

## **WORKSHOP PRACTICE IV (325)**

### **SAFETY PRECAUTION BEFORE ENTERING IN TO WORK SHOP**

1. Never operate any machine without knowing the working principle of machine.
2. Never clear loose fitting while working.
3. Don't guess the working system of any machine.
4. Don't try to clean any parts of machine while the machine is in motion.
5. Changing the belt in motion is dangerous.
6. Mount the job total firmly to avoid chattering.
7. Never clean the chips with bare hand
8. Don't measure the job while revolving
9. Never leaves pointed tools, chips, grease and oil on shop floor.
10. Never insert your finger in to revolving parts.

### **TOOLS USED IN MACHINE SHOP**

#### **Steel Rule**

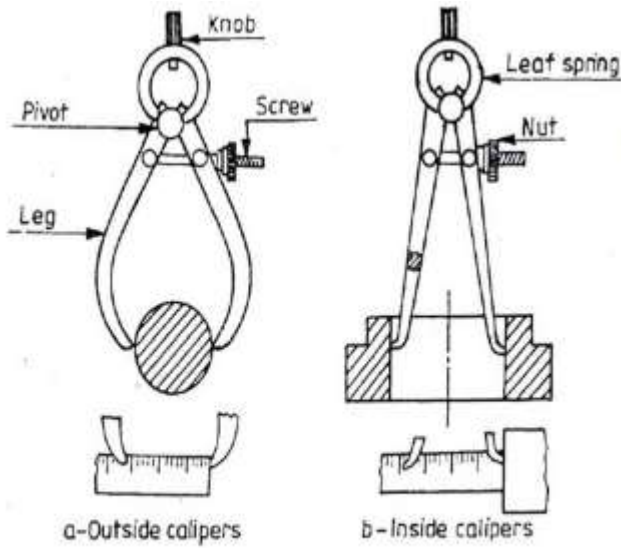
The steel rule is used for taking linear measurement to an accuracy of 0.5mm. It consists of a hardened steel of stainless steel having line graduation of standard unit of length. It usually marked in both centimetres and inches. Centimetre is subdivided of 0.5mm. The inches being subdivided in to  $\frac{1}{8}$ ,  $\frac{1}{16}$ ,  $\frac{1}{32}$  and  $\frac{1}{64}$  if an inch.

#### **Try Square**

They are used for making and testing angle of  $90^\circ$ . it consist of a steel blade reverted in a hard wood stock which has protective brass plate on the working surface.

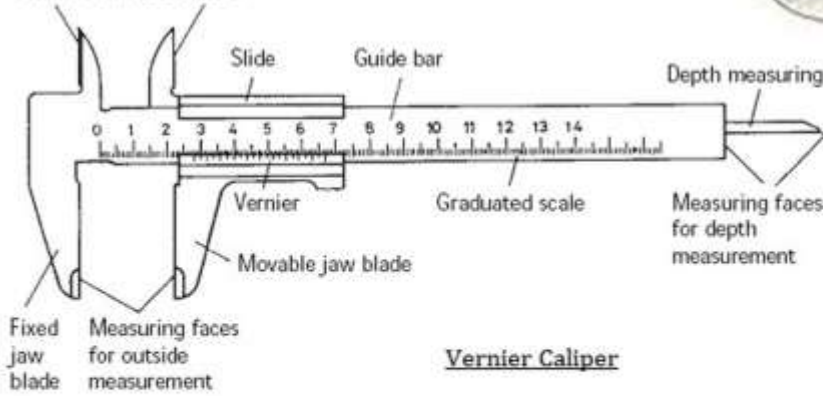
#### **Calipers**

A Caliper is used to transfer and compare dimension from one object to other. The measurement cannot be taking directly, because it is an indirect measuring instrument. Four types of calipers are generally used. They are follows:

