Manufacturing technology

Unit -2

Parts of a Lathe

1. Lathe Bed

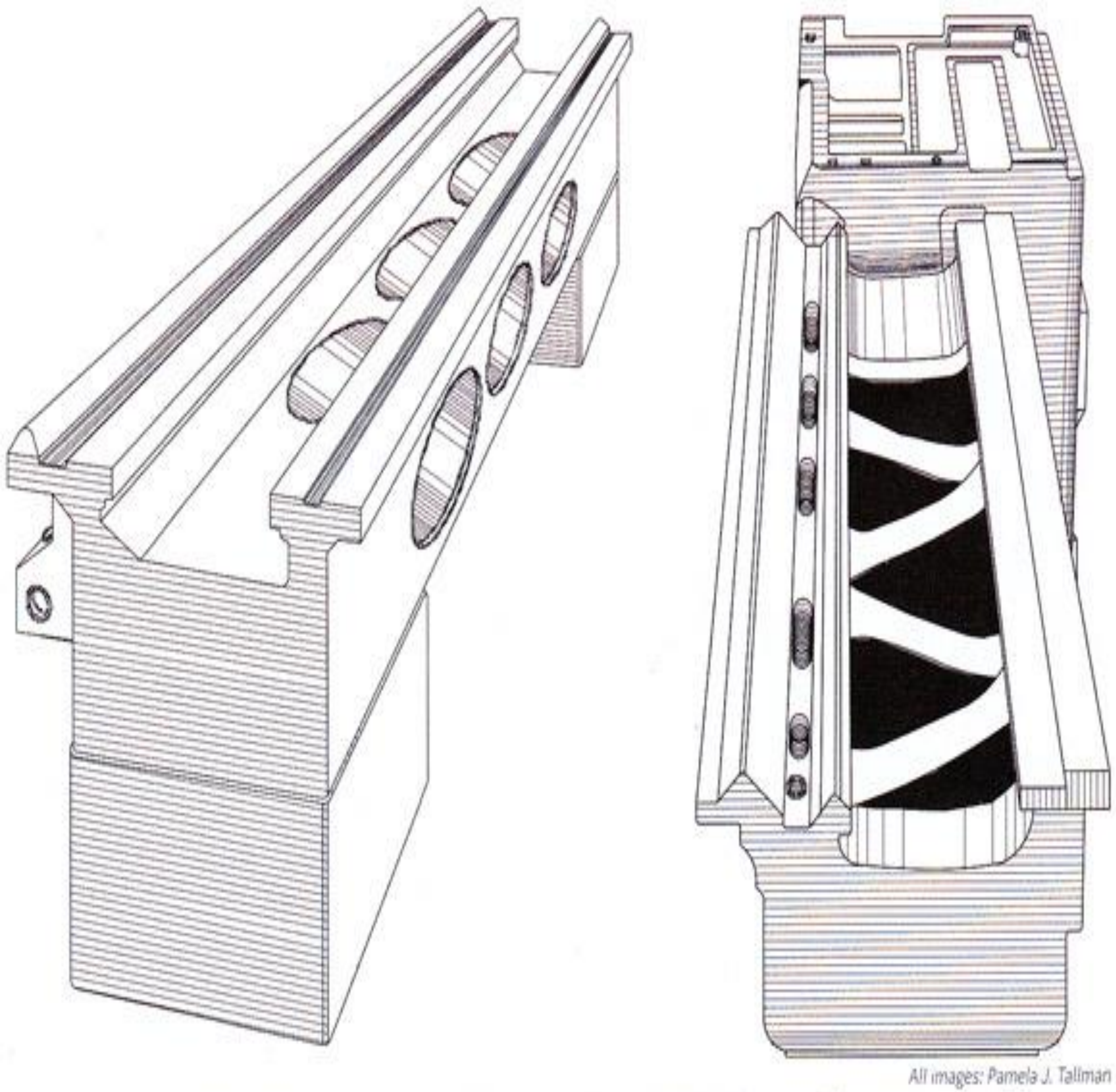
The bed of a lathe machine is the base on which all other parts of lathe are mounted.

It is massive and rigid single piece casting made to support other active parts of lathe.

On left end of the bed, headstock of lathe machine is located while on right side tailstock is located.

The carriage of the machine rests over the bed and slides on it.

On the top of the bed there are two sets of guideways-innerways and outerways.



The left lathe bed casting bolts to the headstock, and the right one has an integral base for the headstock.

