting tool (such as milling cutter, milling cutter, drill, reamer and broach) has a number of teeth or cutting edges on its periphery.

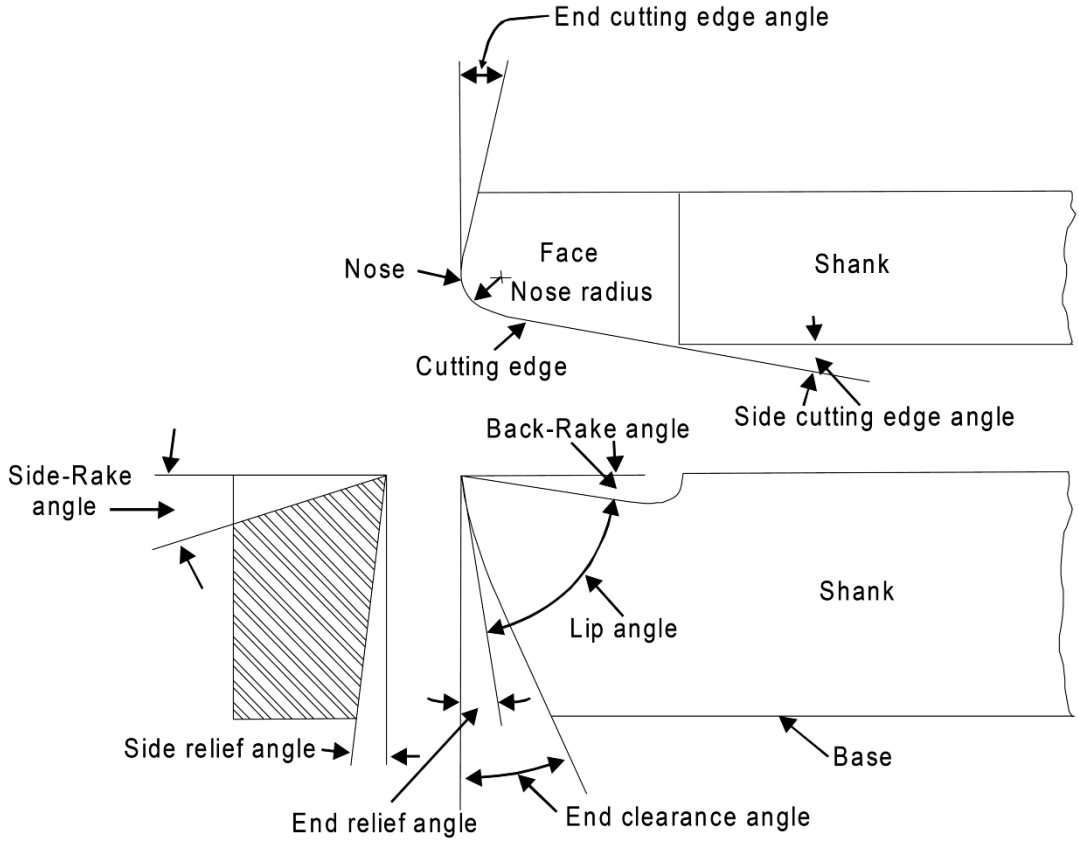
❖ **Single Point Cutting Tools**

- The solid type single point tool may be made from high speed steel, from a cast alloy.
- The tipped type of tool is made from a good shank steel on which is mounted a tip of cutting tool material. Tip may be made of high speed steel or cemented carbide





Geometry of single point cutting tool



Elements of tool signature or nomenclature of single point tool

❖ **Tool Signature**

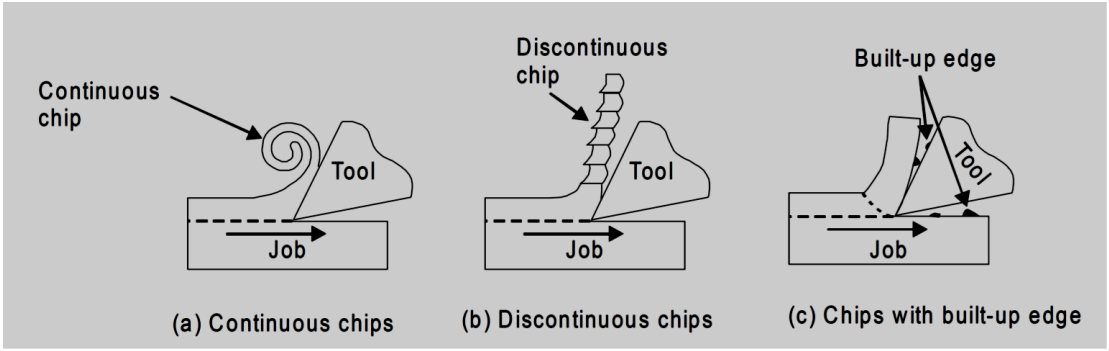
Tool signature 0-7-6-8-15-16-0.8

1. Back rake angle (0°)
2. Side rake angle (7°)
3. End relief angle (6°)
4. Side relief angle (8°)
5. End cutting edge angle (15°)
6. Side cutting edge angle (16°)
7. Nose radius (0.8 mm)

❖ **Types of Chips**

The type of chips edge formed is basically a function of the work material and cutting conditions

1. Discontinuous or segmental chips
2. Continuous chips
3. Continuous chips with built-up edge.
4. Non homogenous chips

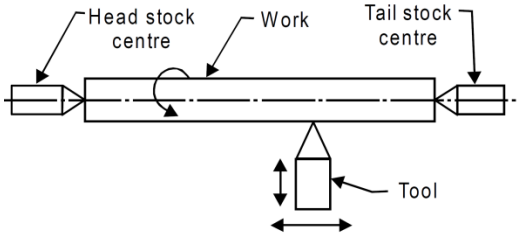


Lecture 2

LATHE MACHINE TOOLS (TYPES, CONSTRUCTION AND WORKING PRINCIPLE)

LATHE MACHINE

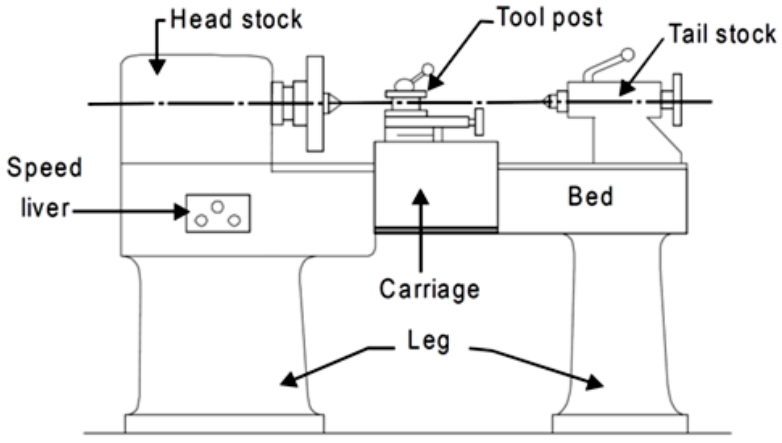
Lathe is one of the most versatile and widely used machine tools all over the world. It is commonly known as the mother of all other machine tool. The main function of a lathe is to remove metal from a job to give it the required shape and size. The job is secure1y and rigid1y held in the chuck or in between centers on the lathe machine and then turn it against a single point cutting tool which will remove metal from the job in the form of chips.