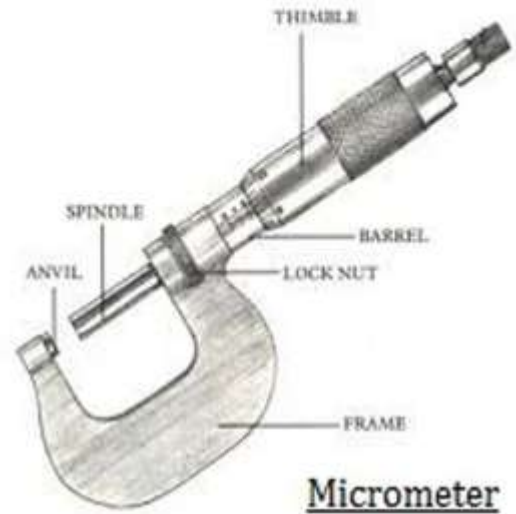
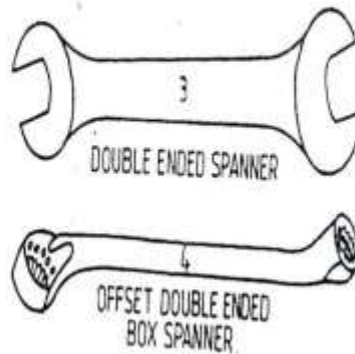
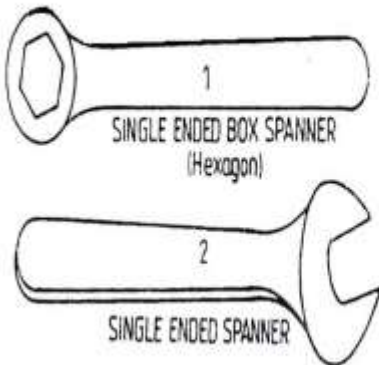
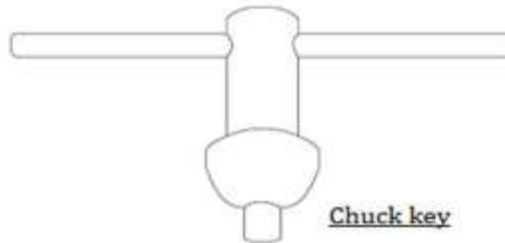
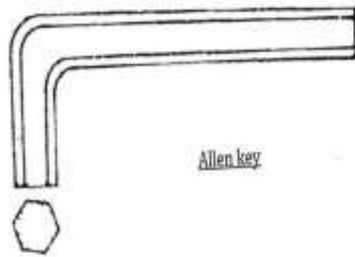


**CALIPERS**

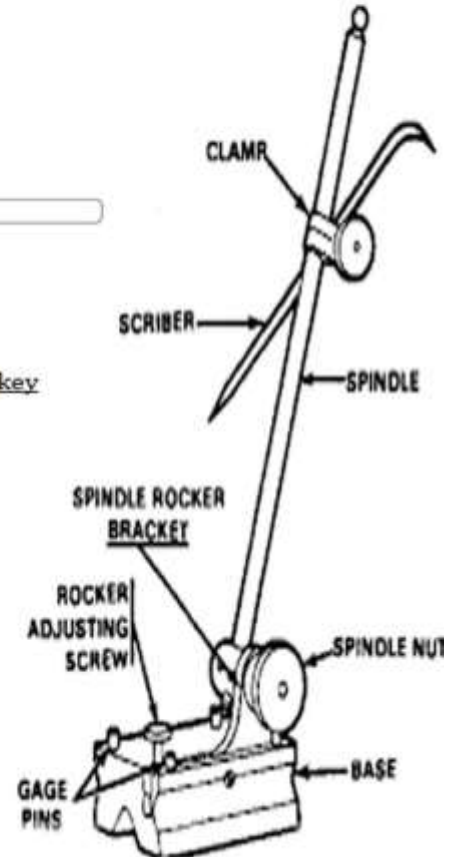
Knife-edge measuring faces for inside measurement



**Vernier Caliper**



**Micrometer**



**Surface Gauge**

## **Outside Caliper**

An outside caliper is a tube legged steel instrument with its leg bent includes as shown in figure. It is used for measuring or comparing thickness, diameter and other outside dimensions. A steel rule inside be used in conjunctions with them it a direct reading in desired.

## **Inside Caliper**

It is exactly similar to an outside caliper in appearance with its legs bend outwards. This is used for comparing or measuring holes diameters between shoulders or other parallel surfaces of any inside dimensions.

## **Vernier Caliper**

The Vernier Caliper is primarily intended for measuring both inside, outside diameters of shafts, thickness of parts etc., to an accuracy of 0.02mm by vernier scale.

## **Micrometer**

For more accurate measurement various instrument like Micrometers, Vernier Calipers etc are used. It works on the principle of screw threads. Here it is known as screw gauge. The commonly used micrometers are outside micrometer, inside micrometer, depth micrometer and thread micrometer. These are available in various size in steps at 25mm like 0.25mm, 25-50mm, and 50 on.

