BANKURA GOVT. POLYTECHNIC

MECHANICAL ENGINEERING DEPARTMENT

MACHINE SHOP

STUDY OF LATHE

Lathe is versatile machine tool is which the job is hold and rotated by chuck of the lathe accessories and excess materials removed by the single point cutting tool, which removed by carriage. it produces mainly cylindrical surface. it can perform a no of machining operation such as straight turning, taper turning, facing, grooving, threading, knurling etc. since a number of machining operation can be done by it hence it is called versatile machine tool.

TYPES OF LATHE:-

1.Bench Lathe 2. Engine Lathe 3. Centre Lathe 4. Speed Lathe 5.Toolroom Lathe 6. Capstan Lathe & Turret Lathe 7. Automatic Lathe 8. Special purpose Lathe 9. C N C Lathe

PARTS OF LATHE:-

1)Head Stock 2) Tail Stock 3)Carriage 4)Bed 5)Feed Mechanism 6)Thread cutting mechanism

HEAD STOCK

Main parts of the Head Stock:-

1. Main Spindle
2. Driving Mechanism of spindle
3. Casing

HEAD STOCK SPINDLE

Head stock spindle is made hollow having externally Threaded rear end and nose. The Threaded nose carries the chuck, catch-plate or Face-plate. The rear Threaded portion carries the driving gear which transmits the motion to the Feed-box through gear-train.

The inner portion of nose is tapered to accommodation taper sleeve in which live-centre is fitted, when tapered sleeve is worn out then it can be replaced at much lower cost.

The spindle consists of a collar which prevents the end-thrust during longitudinal feed of job. The spindle is supported in two bearings which may be either brush-bearing or ball-bearing.

Material:-

Nickel, Chromium, steel is the best material for main spindle.

Function:-

1. It rotates the main spindle at different desired speeds.
2. Its gives motion to the feed bar for automatic feed.
3. It also gives motion to the Lead screw for cutting Threads.

TAIL STOCK

Function:-

1. It supports the job at its other end .
2. It may hold a cutting tool like drill,reamer or tap in place of dead centre for machining the job.
3. It facilitates taper turning by offsetting the tailstock.

CARRIAGE

Function:-

1. It holds the cutter in its tool post.
2. It gives longitudinal feed.
3. It gives cross feed
4. It also gives feed in angular direction by swivelling the compound rest.

BED

Function:-

1.It supports the tail stock and facilitates its movement on its inner guide ways.

2. It supports the carriage and facilitates its movement on its outer guide ways.

3. It absorbs vibrations produced by cutting forces.

4. It stores the chips produced during machining which are removed periodically.

5.It also stores the cutting fluid which is sent back to reservoir.

FEED MECHANISM

Function:-

1. It gives automatic longitudinal feed and hand longitudinal feed.
2. It also gives automatic cross-feed and hand operated cross-feed.

THREAD CUTTING MECHANISM

Function:-

1. It facilitates the thread cutting on the job by the help of lead screw and half nut mechanism.

CONE PULLEY DRIVE MECHANISM

It is a mechanism which rotates the main spindle at different speeds. It consists of three shafts.

1. Counter shaft.
2. Main spindle.
3. Stationary shaft.

Counter Shaft is driven by an induction motor by the half of groove pulley and V-Belt. A cone pulley is rigidly fixed to the counter shaft by the help of key.

The main spindle carries a similar cone pulley in opposite direction and it is loosely fitted.

A gear Z_1 is an integral part of pulley block. A bull gear Z_4 is rigidly fixed to the main spindle. It contains a carrier-bolt which may attach or detach the bull gear with pulley block of main spindle.

The stationary shaft is supported eccentrically and it can be raised or lowered by operating the handle. It carries a quill consisting of back gear Z_2 and Z_3. The quill is free to rotate on the shaft.

WORKING PRINCIPLE:-

The working of cone pulley and back gear mechanism can be divided in two parts.

1.When back gear is disengaged.

2.When back gear is engaged.

FEED MECHANISM

Feed:-The distance moved by the cutting tool during one revolution of the job is called feed.