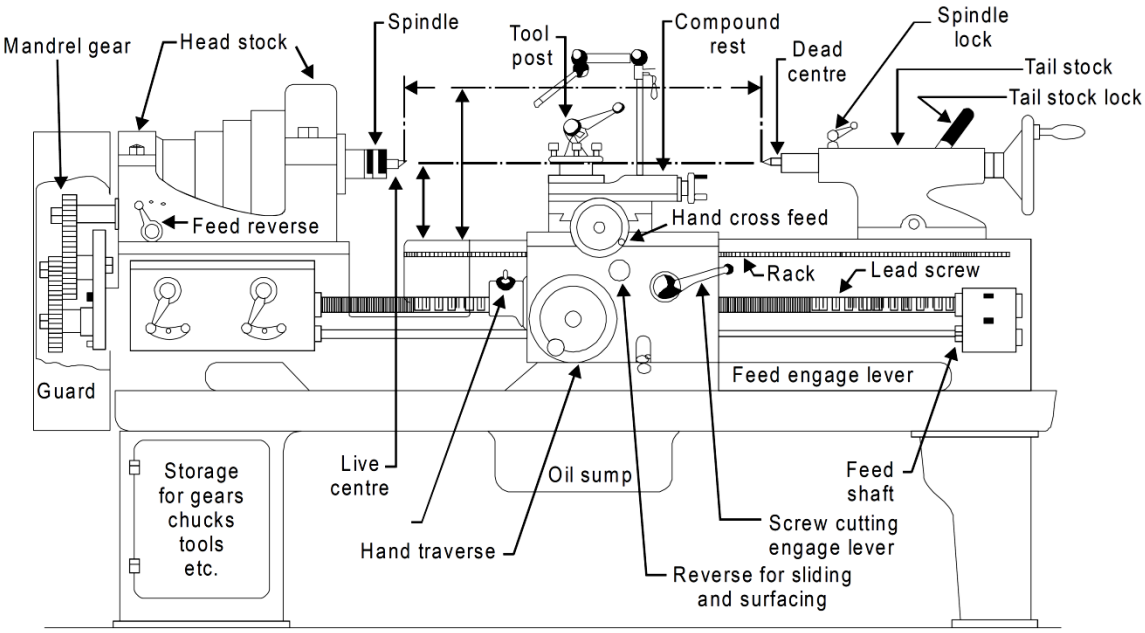
Working principal of lathe machine

Types of Lathe

1. **Speed lathe**
   (*a*) Wood working
   (*b*) Spinning
   (*c*) Centering
   (*d*) Po1ishing
2. **Centre or engine lathe**
   (*a*) Be1t drive
   (*b*) Individual motor drive
   (*c*) Gear head lathe
3. **Bench lathe**
4. **Tool room Lathe**
5. **Capstan and Turret 1athe**
6. **Special purpose lathe**
   (*a*) Whee1 lathe
   (*b*) Gap bed lathe
   (*c*) Dup1icating lathe
   (*d*) T-lathe
7. **Automatic lathe**



Principal components of a central lathe



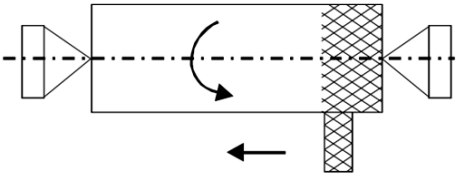
Different parts of engine lathe or central lathe

Lecture 3 & 4

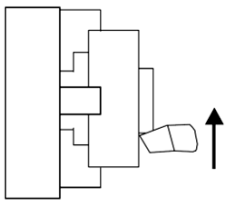
LATHE OPERATIONS -1, 2

❖ **Lathe Operations**

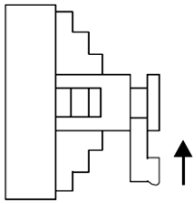
1. Straight turning
2. Shoulder turning
3. Taper turning
4. Chamfering
5. Eccentric turning
6. Thread cutting
7. Facing
8. Forming
9. Filing
10. Polishing
11. Grooving
12. Knurling
13. Spinning
14. Spring winding
15. Undercutting
16. Parting-off
17. Internal thread cutting
18. Drilling
19. Reaming
20. Boring
21. Counter boring
22. Taper boring
23. Tapping



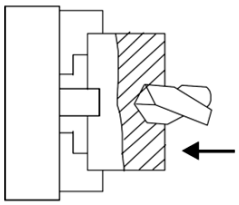
Knurlling



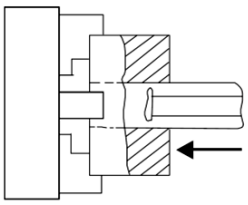
Facing



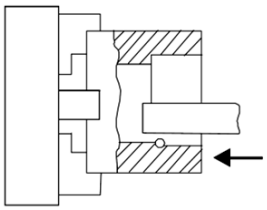
Parting or cutting off



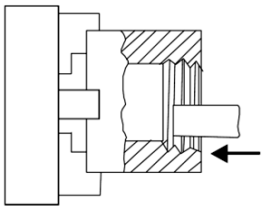
Drilling



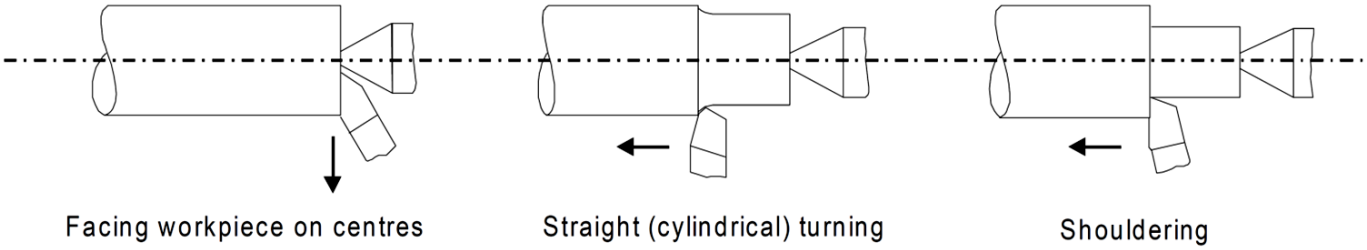
Reaming



Boring



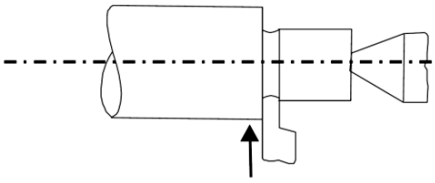
Internal threading



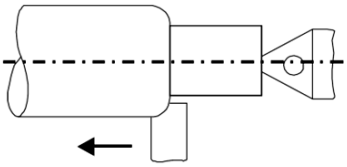
Facing workpiece on centres

Straight (cylindrical) turning

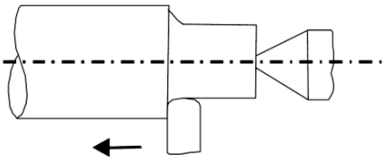
Shouldering



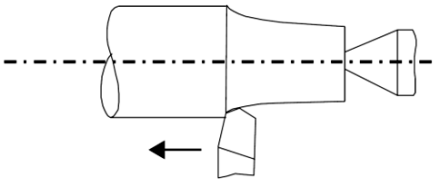
Filleting (form tool)



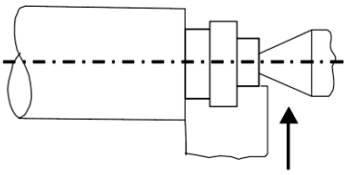
Radius turning (form tool)



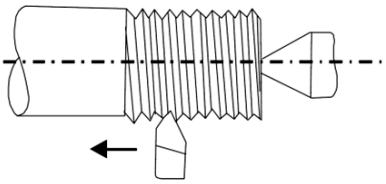
Necking (form tool)



Taper turning



External thread cutting



Forming

Lecture 5

MILLING MACHINE TOOLS (TYPES, CONSTRUCTION AND WORKING PRINCIPLE)

MILLING

A milling machine is a machine tool that removes metal as the work is fed against a rotating multipoint cutter. The milling cutter rotates at high speed and it removes metal at a very fast rate with the help of multiple cutting edges. One or more number of cutters can be mounted simultaneously on the arbor of milling machine. This is the reason that a milling machine finds wide application in production work. Milling machine is used for machining flat surfaces, contoured surfaces, surfaces of revolution, external and internal threads, and helical surfaces of various cross-sections

❖ Principle of Milling

In milling machine, the metal is cut by means of a rotating cutter having multiple cutting edges. For cutting operation, the workpiece is fed against the rotary cutter. As the workpiece moves against the cutting edges of milling cutter, metal is removed in form chips of trochoid shape

❖ Milling Methods

1. Up-milling or conventional milling
2. Down milling or climb milling

1. UP-Milling or Conventional Milling Procedure

- The metal is removed in form of small chips by a cutter rotating against the direction of travel of the workpiece.
- The chip thickness is minimum at the start of the cut and maximum at the end of cut. As a result the cutting force also varies from zero to the maximum value per tooth movement of the milling cutter.
- The major disadvantages of up-milling process are the tendency of cutting force to lift the work from the fixtures and poor surface finish obtained.
- It is commonly used method of milling.

2. Down-Milling or Climb Milling

- It is also known as climb milling. In this method, the metal is removed by a cutter rotating in the same direction of feed of the workpiece.
- The effect of this is that the teeth cut downward instead of upwards. Chip thickness is maximum at the start of the cut and minimum in the end.
- It is claimed that there is less friction involved and consequently less heat is generated on the contact surface of the cutter and workpiece.
- Climb milling can be used advantageously on many kinds of work to increase the number of pieces per sharpening and to produce a better finish.
- With climb milling, saws cut long thin slots more satisfactorily than with standard milling.
- Another advantage is that slightly lower power consumption is obtainable by climb milling, since there is no need to drive the table against the cutter.