## **Surface Gauge**

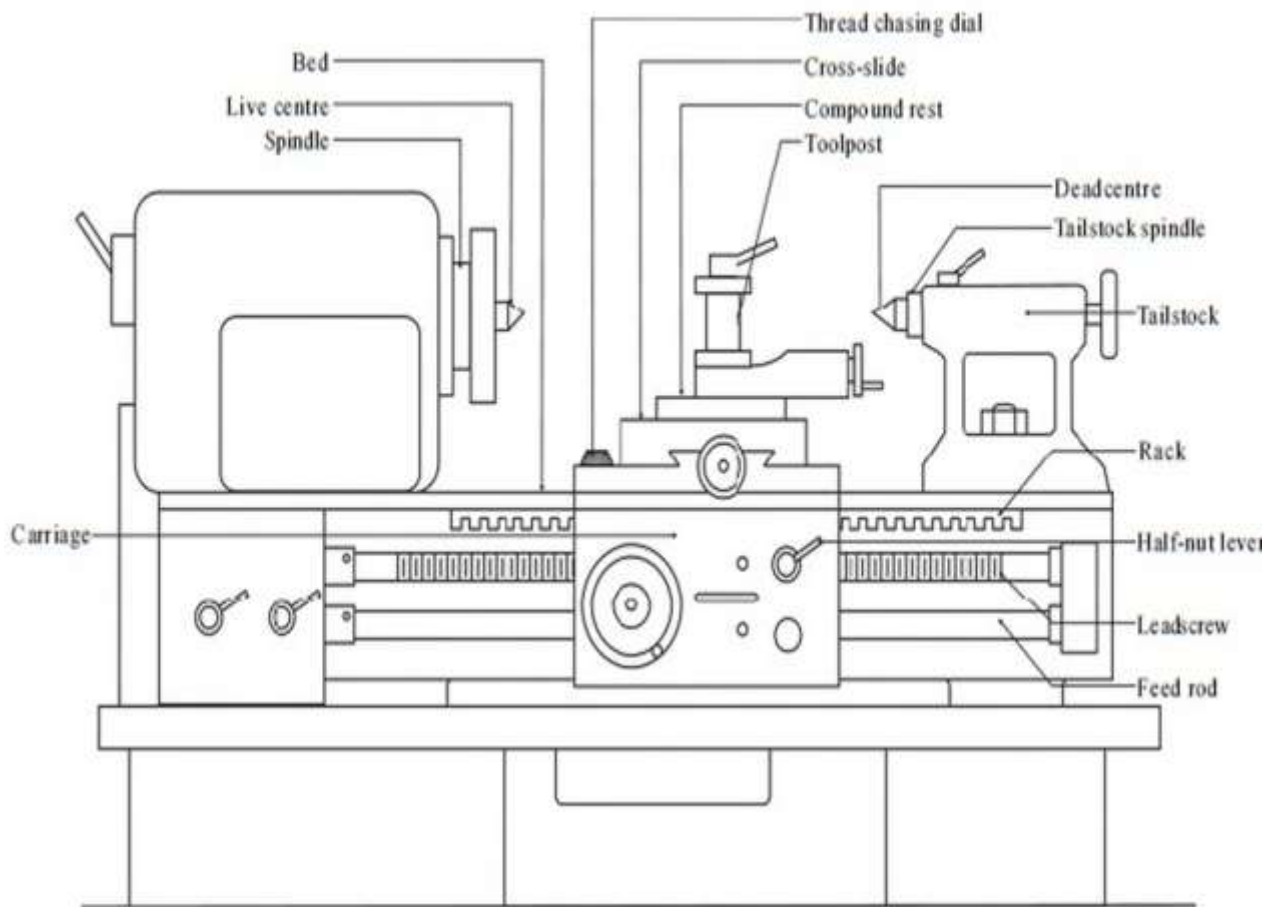
It is also known as scribing block. It consists of a heavy flat cast iron block with a vertical steel rod. On the steel rod as adjustable device is fitted carrying a knocked screw at the end a hole for a scriber can be loosened or tightened with the rod by means of knocked screw. It is mainly used for locating the centre of the round bass held in V-blocks by drawing straight lines and by fitting job through different angles.