Feed may be three types

1. Longitudinal feed

2. Cross feed

3. Angular feed

1. Longitudinal feed:-The longitudinal distance moved by the cutting tool during one revolution of the job is called longitudinal feed. Its unit is mm/rev. Saddle is moved to give longitudinal feed.

2. Cross feed :-The distance moved by the cutting tool across the lathe axis during one revolution of the job is called cross feed.

The cross slide is moved to give cross feed. Its unit is mm/rev.

4. Angular feed:- The distance moved by the cutting tools along the line inclined to lathe axis during one revolution of job is called angular feed . This feed is given by compound slide of carriage. Its unit is mm/rev.

FORMULA:-

1. Longitudinal feed=$\frac{Length\ of\ job\ in\ mm}{\frac{Revolution}{minute}\times Time\ in\ minutes}$

2. Cross Feed:- $\frac{Radial\ distance\ of\ solid\ portion}{Total\ number\ of\ revolutions}$

FEED REVERSING MECHANISM /FEED MECHANISM OF LATHE

The feed mechanism consist of

(a) Transmission of motion from main spindle to feed bar, and
(b) Transmission of motion from feed bar to the apron mechanism.

The motion of main spindle is transmitted to the inner stud

Gear through A & B .The gear D rotates at the same speed and in the same direction as that of C because both are on the same shaft .

Gear D transmits the motion to the gear F through the idle gear intermediate gear E.

Thus motion is transmitted to the feed box which contains gear cone for rotating the feed bar at different desired speeds. Thus the feed bar gets the motion from the main spindle.

APRON MECHANISM

Apron is fixed to the saddle and it carries hand wheel and lever for controlling purposes. It carries a mechanism which converts rotary motion of the feed bar in to longitudinal and transverse motion of the tool.

The apron mechanism consists of

1. Feed bar and worm
2. Worm wheel
3. Gears N , P, Q, R, S,
4. Fixed rack in lower portion of bed
5. Gear S fixed to the cross- feed screw.

CONSTRUCTION:-

The feed bar contains a worm which can be attached to it by a pin. The pin is operated by a lever which forms the part of full proof mechanism.

The worm meshes with the worm wheel. The main feature of worm and worm wheel is that it can give very high speed reduction in a very small space.

A gear N is fixed to the shaft to worm –wheel and it is in constant mesh with gear P. This gear P is carried on a bracket which can be moved in positions 1,2,and 3,in position no 1 it gives the motion for longitudinal feed position no 2 is neutral position and in position no 3, it gives the cross feed by rotating the feed screw of cross- slide by the help of gear S.

The rack is cut below the guide way of bed and pinion R meshes with it. The gear Q and R are rigidly fixed to the same shaft .

WORKOING PRINCIPLE:-It consists of different types of feed.

Automatic longitudinal feed:-When lever is operated then the pin engages the worm with the slot of the feed ber and the worm rotates with it . The worm wheel gets the motion form worm . The gear N mounted on the same shaft of worm wheel starts rotating and its motion is transmitted to the gear Q through P since pinion R is on the same shaft of gear Q hence it rotates.As the rack remains fixed ,the pinion moves along the bed with the whole carriage and longitudinal feed is obtained.

Neutral position:-When braket is operated to bpring the gear 'P' in position 2, then motion of gear 'P' is not transmitted and the carriage has no movement.

Hand operated longitudinal feed:-The gear 'P' is neutral position and hand –wheel is rotated.The gear 'T' fixes to the shaft of hand wheel rotates the gear 'Q' due to which 'R' starts rotating. Since 'R' meshes with fixed rack, hence it moves along bed with the carriage and hand operated longitudinal feed is obtained.

Hand operated cross-feed:-The gear'P' is kept in neutral position and cross feed screw is rotated by hand .The crosswise with the compound slide and tool-post.Thus cross fedd is obtained.

Automatic cross feed:-The gear 'P' is brought is position no.3 by operating the braket.In this position ,the gear 'P' meshes with gear'S' of cross feed screw. As the cross feed screw is rotated by the gear 'S' the cross –slide moves across the lathe axis and automatic cross feed is obtained.