❖ Types of Milling Cutters

(1) Plain milling cutters,
(2) Side milling cutters,
(3) Face milling cutter,
(4) Angle milling cutters,
(5) End milling cutter,
(6) Fly cutter,
(7) T-slot milling cutter,
(8) Formed cutters,
(9) Metal slitting,

❖ Types of Milling Machines

1. Column and knee type milling machines
- (*a*) Hand milling machine
- (*b*) Horizontal milling machine
- (*c*) Universal milling machine
- (*d*) Vertical milling machine

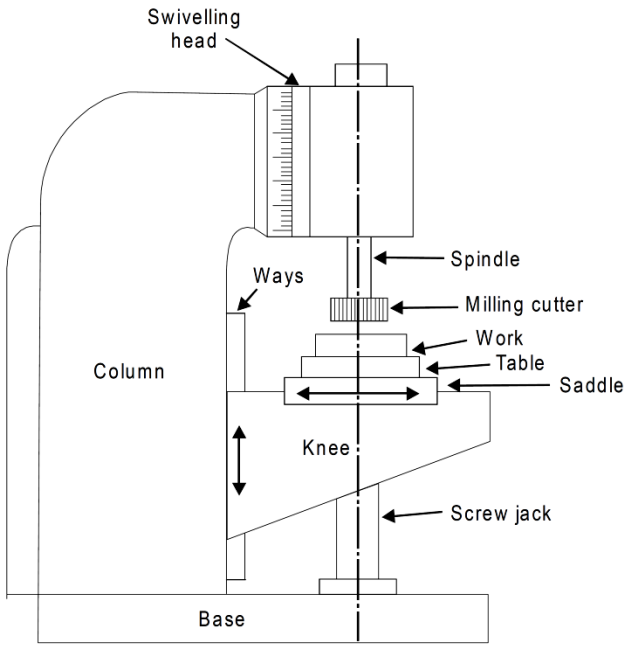
2. Planer milling machine

3. Fixed-bed type milling machine
- (*a*) Simplex milling machine.
- (*b*) Duplex milling machine.
- (*c*) Triplex milling machine.

4. Machining center machines

5. Special types of milling machines
- (*a*) Rotary table milling machine.
- (*b*) Planetary milling machine.
- (*c*) Profiling machine.
- (*d*) Duplicating machine.
- (*e*) Pantograph milling machine.
- (*f*) Continuous milling machine.
- (*g*) Drum milling machine
- (*h*)Profiling and tracer controlled milling machine

❖ Column and Knee Type Milling Machine

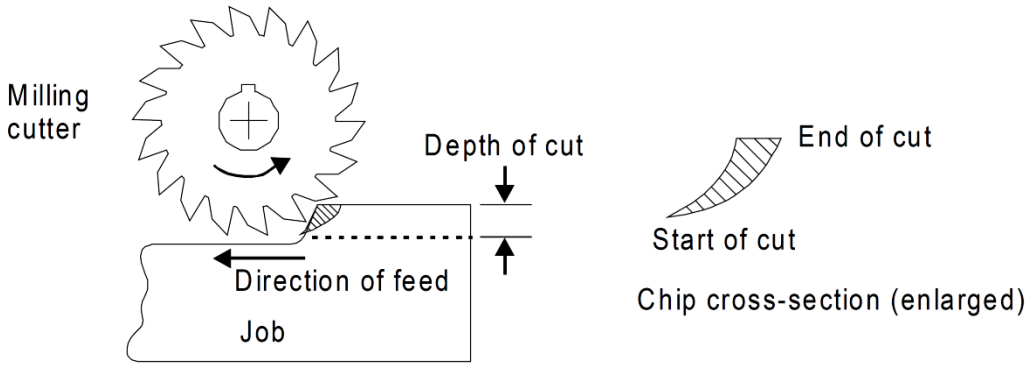


A column and knee type milling machine

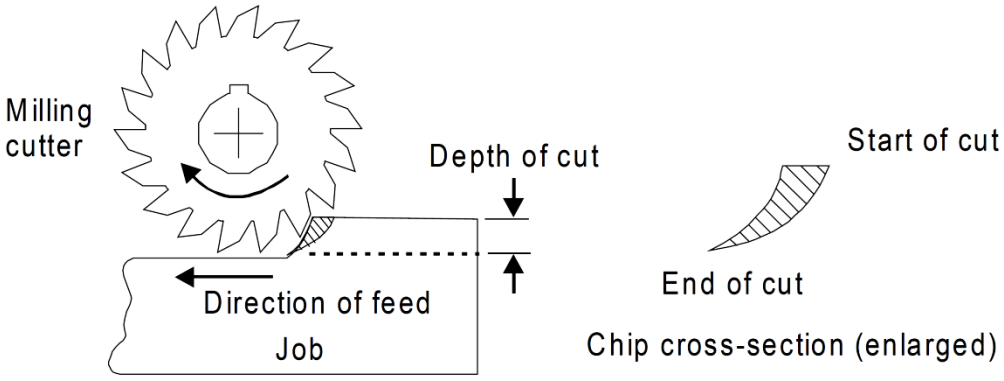
1. Base
2. Column
3. Saddle
4. Table
5. Elevating screw
6. Knee
7. Knee elevating handles
8. Cross feed handle
9. Front brace
10. Arbor support
11. Arbor
12. Overhanging arm
13. Cutter
14. Cone pulley
15. Telescopic feed shaft.

Lecture 6

MILLING MACHINE TOOLS (UP MILLING, DOWN MILLING, INDEXING)



Principal of up-milling



Principal of down-milling

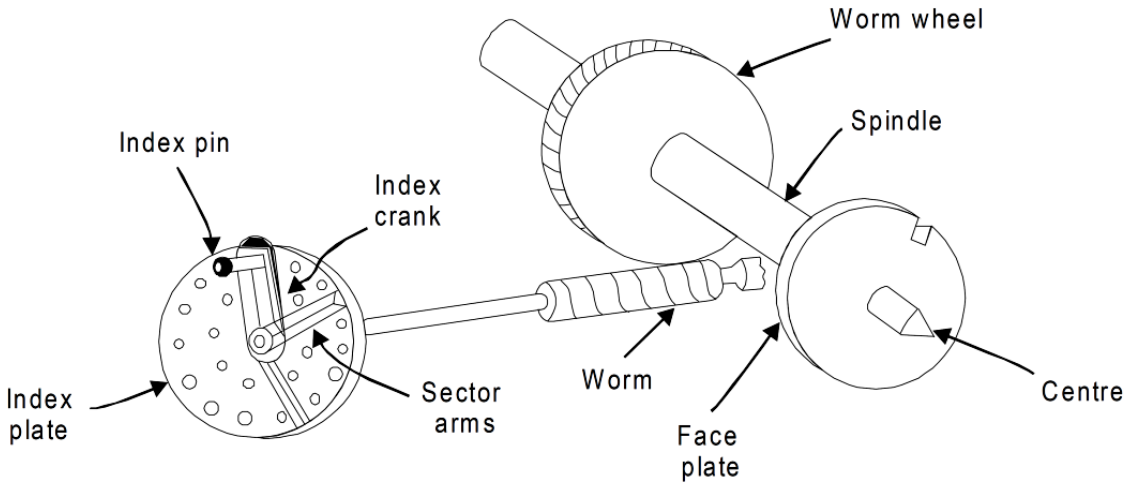
❖ **Indexing and Dividing Heads**

Indexing is the operation of dividing the periphery of a piece of work into any number of equal parts. In cutting spur gear equal spacing of teeth on the gear blank is performed by indexing. Indexing is accomplished by using a special attachment known as dividing head or index head.

(1) Plain or simple dividing head,

(2) Universal dividing head and

(3) Optical dividing head.



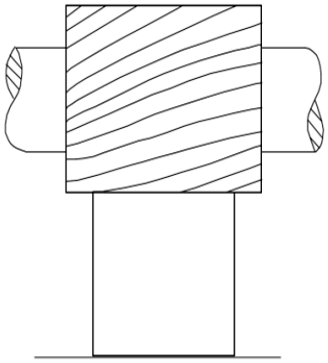
Dividing head

Lecture 7

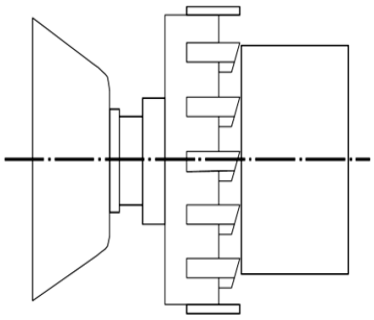
MILLING OPERATIONS

❖ **Operations Performed On Milling Machine**

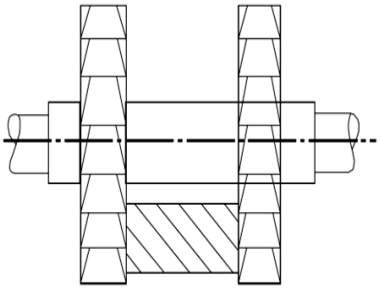
1. **Plain milling or slab milling**: It is a method of producing a plain, flat, horizontal surface parallel to the axis of rotation of the cutter.
2. **Face milling**: It is a method of producing a flat surface at right angles to the axis of the cutter.
3. **Side milling**: It is the operation of production of a flat vertical surface on the side of a work-piece by using a side milling cutter
4. **Angular milling**: It is a method of producing a flat surface making an angle to the axis of the cutter.
5. **Gang-milling**: It is a method of milling by means of two or more cutters simultaneously having same or different diameters mounted on the arbor of the milling machine.
6. **Form milling**: It is, a method of producing a surface having an irregular outline.
7. **End milling**: It is a method of milling slots, flat surfaces, and profiles by end mills.
8. **Profile milling**: It is the operation of reproduction of an outline of a template or complex shape of a master die on a workpiece.
9. **Saw milling**: It is a method of producing deep slots and cutting materials into the required length by slitting saws.
10. **T-slot milling**
11. **Keyway milling**
12. **Gear cutting milling**
13. **Helical milling**
14. **Flute milling**
15. **Straddle milling**: It is a method of milling two sides of a piece of work by employing two side-milling cutters at the same time.