## **Spanners**

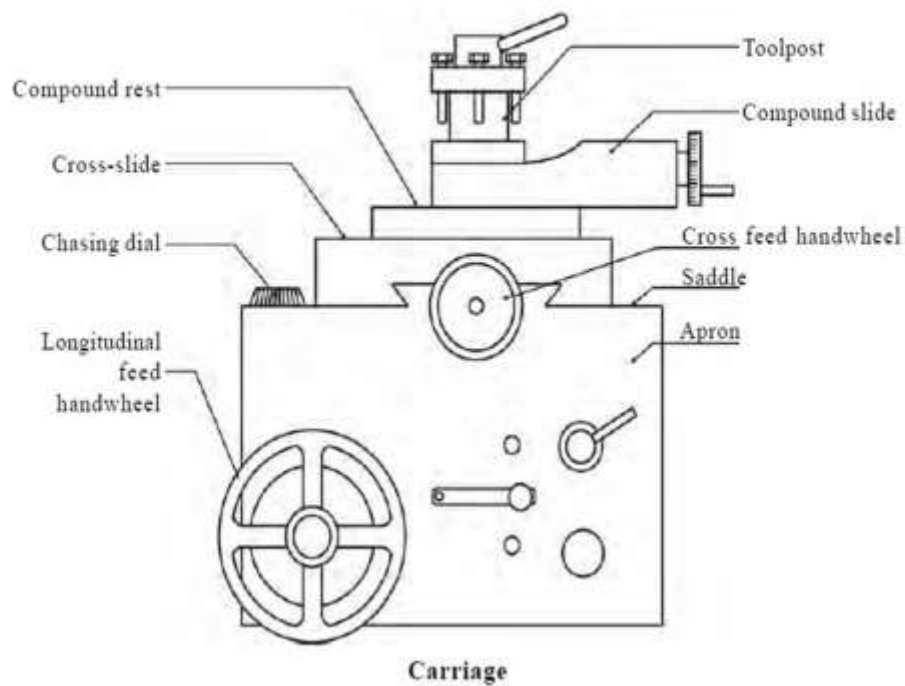
These are hand tools used in the work shop for holding or rotating of nuts and bolts. This unit has only two points to support the work.

## **Chuck key**

It is used for tightening and loosening the nuts of the chucks for fitting the work piece on the chuck.



## LATHE - PARTS



### **Tool post spanner**

It is used for hold or removes the cutting tool on the tool post by loosening or tightening the hole on the tool post. The shape of the spanner is square or hexagonal.

### **Allen key**

It is used for tightening or loosening of Allen screws.

## **LATHE**

Lathe is considered as one of the oldest machine tools and is widely used in industries. It is called as mother of machine tools. It is said that the first screw cutting lathe was developed by an Englishman named Henry Maudslay in the year 1797. Modern high speed, heavy duty lathes are developed based on this machine.

The primary task of a lathe is to generate cylindrical work pieces. The process of machining a work piece to the required shape and size by moving the cutting tool either parallel or perpendicular to the axis of rotation of the work piece is known as turning. In this process, excess unwanted metal is removed. The machine tool useful in performing plain turning, taper turning, thread cutting, chamfering and knurling by adopting the above method is known as lathe.

### **PRINCIPAL PARTS OF A LATHE**

#### **Bed**

It is an essential part of a lathe, which must be strong and rigid. It carries all parts of the machine and resists the cutting forces. The carriage and the tail stock move along the guide ways provided on the bed. It is usually made of cast iron.

#### **Head stock**

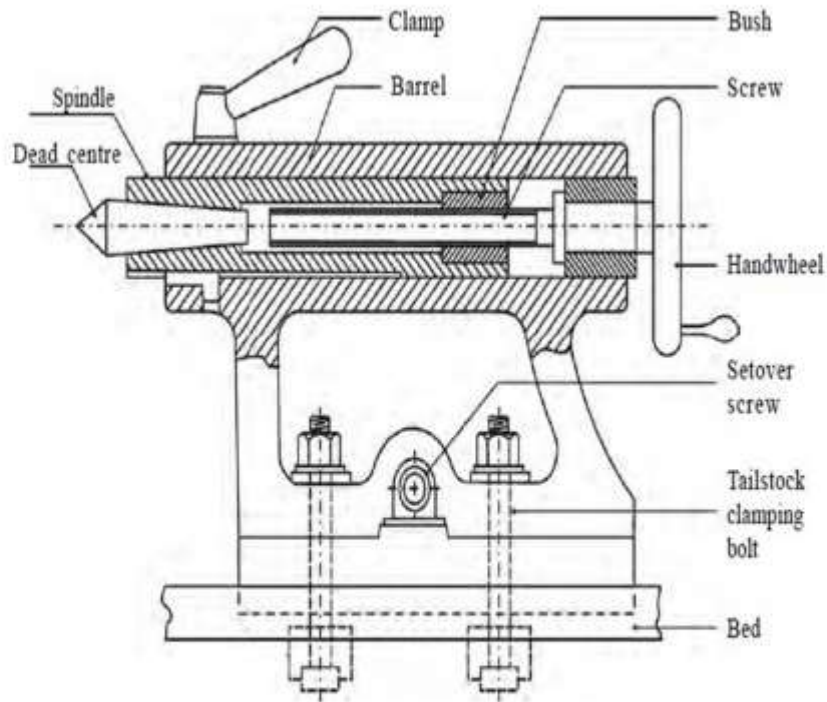
It contains either a cone pulley or gearings to provide the necessary range of speeds and feeds. It contains the main spindle, to which the work is held and rotated.