Work holding devices ,lathe accessories & attachment:-The devices used in lathe for

(i)Holding or supporting the job or

(ii)Holding the tool

Is called lathe accessory.

The following are lathe accessories :-

(i)Lathe centre

(ii)Chuck

(iii)Catch plate & carrier

(iv)Mandrel

(v)Steady rest and follower rest.

LATHE CENTRE

There are two lathe centre

(a) Live centre

(b) Dead centre

The live centre is fitted to the main spindle while dead centre is fitted to the Tail stock spindle.

The included angle of lathe centres is 60°. It may be up to 75° for supporting heavier job.

The lathe centres are made of carbon tool steel. The dead centre is case hardened to reduce the rate of wear due to rotation of job.

There is no need of case hardening of live centre because it rotates with job and there is no relative motion with respect to the job.

The following are different types of lathe centres.

CHUCKS:-The lathe chuck is the device which holds the job by means of adjustable jaws.The jaws can be reversed for holding larger size of jobs.It rorates job by the help of spindle.

The boss of chuck has internal 'v' thread to fot it on the externally threaded nose of spindle.

The following are different type of chuck :-

(i) Two jaw chuck
(ii) Three jaw universal chuck or self centering chuck
(iii) Four jaw independent chuck
(iv) Combination chuck
(v) Magnetic chuck
(vi) Collect chuck
(vii) Pneumatic chauck & hydraulic chuck

TWO JAW CHUCK:-It is a very simple chuck used for holding for small jobs and small stock work,polishing etc.Where holding power and accuracy not so important.

THREE JAW UNIVERSAL CHUCK or SELF CENTERING CHUCK:-It has three jaw which slide simultaneously through internal scroll plate with the help of chuck-key.

It is used for holding cylindrical and hexagonal jobs.It takes minimum time to centre the job.

Limitation of three jaw chuck is that only regular e/s components can be hold in it.The run out can't be corrected in this case.

FOUR JAW INDEPENDENT CHUCK:-It is used for holding the jobs of irregular shape .It has four jaws which can be moved independently. Each jaw has three inner and one outer gripping surfaces.The jaw are made of high carbon steel to resist the wear.

COMBINATION CHUCK:-It is combination of self centering chuck and independent jaw chuck.It may have 4 or 6 jaw which can be operated simultaneously by the scroll dise and independently by separate screw.

Both regular and irregular shape jobs may be accommodated by it.

MAGNETIC CHUCK :-It is used for holding magnetic materials for machining. This jobs of magnetic material are held by it.It is magnetised by inserting a key and turning it by 180˚

COLLECT CHUCK:-It is a self –centering chuck which retains high degree of concentricity.The slots are cut along lengthwise and as the collect is drawn ,the split tapered and decrese in diameter and hold the job.

Advantages:

1) It is very simple in construction and reliable.
2) The work is held in it very quickly.
3) It has high accuracy of concentricity.
4) It has good gripping capability.

Disadvantage /Limitation :

1) It can't hold the jobs of larger diameters.
2) Jobs of regular size can only be held.

Use:-It is used for holding round square or hexagonal jobs.

PNEUMATIC CHAUCK & HYDRAULIC CHUCK:-Heavy jobs are hold by air chuck or hydraulic chuck. The air or hydraulic chuck has a cylinder fitted with piston which operates the piston rod.A control valve is used for movement of piston.

Compressed air is used for operation of air chuck which is also called pneumatic chuck.In hydraulic chuck the compressed brake fluid is used for movement of piston.

FACE PLATE;-It is used for holding the eccentric job. It is cast iron dise having a number of slots for holding job by the help of nuts and bolts. It has a threaded hole at the centre so that it may be screwed on the nose of the nose of the spindle.