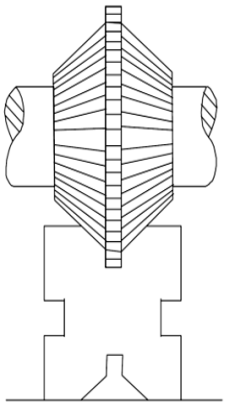
(a) Plane milling



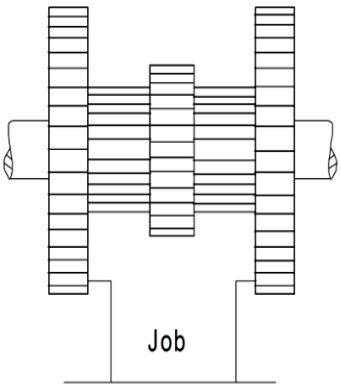
(b) Face milling



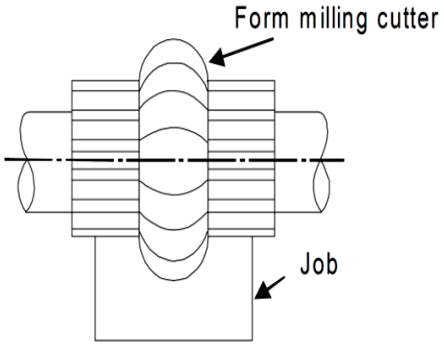
(c) Side milling



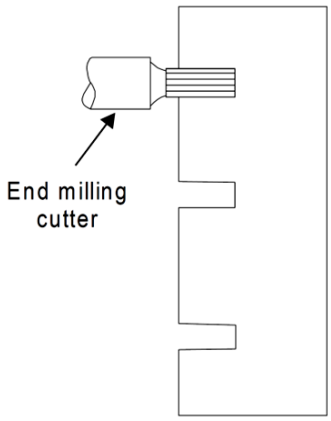
(d) Angular milling



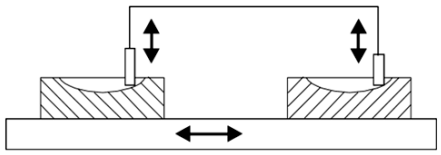
(e) Gang milling



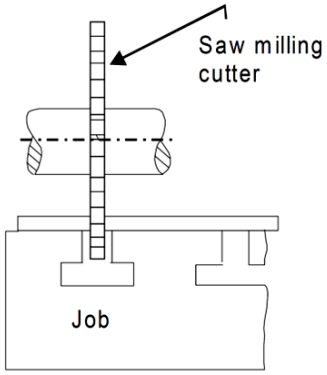
(f) Form Milling



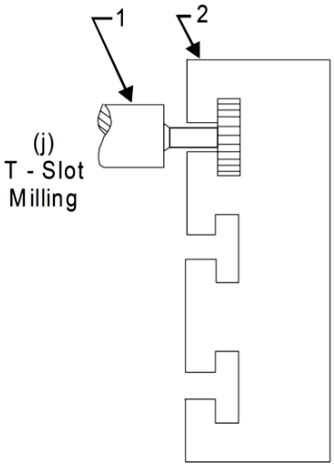
(g) End milling

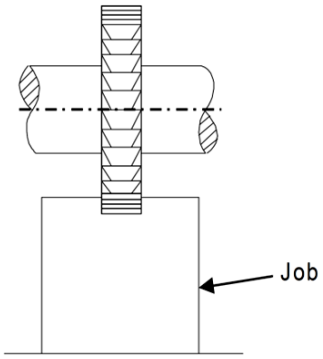


(h) Profile milling

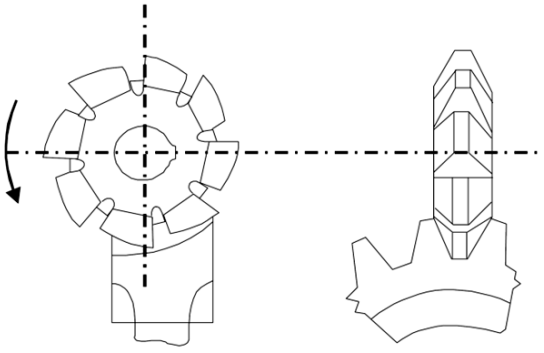


(i) Saw milling





(k) Key way milling



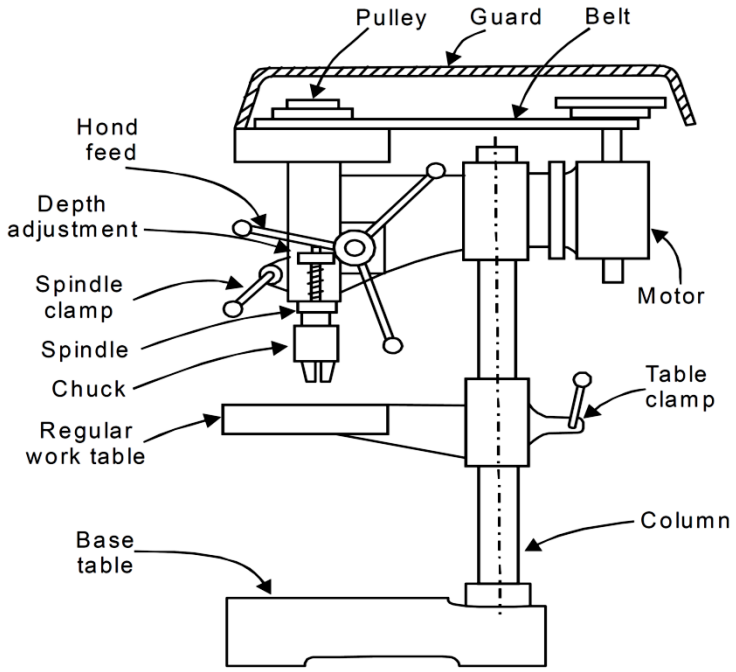
(l) Gear Cutting Milling

Lecture 8

DRILLING MACHINE TOOLS (TYPES, CONSTRUCTION AND WORKING PRINCIPLE)

DRILLING MACHINE

Drilling is an operation of making a circular hole by removing a volume of metal from the job by cutting tool called drill. A drill is a rotary end-cutting tool with one or more cutting lips and usually one or more flutes for the passage of chips and the admission of cutting fluid.



Construction of drilling machine

❖ Types of Drilling Machine

(1) Portable drilling machine
(2) Sensitive drilling machine
(a) Bench mounting
(b) Floor mounting
(3) Upright drilling machine
(a) Round column section
(b) Box column section machine
(4) Radial drilling machine
(a) Plain
(b) Semi-universal
(c) Universal
(5) Gang drilling machine
(6) Multiple spindle drilling machine
(7) Automatic drilling machine
(8) Deep hole drilling machine
(a) Vertical
(b) Horizontal

❖ Size of A Drilling Machine

1. Table diameter
2. Number of spindle speeds and feeds available
3. Maximum spindle travel
4. Morse taper number of the drill spindle
5. Power input
6. Net weight of the machine
7. Floor space required

❖ **Types of Drills**

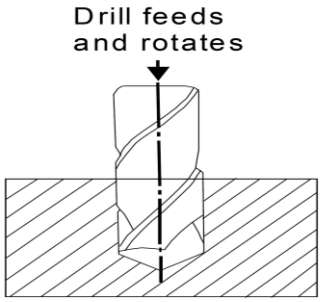
1. Flat drill
2. Straight-fluted drill
3. Twist drill