#### **Tail stock**

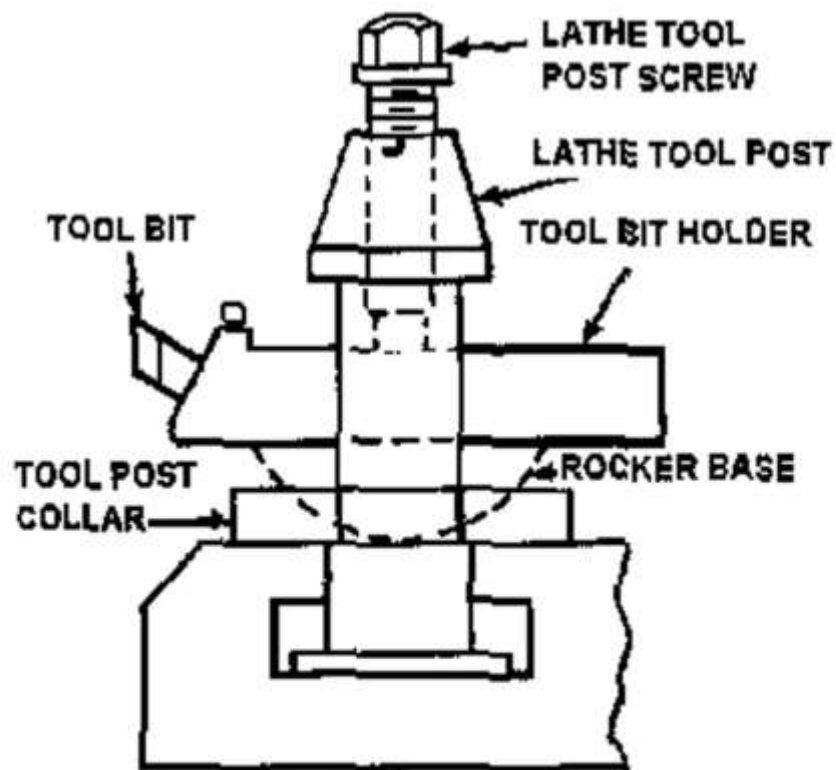
It is used to support the right hand end of a long work piece. It may be clamped in any position along the lathe bed. The tail stock spindle has an internal Morse taper to receive the dead centre that supports the work.

Drills, reamers, taps may also be fitted into the spindle, for performing operations such as drilling, reaming and tapping

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Tailstock



Standard round tool post.

### **Carriage or Saddle**

It is used to control the movement of the cutting tool. The carriage assembly consists of the longitudinal slide, cross slide and the compound slide and apron. The cross slide moves across the length of the bed and perpendicular to the axis of the spindle. This movement is used for facing and to provide the necessary depth of cut while turning. The apron, which is bolted to the saddle, is on the front of the lathe and contains the longitudinal and cross slide controls.

### **Compound Rest**

It supports the tool post. By swivelling the compound rest on the cross slide, short tapers may be turned to any desired angles.

### **Tool Post**

The tool post holds the tool holder or the tool, which may be adjusted to any working position.

### **Lead Screw**

It is a long threaded shaft, located in front of the carriage, running from the head-stock to the tail stock. It is geared to the spindle and controls the movement of the tool, either for automatic feeding or for cutting threads.

## **Work holding devices used in a lathe**

The work holding devices are used to hold and rotate the work pieces along with the spindle. Different work holding devices are used according to the shape, length, diameter and weight of the work piece and the location of turning on the work. They are,

1. Chucks
2. Face plate
3. Driving plate
4. Catch plate
5. Carriers
6. Mandrels
7. Centres
8. Rests

### **Chucks**

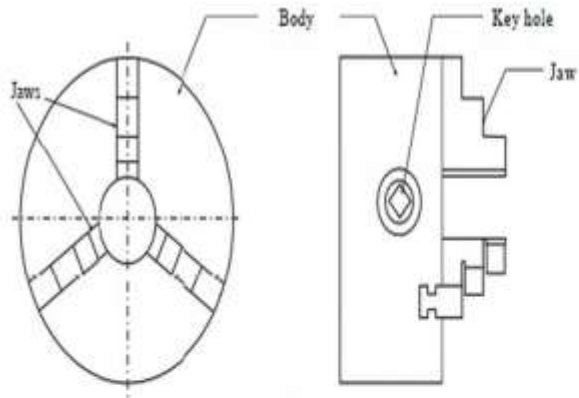
Work pieces of short length, large diameter and irregular shapes, which cannot be mounted between centres, are held quickly and rigidly in chuck. There are different types of chucks namely, three jaw universal chuck, four jaw independent chuck, Magnetic chuck, Colet chuck and Combination chuck.