TOOL HOLDING DEVICES

Type of tool used in Lathe work:-

Different operation of lathe	Tool used
1. Cantering	Centre drill
2. Turning	V tool

3. Facing tool	Facing
4. Shoulder turning	Facing tool
5. Chamfering	V tool
6. Grooving	Form tool
7. Parting off tool	Square nose parting
8. Knurling	Knurling tool
9. Forming	Forming tool
10. Taper turning	V tool & Form tool
11. Thread cutting thread	Threading tool for different angle
12. Drilling	Drill
13. Reaming	Reamar
14. Tapping Tap	
15. Under cutting tool	Squre nose parting
16. Boring bar.	While tool is hold in the boring
17. Counter boring	Counter boring tool
18. Internal threading tool	Internal threading
19. Grinding wheel	Grinding
20. Milling cutter	Different type of

JOB HOLDING PRINCIPLES

The jobs can be hold on head stock spindle by the following methods:-

1. Holding and driving the small jobs by chuck

2. Holding the longer job in between centres and driving by catch plate and carrier.

3. Holding the hollow job on mandrel and the mandrel is driven by the catch plate and carrier .

4. Holding the small thickness and odd job on face plate. Clamping by angle plates nuts and bolts etc.

5. Holding the production job on fixture.

SETTING OF WORK AND TOOLS AND ONLY FOR OPERATE:-

In the lathe operation, the head stock spindle holding the job & rotates with the same speed of the spindle, the carriage holding the tool on tool post moves translator path either longitudinally or cross-wise to give the desired feed, the two relative motions of job- tool make certain operation and removes metal in the form of chips, giving the desired shape of the job.

Facing :- It is the operation of the producing flat end of the job perpendicular to the longitudinal axis. Facing tool is given cross feed while the job is rotated by the main spindle .The feed for roughing is 0.3 to 0.7 mm/rev. and that for finishing is 0.1 to 0.3 mm/rev. The depth of cut for roughing is 2 to 5 mm and that for finishing is 0.6 to 1 mm.

PLAIN TURNING :-It is the machining operation of removing the excess metal form the job along its length.

The regular shaped jobs are held in chuck and eccentric jobs are hold in face plate

The job is rotated about the lathe axis while the tool is moved along the length. The depth of cut for rough turning is not kept more then 3mm and that for finish turning is 1mm. Rough turning is done by rough turning tool and finish turning is done by finish turning tool. The main difference between rough and finish turning tool is that the nose radius of finish turning tool is more.

GROOVING:-

Desired shape of groove can be produced by rotating the job in lathe and cross-feeding the form –tool as shown in the fig.

KNURLING:-

Knurling is the process of making the surface rough to prevent slipping. The set of the knurl rotates and cuts the threads in opposite directions to make the surface of job rough. Knurling tools single, to or three sets of rollers are hold rigidly on tool post. Pressed against the

rotating 1/3 speed of turning surface of a job. Leaving exact facsimile of the tool on the surface of the job.

Type of knurling

1. Straight lined
2. Diamond shaped pattern.
3. Cross lined pattern.

Chamfering:-

It is the operation of bevelling the end of a job to remove burrs, to look better, to.make passage of the nut into the bolt, this operation is generally done after thread cutting, knurling, rough turning etc. Operations on ends of bolt/nut,bush etc.

Shoulder Turning/step Turning:-

If a job is turned with different diameters, the step from one diameter to the other so formed,The surface is known as shoulder turning, there are several types of shoulder turning such as Square, Bevelled, Radius etc.

Use of measuring instrument for lathe work:-
1. Steel rule
2. Caliper outside & inside
3. Verneer calipers.
4. Micrometer
5. Divider

Steel rule:-

The steel rule is the simplest and most common non-precision linear measuring instrumentsand it is made the tempered steel. On one of the flat taees. The graduation are marked in inches and in centimeters. The steel rule is common used are either 100mm or 300mm long.

Calipers:-

Calipers are simple measuring instrument used to transfer measurements from a steel rule to objects, and vice versa.

Calipers are of different types depending on the type of joint and the shape of leg.

Type of joint:-

The commonly used calipers are:
I. Firm joint calipers
II. Spring joint calipers.

I. Firm joint calipers:-

In the case of firm joint caliper, both leg are rivoted at one end. To take measurements of a
work piece. It is opened roughly to the required site. Fine setting is done by tapping the caliper
lighthy on a wooden surface.