Lecture 9

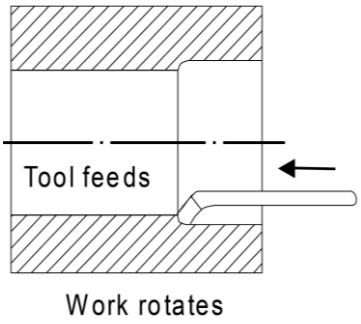
DRILLING OPERATIONS

❖ **Operations Performed On Drilling Machine**

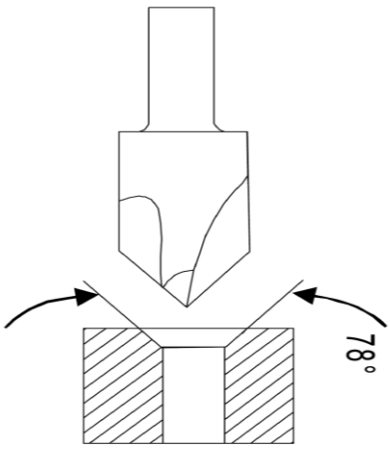
1. Drilling
2. Reaming
3. Boring
4. Counter boring
5. Countersinking
6. Spot facing
7. Tapping
8. Lapping
9. Grinding



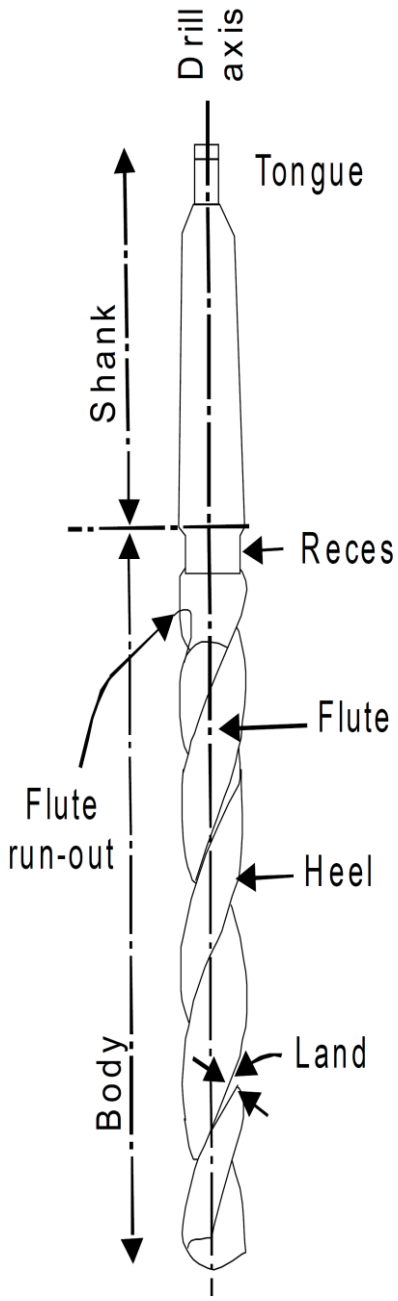
Drilling operation



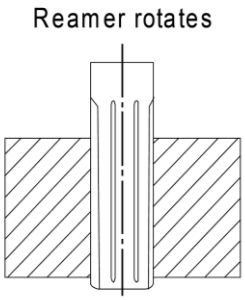
Boring operation



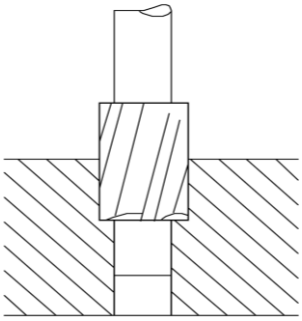
Counter sinking



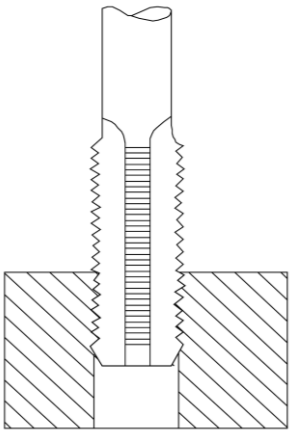
Twist Drill Geometry



Reaming operation



Counter boring operation



Tapping operation

Lecture 10

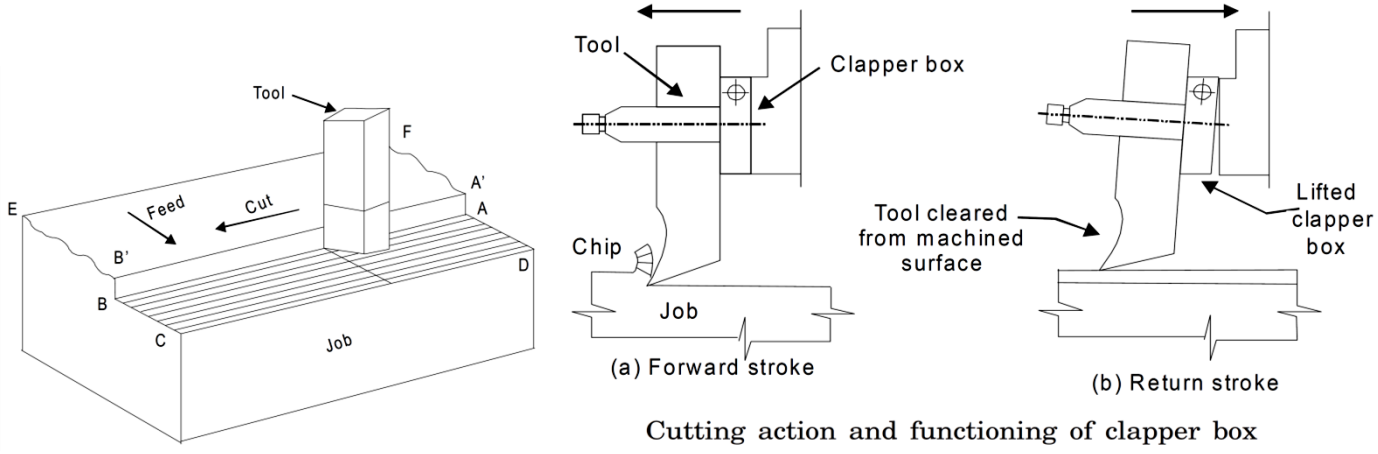
SHAPER MACHINE TOOLS (TYPES, CONSTRUCTION AND WORKING PRINCIPLE)

SHAPER

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 workpiece is rigidly held in a vice or clamped directly on the table.
- The ram reciprocates and thus cutting tool held in tool holder moves forward and backward over the work piece.
- 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 workpiece and depth of cut is adjusted by moving the tool downward towards the workpiece.
- The time taken during the idle stroke is less as compared to forward cutting stroke and this is obtained by quick return mechanism



Cutting action and functioning of clapper box

❖ Types of Shapers

(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:

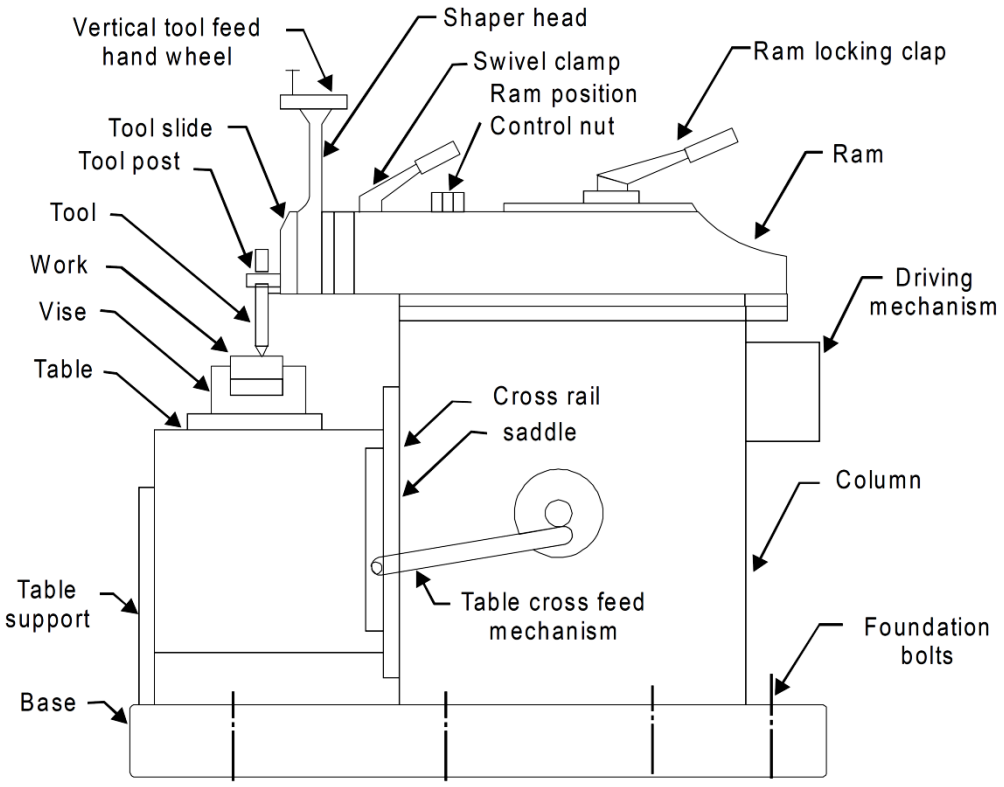
(3) According to the position and travel of ram:

(*a*) Horizontal type
(*b*) Vertical type
(*c*) Traveling head type

(4) According to the type of cutting

(*a*) Standard shaper
(*b*) Universal shaper

stroke:
(*a*) Push type
(*b*) Draw type.