### **Three jaw self-centering chuck**

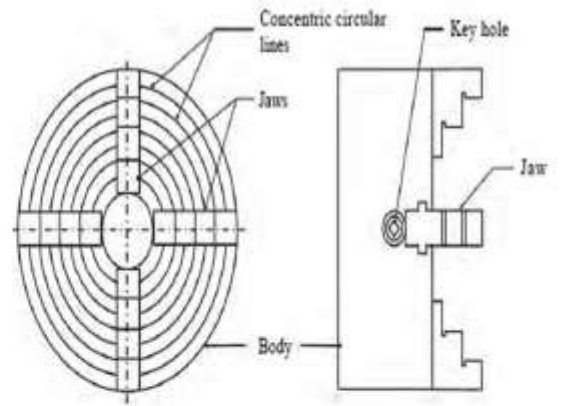


The three jaws fitted in the three slots may be made to slide at the same time by an equal amount by rotating any one of the three pinions by a chuck key. This type of chuck is suitable for holding and rotating regular

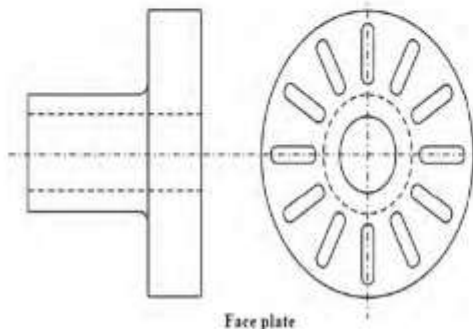
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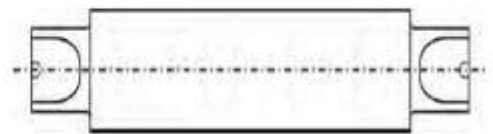
Three jaw chuck



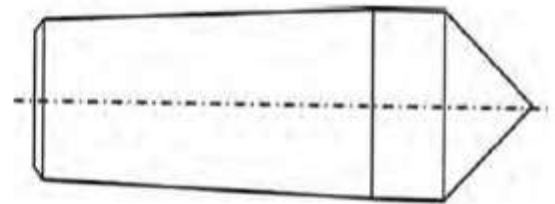
Four jaw chuck



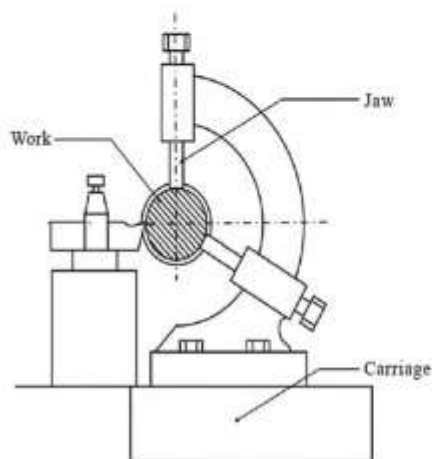
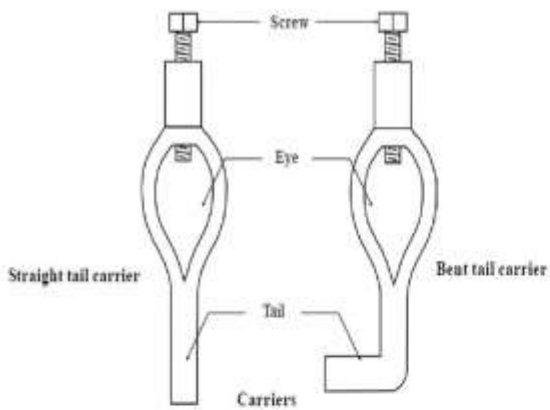
Face plate



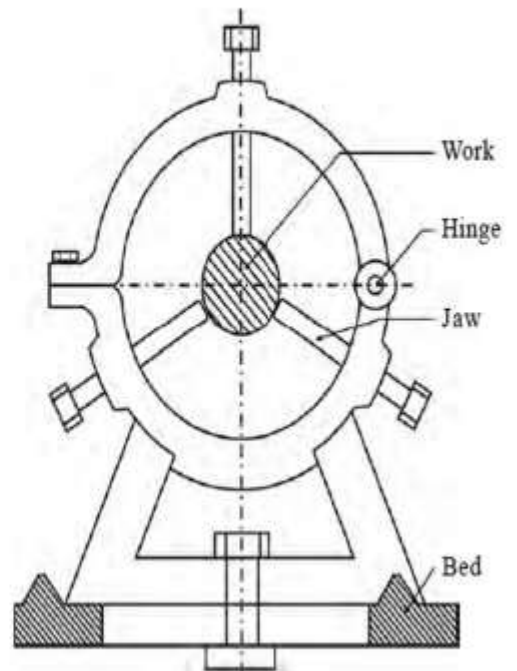
Plain mandrel



Centre



Follower rest



Steady rest

Shaped work pieces like round or hexagonal rods about the axis of the lathe. Work pieces of irregular shapes cannot be held by this chuck.