Spring joint calipers:-

For this type of calipers, the leg are assembled by means of a pivot loaded with a spring. For opening & closing the caliper leg a screw and nut are provided.

Advantages:-
(¡) Quick setting
(¡¡) The setting made will not change unless the nut is turned.

The accuracy of the measurement taken depends very much on the sense of 'feel' or 'touch'.While measuring the job, you should get the feel when the legs are just touching the surface.

Type of legs:-
Differents types of legs are caliper,
(¡) Out side calipers
(¡¡) Inside calipers
(¡¡¡) Odd leg caliper

(¡) Out side calipers:-

The out side caliper as shown have their leg bent inword and hinged at the top. These areused for checking or measuring out side dimension or plate thickness. A steel rule must be
used with the caliper when direct reading is required.

(¡¡) Inside caliler:-

The inside caliper as shown have leg bent outwords. These are used for checking or Measuring the internal dimensions recesses, hole diameters and parallel surface of inside Dimensions. A steel rule must be used to obtain a specific reading as in outside calipers.

(¡¡¡) Odd leg calipers:-

The Harmaphrodite or odd leg calipers has one of its leg pointed while the other leg is bentinwords. It is chiefly used for marking out lines, parallel to the edge of work and for locating
Centre of cylindrical work.

Divider:-

The divider may be firm joint and spring type. Spring type divider more accurate work. The toolis used for transferring diamention, marking out curves and circle and for doing leyout work.

Micrometer:-

The micrometers are precision measuring instrument. These are available in English system orin metric system.
Metric system micrometers are mostly used.

Various type of Micrometer:-
1. Outside micrometer.
2. Inside micrometer
3. Screw thread micrometer.
4. Depth gauge micrometer

1. Outside Micrometer:-

It is mainly used to measure the outside diameter of a job or legth of a small part. It can
measure the dimension to an accuracy of 0•01mm. The main part of an outside micrometer.

2. Inside micrometer:-

The inside micrometer is used for measuring large internal diameters (over - 50mm) to anaccuracy of 0•01mm. It work on the same principal as that of outside micrometer.

3. Screw thread micrometer:-

It is designed to measure the fitel diameter of screw threaded to an accuracy of 0•01mm inconstruction the screw thrade micrometer as shown is similar to outside micrometer.

Differences:-
1. The movable spindle is pointed and
2. The end of the anvil is of the same from as the screw thread to be measured.

4. Depth Gauge micrometer:-

The depth gauge micrometer (also known as depth micrometer), is used to measure the depthof holes, slots and recessed areas to an accuracy of 0•01mm.

Vernier Caliper:-

It is a precision instrument which is used for measuring external as well as internal diametersof shaft thickness of parts etc.To an accuracy of 0•02mm . It can also be used to measure the depth of slats and holes. The principal of vernier is that which two scale or

division slightly different in size are used, the difference between them can be utilized to determine the
accuracy of measurement.

Reading a Vernier Caliper:-

The smallest division on the main scale is either 0•5mm or 1mm and the vernier scale mayhave 25 or 50 division. The ratio of the smallest division on the main scale of the number of
division on the vernier scale is known as least count of the vernier caliper mathematically.
Least count=(smallest division of main scale)/(number of division on vernier scale) =0•5/25 =
0•02mm

Different type of verniercalipers :-
(¡) vernier height gauge
(¡¡) Vernier depth Gauge
(¡¡¡) Vernier Gear-tooth caliper
etc

Study of drilling machine:-

Drilling machine is a machine tool designed for drilling hole in a solid job by a rotating drill.Many operation like remaining, counter boring, counter sinking, taping, honing, lapping etc are also done by a drilling machine.

Type of Drilling Machines:-
1. Portable drilling machine
2. Sensitive drilling machine
3. Upright drilling machine
4. Radial drilling machine
5. Gang drilling machine
6. Multiple spindle drilling machine
7. Deep hole drilling machine
8. Automatic drilling machine

1. Portable drilling machine:-

Since this Drilling Machine can be taken from one place to another, hence it is called portabledrilling machine. Used for drilling holes of smaller diameter in large as well as small jobs. Holeupto 12mm. diameter in large as well as small jobs. Holeupto 12mm diameter are drilled by it.