Parts of a standard shaper

❖ **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 quick return 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.

(1) Crank and slotted link mechanism
(2) Whitworth quick return mechanism, and
(2) Hydraulic shaper mechanism

❖ **Surfaces Produced On Shaper**

1. Horizontal plain surface
2. Vertical plain surface
3. Inclined surface
4. Grooved surface
5. Slotted surface
6. Stepped surface

Lecture 11

SHAPER OPERATIONS

❖ **Shaper Operations**

1. Machining horizontal surface
2. Machining vertical surface
3. Machining angular surface
4. Slot cutting
5. Key ways cutting
6. Machining irregular surface
7. Machining splines and cutting gears

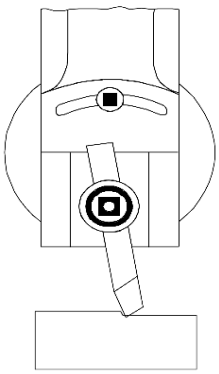


Fig. Machining horizontal surface on shaper

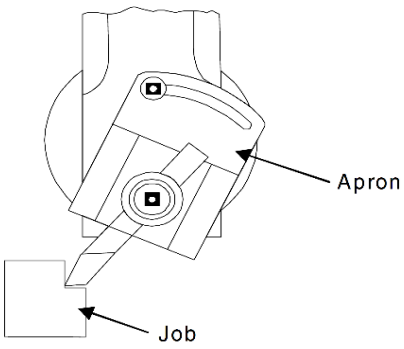
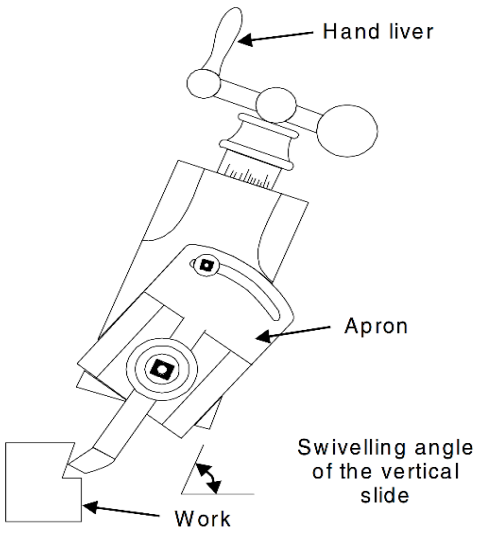


Fig. Machining vertical surface on shaper



Cutting slots and keyways.

Fig. Machining angular surface on shaper

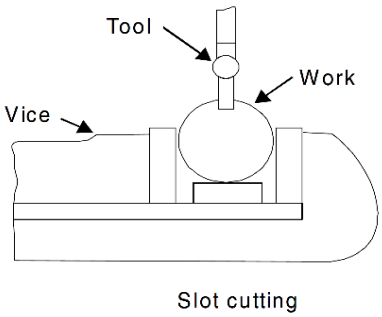


Fig. Slot cutting on shaper

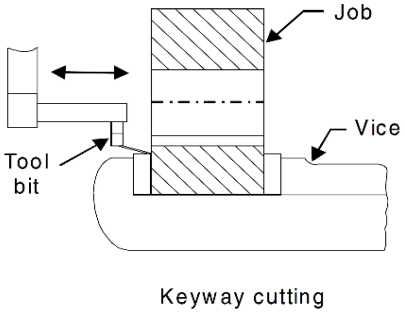


Fig. Keyway cutting on shaper

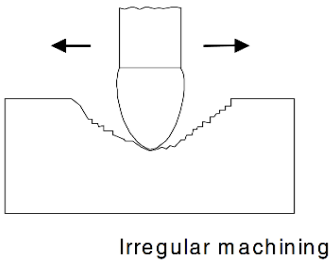


Fig. Machining irregular surface on shaper

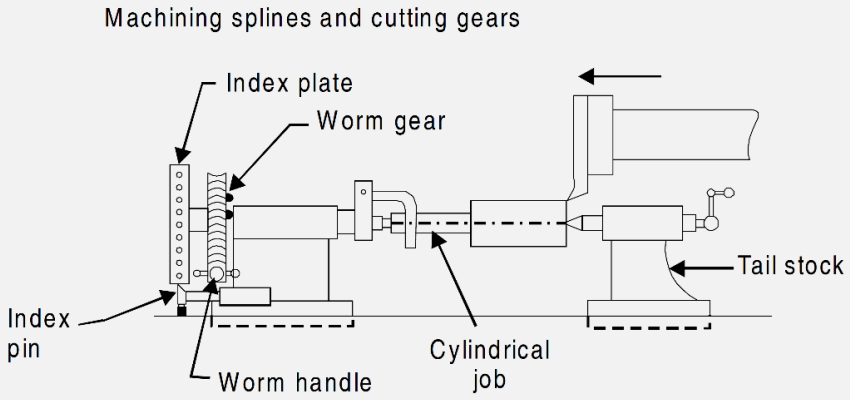


Fig. Machining splines and cutting gears on shaper

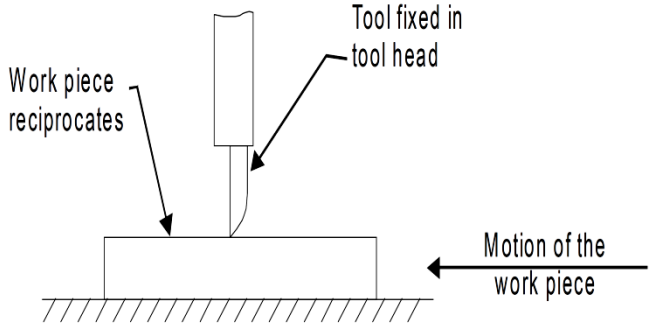
Lecture 12

PLANNER MACHINE TOOLS (TYPES, CONSTRUCTION AND WORKING PRINCIPLE)

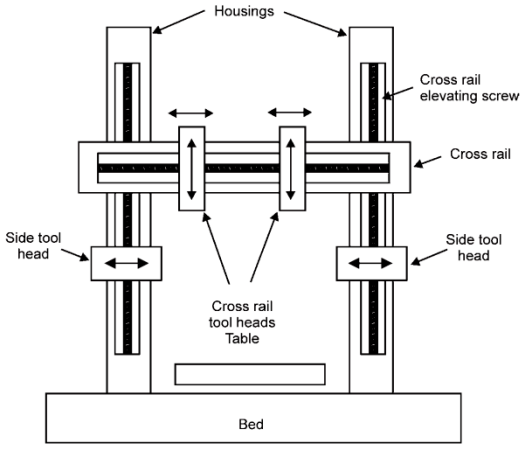
PLANER

- Planer is used primarily to produce horizontal, vertical or inclined flat surfaces by a single point cutting tool.
- It is used for machining large and heavy work pieces that cannot be accommodated on the table of a shaper.
- In addition to machining large work, the planer is frequently used to machine multiple small parts held in line on the platen.
- Planer is mainly of two kinds namely open housing planer and double housing planer.
- The bigger job is fixed with help of the grooves on the base of the planer and is accurately guided as it travels back and forth.
- The size of a standard planer is specified by the size of the largest solid that can reciprocate under the tool.

❖ Working Principal of Planer



Working principle of a planer



Standards or double housing planer

- Cutting tools are held in tool heads of double housing planer and the work piece is clamped onto the worktable.
- The worktable rides on the gin tool heads that can travel from side to side i.e., in a direction at right angle to the direction of motion of the worktable.
- Tool heads are mounted on a horizontal cross rail that can be moved up and down.
- Cutting is achieved by applying the linear primary motion to the workpiece (motion X) and feeding The tool at right angles to this motion (motion Y and Z)

❖ Types of Planers

1. Double housing planer
2. Open side planer
3. Pit planer
4. Edge or plate type planer
5. Divided table planer

❖ **Difference between Shaper and Planer**

Planer	Shaper
1. It is a heavy duty machine tool.	1. It is a light duty machine tool.
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. More than one cutting tool can be used at a time.	4. Only one cutting tool is used at a time.
5. Tool is fixed and work moves.	5. Work is fixed and the tool moves.
6. Planer table is either driven by gears or by hydraulic means.	6. It is normally driven by crank and slotted lever quick return motion mechanism.
7. Heavier feeds are applied.	7. Lighter feeds are applied.
8. It can take deep cuts.	8. It cannot take deep cuts.
9. Work setting requires much of skill and takes longer time.	9. Work may be clamped easily and quickly.
10. Tools used are of larger size.	10. Tools used are of smaller size.