### **Four jaw independent chuck**

There are four jaws in this chuck. Each jaw is moved independently by rotating a screw with the help of a chuck key. A particular jaw may be moved according to the shape of the work. Hence this type of chuck can hold works of irregular shapes. But it requires more time to set the work aligned with the lathe axis. Experienced turners can set the work about the axis quickly. Concentric circles are inscribed on the face of the chuck to enable quick centering of the work piece.

### **Face plate**

Faceplate is used to hold large, heavy and irregular shaped work pieces which cannot be conveniently held between centres. It is a circular disc bored out and threaded to fit to the nose of the lathe spindle. It is provided with radial plain and "T" – slots for holding the work by bolts and clamps.

### **Carrier**

When a work piece is held and machined between centres, carriers are useful in transmitting the driving force of the spindle to the work by means of driving plates and catch plates. The work is held inside the eye of the carrier and tightened by a screw.

### **Mandrel**

A previously drilled or bored work piece is held on a mandrel to be driven in a lathe and machined. There are centre holes provided on both faces of the mandrel. The live centre and the dead centre fit into the centre holes. A carrier is attached at the left side of the mandrel. The mandrel gets the drive either through a catch plate or a driving plate. The work piece rotates along with the mandrel.

### **Centres**

Centres are useful in holding the work in a lathe between centres. The shank of a centre has Morse taper on it and the face is conical in shape. There are two types of centres namely

- (i) Live centre
- (ii) Dead centre

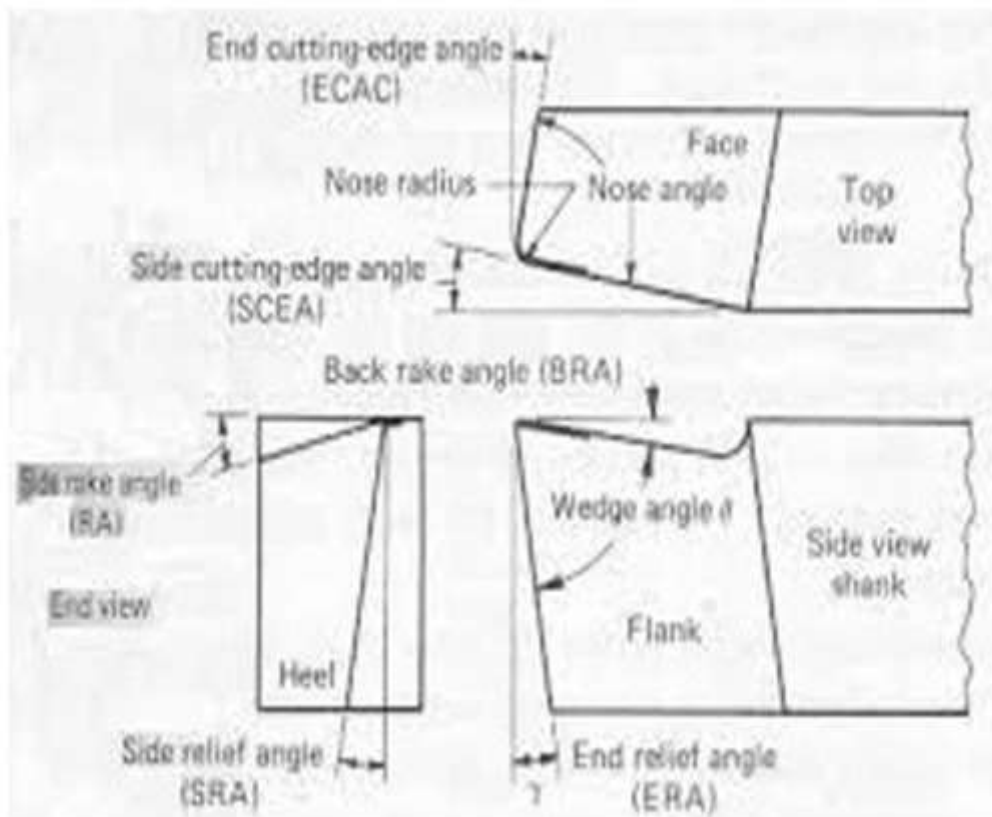
The live centre is fitted on the headstock spindle and rotates with the work. The centre fitted on the tailstock spindle is called dead centre. It is useful in supporting the other end of the work.