2. Sensitive Drilling machine:-

Since hand operated feed is given in this case, hence it is called sensitive drilling m/c. It ismainly used for making holes of smaller diameter usually in range 1•5mm to 15•5mm. It is rotated by a motor at a speed as out 20,000 to 30,000 r.p.m. for drilling operation.

3. Upright Drilling machine:-

Upright Drilling machine is used for heavy jobs. It may be of two type.

(¡) Box column section.

(¡¡) Round column section.

The Box column section drilling machine has move strength then that of Round column typedue to higher section- modulus.

4.Radial Drilling machine:-

It is heavy duty machine which is used to drill the jobs of very large size, it can drill a holeupto75mm

It consists of a vertical column which supports the horizontal arm. This arms may be raised orlowered down.

The drill head is mounted on the arm and it may be moved along the arm on the guide ways.The can also be swivelled around the column and the drill-head can be brought to different radii for doing the operations quickly. The job may be placed on the table or on the floor.

The spindle motor is reversible so that the power tapping attachment can be used.

Type:-

I. Plain radial drilling machine
II. Semi universal Radial Drilling Machine
III. Universal machine

Different parts of Radial Drilling Machine:-

1. Base
2. Column
3. Radial arm
4. Motor for elevating the arm
5. Elevating screw
6. Guide ways
7. Motor for driving the drill spindle
8. Drill head
9. Drill spindle
10. Table

5. Gang Drilling machine:-

It is a series of single spindle drilling heads mounted on a long column. There may be 4 to 6spindle and even more which are mounted side by side

6. Multiple spindle Drilling machine:-

A number of spindle are attached to one spindle- head. All the spindle rotate at same speedand they are fed simultaneously. It is most suitable for automobile industries.

7. Deep hole Drilling machine:-

It is special type of drilling machine which is used for drilling deep hole in the barrel of rifle orlong shaft. The drill is rotated at high speed but feed is very slow.

8. Automatic drilling machine:-

It is a production type drilling Machine which performs the operations in the set sequence.

Pillar Drilling Machine:-

The upright drilling machine with round column section is called pillar drilling machine.

The base of pillar drilling machine is made of cast iron and it is fixed to the floor by the helpof 4 foundation bolts. A round column rises from the base. It contains rack for lifting the arm
Vertically. There is a horizontal arm which may by moved upword or downword by rotating the
table elevating handle. The arm may be moved in an arc upto 180°. There is a table at the end
of the arm. It can be rotated by 360° about its own vertical axes independent of position of the
arm.

The spindle head rotates the spindle at different desired speed. It also contains the spindlefeed mechanism for giving hand feed as well as power feed. Induction motor of 5 to 10 kw is used for running the spindle.

Drive & Feed mechanism:-

There are two common methods of driving the spindle. A constant speed motor is mounted atthe extreme end of the arm which balances partially the weight of the overhanging arm. The motor drives a horizontal spindle which runs along the length of the arm and the motion is transmitted to the drill head through bevel gears. By train of gearing within the drill head. The speed of the spindle may be varried. Through another train of gearing within the drill head, different feed of the spindle are obtained. In some machines a vertical motor is fihed directly on the drill head and through gear box multiple speed and the feed of the spindle can be
obtained.

Types of drill:-

The following are different types of drill:-
(1) Plate drill or spade drill
(3)Twist drill
(4)Center drill
(5)Multi flute core drill
(6)Oil holes drills
(7)Step drill
(8) Subland drill
(9) D-bits

Nomenclature of Twist Drill:-
The following are essential elements of twist drill:
1. Flutes
2. Land
3. Helix angle or Rake angle
4. Point angle
5. Chisel edge angle
6. Lip clearance angle
7. Shank
8. Tang
9. Body
10. Neck
11. Heel
12. Recess
13. Face
14. Flank

(3) Twist drill is 4 types

a. Parallel shank drill
b. Taper shank drill
c. Stub drill
d. Jobber's drill

Drill holding device:-
The following are tool holding device in drilling machine:-
(1) Drill chuck
(2)spindle for drilling machine
(3) sleeve
(4) Socket

(1) Drill chuck:-

It is widely used for holding small size drills of parallel shank. The jaw are adjustable heanceany size of drill between minimum and maximum capacity can be hold in it.