Lecture 13

GRINDING MACHINE TOOLS (TYPES, CONSTRUCTION AND WORKING PRINCIPLE)

GRINDING

It is metal cutting process which makes use of an abrasive tool called the grinding wheel. It is made of abrasive grains having high hardness and heat resistance and is held together by a bonding material. The grinding process provides high accuracy and good surface finish so they are used for finishing operations. The material removal rate in this process is quite less, normally from 0.25 mm to 0.55 mm. Tolerances, as small as 0.002 can be maintained.

The various cutting fluids generally used are as follows:

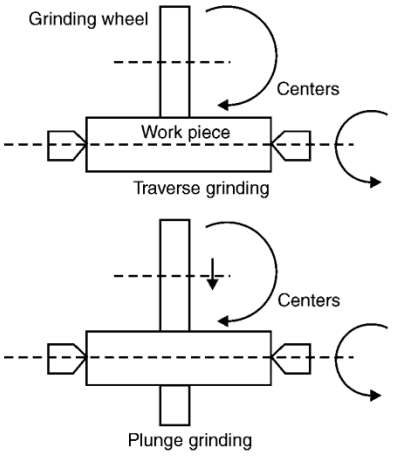
1. One per cent solution of soda ash with 0.15 per cent sodium nitrite.
2. A two percent water solution of powdered soap.
3. Cast iron and copper are ground without any coolant.
4. Aluminum is ground by using kerosene with or without a mixture of mineral oil as a coolant.

The process of grinding is dependent upon the following:

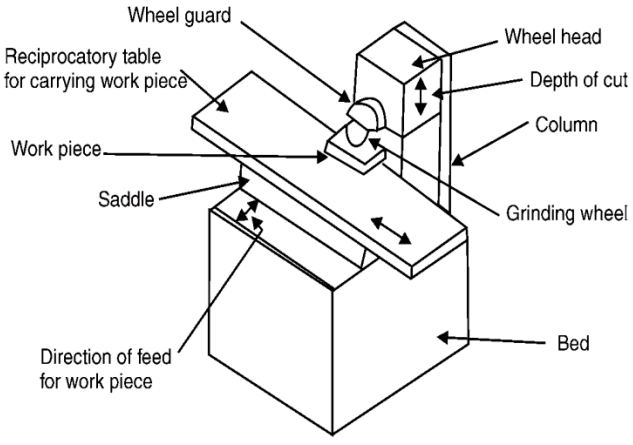
a. Type of abrasive used in the wheel
b. Size and distribution of grit in the wheel
c. Amount and type of bonding material
d. Volume of porosity: relative to abrasive and bonding material

Types of Grinding Machines

1) Cylindrical grinders
2) Surface grinders
3) Center less grinding machine



Working of Cylindrical Grinders



Main Parts of Surface Grinder

Lecture 14

GRINDING OPERATIONS

❖ **Operations Performed on Grinding Machine**

(a) Polishing: This process is used for removing scratch marks and tool marks on the work piece to give a good look. For this process, polishing wheels made of canvas, leather or paper are used. The work piece is brought in contact with the revolving wheel to remove the marks on the work piece.

(b) Buffing: This is also a surface finishing process and is used to produce lustrous surface of attractive appearance. In this process, a very small amount of material is removed. The buffing wheel is made of felt, cotton and powered abrasives are applied on the surface of the wheel.

(c) Lapping: This process is used for producing extremely accurate highly finished surfaces. Lapping is carried out by means of shoes called Laps. The Laps are made up of soft cast iron, copper, lead and brass. Fine abrasive particles are charged into the lap. Silicon carbide, aluminum oxide and diamond dust are the commonly used lapping powders. Oil and greases are used to spread the abrasive powders. The charged lap is rubbed against the work piece surface and the abrasive particles in the surface of the lap remove small amounts of material from the work piece surface. The material removed by lapping is less than 0.025 mm.

Lapping can be done either by hand or special machines. The lap has a series of grooves in it. These are provided for collecting the excess abrasive and chips. The surface of the lap is charged with a fine abrasive. The work piece is moved across the surface of the lap using reciprocating or rotary motion. In machine lapping, two flat laps are used that are called upper and lower laps. The work pieces to be lapped are inserted between these two laps rotating in opposite direction. The work piece holder can accommodate a number of work pieces which are not clamped.

(d) Honing: Honing is an abrasing process used for finishing internal cylindrical surfaces like drilled or bored holes. Honing stones are manufactured by bonding abrasives like aluminum oxide or silicon carbide. Materials like sulphur, resin or wax are added to improve the cutting action. Honing can be done manually or by machines. The preferred method is by using machines. The stones are held in a honing head. This head is directed to move in and out of the hole for carrying out operation. Honing is both a sizing and finishing operation and is generally used for removing the scratch marks produced by grinding. The material removal is less than 0.125 mm.

(e) Super finishing: It is an abrasive process for removing scratches produced by machining and other surface irregularities. It is used for producing extremely high quality surface finish. The amount of material removal is 0.005 to 0.0025 mm. In super finishing, an abrasive stick is retained in a suitable holder and applied to the surface of the work piece with a light pressure. This process is normally carried out for finishing outer surfaces. The abrasive block reciprocates across the rotating work piece. These two motions produce a high degree of accuracy. The abrasive used are aluminum oxide for materials like alloy and high speed steels. Silicon carbide abrasives are used for materials like cast iron, alluminium, brass. Bonded diamond dust is used for finishing carbide tools.

Lecture 15

PWER PRESS (TYPES, CONSTRUCTION AND WORKING PRINCIPLE)

POWER PRESS

- The press is a metal forming machine tool designed to shape or cut metal by applying mechanical force or pressure.
- The metal is formed to the desired shape without removal of chips
- Presses and press tools facilitate mass production work
- These are considered fastest and most efficient way to form a sheet metal into finished products

❖ TYPES OF PRESSES

- Classification based on the source of power:
  - Hand press or ball press or fly press
  - Power Press

- Classification based on the design of frame:
  - Gap
  - Inclinable
  - Adjustable
  - Horn
  - Straight side
  - Pillar

- **Manually Operated or Power Driven:**
  These presses are used to process thin sheet metal working operations where less pressure or force is required. These are operated by manual power. Most of manually operated presses are hand press, ball press or fly press.

- **Power Presses**
  Power presses are normally driven by mechanical mechanism or hydraulic system. Power source of these presses may be electric motor or engine.

  - **Gap Frame Press**
    These presses have larger frame openings, that means a wide gap between its base and ram to accommodate larger work pieces. It also has longer beds.

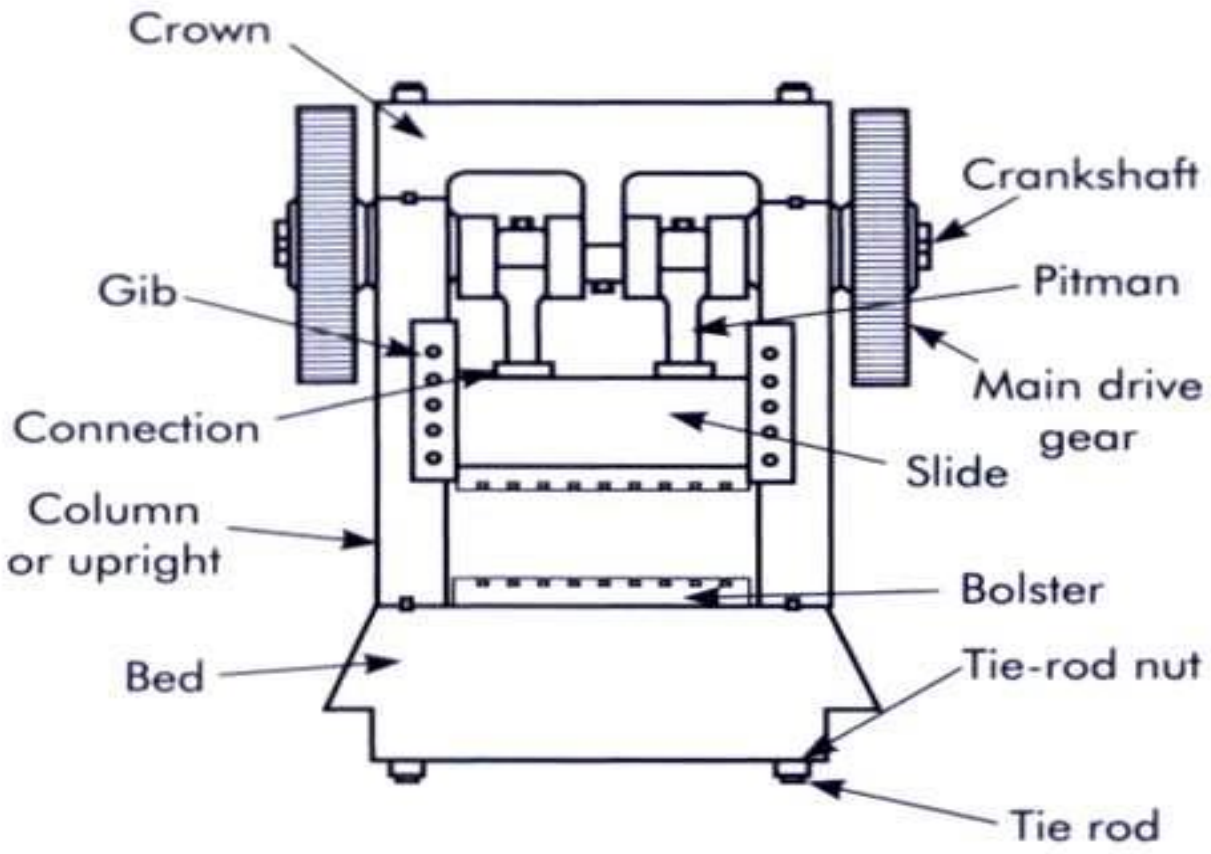
  - **Inclinable Frame Press**
    Its frame is called inclinable due to its capability to tilt back up to some angle. Its back is open to exit the scrap so it is also called open back inclinable press.