### **Rests**

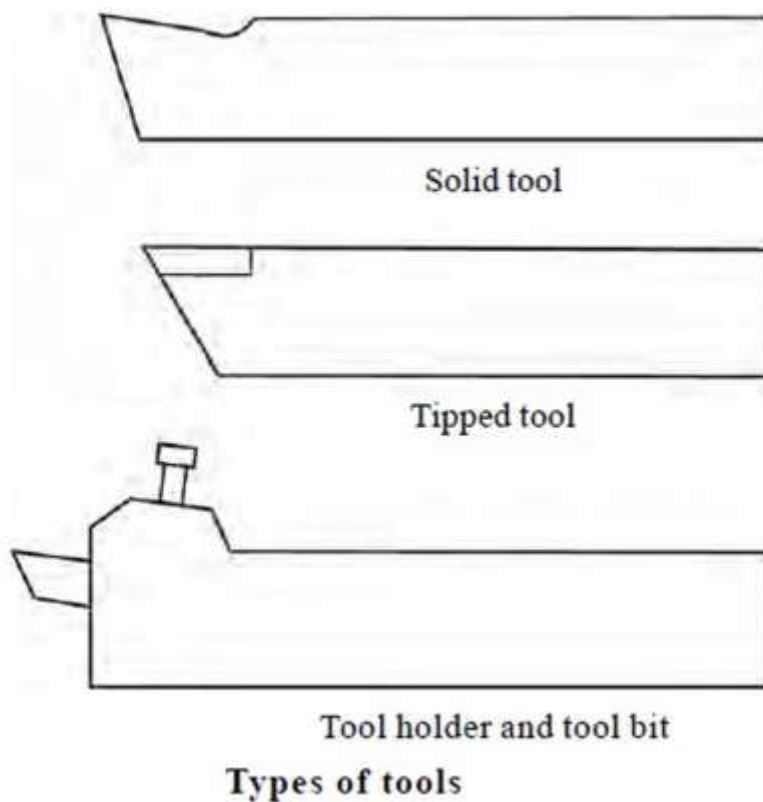
A rest is a mechanical device to support a long slender work piece when it is turned between centres or by a chuck. It is placed at some intermediate point to prevent the work piece from bending due to its own weight and vibrations setup due to the cutting force. There are two different types of rests.

1. Steady rest

## 2. Follower rest



## TOOL ANGLES



### **Steady rest**

Steady rest is made of cast iron. It may be made to slide on the lathe Bed ways and clamped at any desired position where the work piece needs support. It has three jaws. These jaws can be adjusted according to the diameter of the work. Machining is done upon the distance starting from the headstock to the point of support of the rest. One or more steady rests may be used to support the free end of a long work.

### **Follower rest**

It consists of a 'C' like casting having two adjustable jaws to support the work piece. The rest is bolted to the back end of the carriage. During machining, it supports the work and moves with the carriage. So, it follows the tool to give continuous support to the work to be able to machine along the entire length of the work.

### **Tools used in a lathe**

Tools used in a lathe are classified as follows

A. According to the construction, the lathe tools are classified into three types

1. Solid tool
2. Brazed tipped tool
3. Tool bit and tool holders

B. According to the operation to be performed, the cutting tools are classified as

1. Turning tool
2. Thread cutting tool
3. Facing tool
4. Forming tool
5. Parting tool
6. Grooving tool
7. Boring tool
8. Internal thread cutting tool
9. Knurling tool

C. According to the direction of feed movement, the following tools are used

1. Right hand tool
2. Left hand tool
3. Round nose tool

### **Tool angles**

Tool angles of a single point cutting tool direct influence in all metal cutting operations in a lathe.

### **Rake**

It is defined as the slope given on the tool. Front rake angle, side rake angle, true rake angle, positive rake angle.

### **Clearance angle**

These are slopes ground downwards from the cutting edges. Front clearance angle, side clearance angle.

### **Operations performed in a lathe**

Various operations are performed in a lathe other than plain turning.

They are

1. Facing
2. Turning
  - a. Straight turning
  - b. Step turning
3. Chamfering
4. Grooving
5. Forming
6. Knurling
7. Undercutting
8. Eccentric turning
9. Taper turning
10. Thread cutting
11. Drilling
12. Reaming
13. Boring
14. Tapping.