The drill chuck may be tightened or loosened with the help of chuck key. A taper arbor may befitted in arbor hole of sleeve. This arbor is fitted in spindle of drill.

(2) Spindle of Drilling machine:-

Drilling machine has a spindle of standard internal taper. Thus it can hold only one size ofdrill. The shank of drill is inserted into taper hole of spindle and its tang fits into the slot. Thus
the chance of slipping is eliminated.

The drill can be taken out from the spindle by mildly hammering the drill drift in the top portionof slot.

(3) sleeve:-

Drills of smaller taper number than that of spindle are held in the sleeve. This sleeve has
external taper conferming to the inner taper of spindle. The inner taper of sleeve has another taper number for holding the drill only one drill size can be held by one sleeve.

The drill is fitted in sleeve and sleeve is fitted in spindle.

Socket:-
The shanks of largest taper number than that of spindle, are held in socket and socket is held in the spindle.
The socket has two parts:
(¡) Upper part and
(¡¡) Lower part.

The upper part has outer taper in conformity with the inner taper of the spindle. Each sockethas internal taper in its lower part for holding the shanks of drill of larger taper number. Only one drill can be held in one socket.

Work holding device:-
The following devices are commonly used for holding the job in drilling machine.
(1). T- Bolt and clamp
(2). Step block
(3). Drill press vice
(4). Angle plate
(5). V- block
(6). Drill jig

(1). T- bolt and clamp:-

Various type of clamps are used for holding the job on the table. The T-bolt is inserted in theT-slot of table. A block is set at rear end of the clamp as shown in the fig and nut is tightened.
Various type of clamps are used for holding the different type of job:

(¡) Goose neck clamps
(¡¡) U- clamps
(¡¡¡) Finger clamp
(¡v) Adjustable set clamp

(2) Step Block:-

Step block is used for holding the jobs of different heights. The step provide support for otherend of the clamp. The step Block is made of mild Steel.

(3) Drill press vice:-

Small size rectangular jobs are held in drill pressed between fixed jaw and movable jaw. Themovable jaw is moved by the screw which has square or Acme thread. The jaw lift up from the base of vice by the use of parallels. Thus the base of vice will not be damaged during drilling.

The vice may be plain type or universal type.

(4). Angle plate:-

Angle plate has two faces at right angles to each other. It is made of cast iron. The faces aremachined very accurately. Angle plate is bolted on the table and holds the work piece on its
vertical face by bolts and clamps.

(5). V-block:

It is used for holding cylindrical job. V-block has V-shape opening for supporting and locatingthe job. It is made of cast iron or steel. The V - surfaces are very accurately machined

(6)Drilling jig:-

It is used to drill the jobs on mass scale. The jig locates to work clamp it and guides the drillthrough its bushings. The drill-jig has been shown in the fig.

DRILLING::-

It is the operation of producing round hole in a solid job by the help of rotating drill.

Drilling does not produce hole of accurate size. The hole becomes oversize by certain amountdue to bending of drill under action of feed force. The drill may be considered as a column having one end fixed and other end free which deflects by certain amount when subjected to axial load. A 12mm diameter drill will produce a note of 12•125mm diameter. Twisted chips come out through the flute of the drill in from of long ribbon.

{4}. Practice on Making a job involving drilling operation of different diameter hole at different

location, reaming operation at a particular hole counter oo sinking operation at one hole.

Study of shaper machine:-

The shaper is a reciprocating type of machine tool intended primarily to produce flate surfaces. These surfaces may be horizontal, vertical, or inclined in general. The shaper can produce any surface composed of straight line elements.

Type of shaper:-

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 position and travel of ram:
(a) Horizontal type
(b) Vertical type
(c) Traveling head type

3. According to the type of design of the table:
(a) Standard shaper
(b) universal shaper

4. According to the type of cutting stroke:
(a) Push type
(b) Draw type

The following are standard shaper:-

A shaper is termed as standard or plain when the table has only two movements, vertical andhorizontal to give the feed. The table may or may not be supported at the outer end.