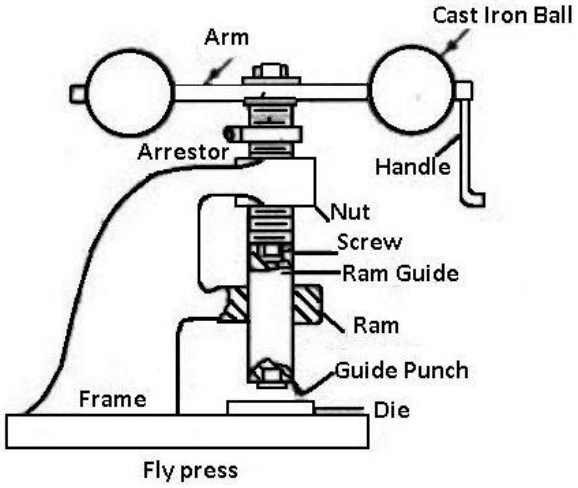
  - **Adjustable Bed Type Press**
    Its bed (knee) can be adjusted at any desirable height by moving it vertically up or down with the help of power screws. This enables the settings of different sizes of work and dies on the machine

- **Straight Side Press**
  It has two vertical rigid frames mounted on two sides of the base which are intended for absorbing severe load exerted by the ram. The machine is suitable for heavy work but due to presence of side frames, the sheet Metal cannot be fed from the side.

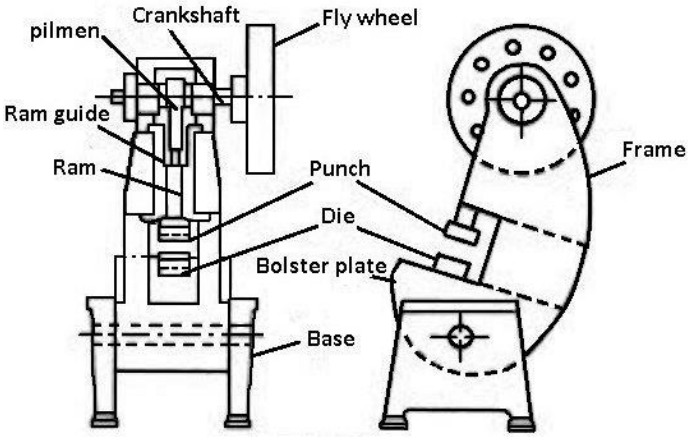
- **Horn like press**
  The horn press has a cylindrical horn like projection from the machine frame, which serves as the die support. The horns may be interchanged for different sizes of work.

- **Pillar press**
  The pillar press is a hydraulic press having four pillars mounted on the base .The pillars support and guide the ram.

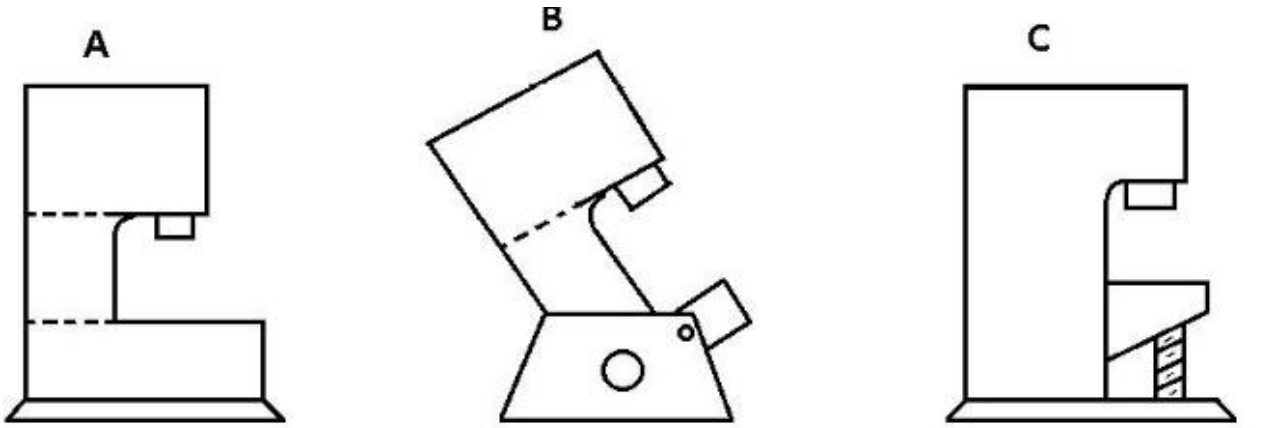




Fly press



Power press



Gap Press | Inclined Press | Adjustable Bed Press

Lecture 16

POWER PRESS TOOLS AND APPLICATIONS

- **Parts and functions of Press machine**

Base

The base is the supporting member of the press and provides arrangement for tilting and clamping the frame in an inclined press.

Frame

Frame constitutes main body of the press located at one edge of its base. It houses support for ram, driving mechanism and control mechanisms. All presses except the straight side type have "C" shaped frame to take up the vertical thrust of the ram.

Bolster Plate

It is the flat plate fitted on the base for supporting the die block and other accessories of the press. Ram reciprocates to and fro within its guide ways with prescribed stroke length and power. The stroke length and power transferred can be adjusted as per the requirements. Ram at its bottom end carries punch to process the work piece.

Pitman

It is the part which connects the ram and crankshaft or ram eccentric.

Driving mechanism

The rotary movement of the motor is converted into the reciprocating movement of the ram by crank and connecting rod, eccentric and connecting rod in mechanical presses.

Fly Wheel

The flywheel is mounted at the edge of the driving shaft and is connected to it through a clutch. The energy is stored up in the fly wheel during idle periods and it is expected to maintain the constant speed of the ram when the punch is pressed into the work.

Clutch

The clutch is used for connecting and disconnecting and the driving shaft with the flywheel when it is necessary to start or stop the movement of the ram.

Brakes

The brakes are used to stop the movement of the driving shaft immediately after it is disconnected from the fly wheel

❖ **Press size**

The size of the press is designated by its maximum capacity of applying load on a piece of blank, and it is expressed in tones.

The bed area is also considered in the press size.

- **Mechanical**
  - Capacities to 6,000 tons
  - Force varies throughout the stroke
  - Limited/difficult overload

- **Hydraulic**
  - 50,000 + ton capacities
  - Large force available at the top of the stroke
  - Overload protection

❖ **Press Tools**

- **Punch**:-

  It is that part of the press tool which enters into the cavity formed in the die section .The punch is usually the upper member of the press tool which is mounted on the lower end of the ram and slides with it.

- **Die**:-

  A die is that part of the press tool which has opening cavity to receive the punch .The die is usually the lower member of the press tool which is clamped on the bolster plate fitted on the table and remain stationary.

- **Die set:-**

  Both die and punch work together as a unit and this is called a die set. Punch and die both are made of high speed steel. Die is the part where strength and wear resistant both properties are required. So normally working surface

❖ **Application of power press**

- Power presses are used for punching or stamping, forming or drawing and embossing operation. Press brakes are used for bending operations.
- Press working is used in large number of industries like automobile industry, aircraft industry, telecommunication electrical appliance, utensils making industry are major examples