Different part of standard shaper:
(1). Base
(2). Column
(3). Cross rail
(4). Saddle
(5). Table
(6). Ram
(7). Tool head

(1). Base:-

Base is rigidly bolted to shap floor and machine components rest on it. This base has to takeup machine load, both dynamic and impact load, during machining operations. Grey

cast iron is generally used as base material to resist vibration and to take up maximum compressive
load.

(2). Column:-
The main part, column of the machine consists of a hollow casting, a ram reciprocates on the top of the column through two machined horizontal guide ways and the table moves vertical ways through cross-rail on the front vertical face of the column. The ram and table driving mechanism are enclosed inside the column.

(3-4). Cross-rail and saddle:-
Cross-rail slides up and down for positioning the table over the front vertical ways of the
column by the cross-rail vertical screw. The work table is bolted on the saddle and the saddle is also mounted on the cross-rail. The work table along with the saddle can be moved horizontally by the table cross-feed screw.

(5). Table:-
The table which is bolted the saddle receives cross wise and vertical movement from the
saddle and cross-rail. It is a box like casting having T- slots both on the top and sides for clamping the work. In a universal shaper the table may be swivelled on a horizontal axis and the upper part of the table may be tilted Up or down. In a heavier type shaper, the front face of
the table is clamped with a table support to make it more rigid.

(6). Ram:-
The ram is the reciprocating member of the shaper. This is semi-cylindrical in from and
heavilyrlbbed inside to make it more rigid. It slides on the accurately machined dovetail guideway on the top of the column and is connected to the reciprocating mechanism contained within the column. It houses a screwed shaft for alterning the position of the ram with respect to the work and holds the tool head at the extreme forward end.

(7). Tool Head:-
It is fixed to the front end of the ram. It consists of tool post, clapper box, down feed screw.Tool slide can be swivelled for the shaping of bevels, angular cuts, etc. The clapper box (or tool box) hinges on a pin, in order to allow the tool to swing up during the return stroke. Down feed screw is operated by hand or by power for required depth of cut and down feed cutting.

Shaping tools:-

Generally shaping tools are manufacturered from high speed steel, and sometime cementedcarbide is brazed at the tool tips. Single point cutting tool used in shaping machine should be sufficiently rigid and heavier to withstand shock during shearing of metal.

Shaping operations:-

A shaping machine is to generate the flat surface by a single point cutting tool. The generationof flat Surface is Horizontal, vertical, angular, irregular, splines etc.Grooves, slots key way, Tee-slots, Dovetail etc may also be machined by the shaper.

Planing machine:-

This is also reciprocating type of machine like shaper. The table with T-slots for mountingwork piece. A planer is very large and massive campared to a shaper and capable of machining heavy workpieces. The tool head holding the tool, machine during the forward (or cutting) stroke of the tool remains stationary. The tool horizontal feed is given during return (or
backward) stroke of the work table.

Type of Planing machine:-
1. Double housing planer
2. Open side planer
3. Rit planer
4. Edge or plate planer
5. Divided table planer

Standard or Double Housing Planer:-

The standard or double housing planer is most widely used in work shaps. A double housingplaner has a long heavy base on which a table reciprocates on accurate guideways. To ensure rigidity of the structure, these two housing are connected at the top by a cast iron member.
The tool head which hold the tools are mounted upon the crossrail.
Standard or Double Housing planer size range from 750mm × 2•5mm at the smallest upto 3000mm×3000mm×18•25mm at the largest size.

Planing machine parts:-
1. Bed
2. Table or platen
3. Tool head
4. Crossrail
5. Housing or column or upright
6. Driving and feed mechanism.

Tool Head:- Important parts
1. Saddle

2. Swivel base
3. Vertical slide
4. Apron
5. Clapper box
6. Clapper block
7. Tool post
8. Down feed screw
9. Apron clamping bolt
10. Apron swivelling pin
11. Machanism for cross and down feed of the tool