Lathe Bed

The innerways provide sliding surfaces for the tailstock and the outerways for the carriage.

The guideways of the lathe bed may be flat and inverted V shape.

Generally cast iron alloyed with nickel and chromium material is used for manufacturing of the lathe bed.

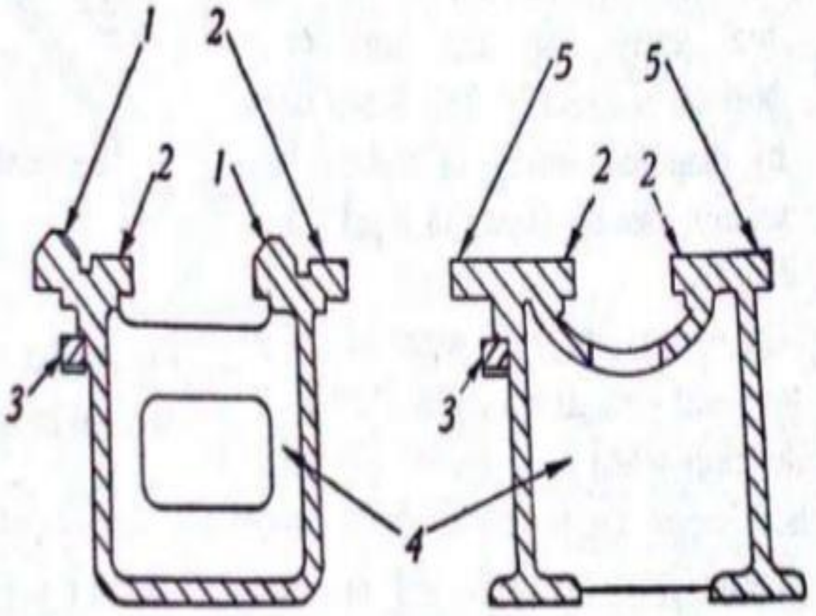


Figure 3.5 Types of lathe bedways

1. Inverted-V bedway, 2. Flat bedways, 3. Rack, 4. Box section, 5. Flat bedways for saddle.

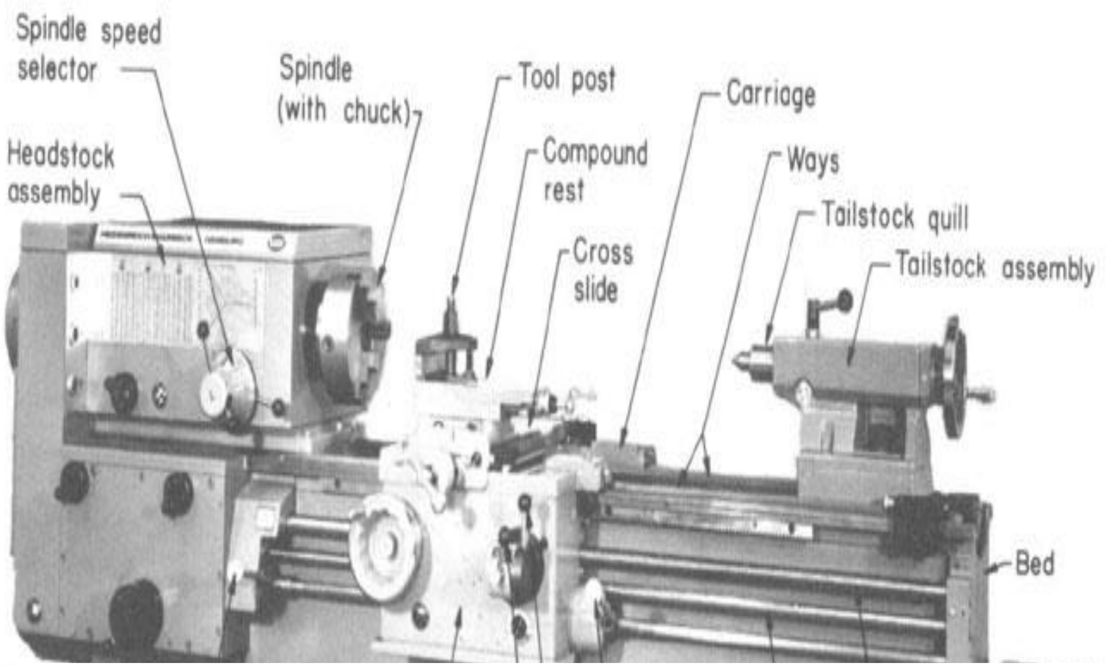
2. Headstock

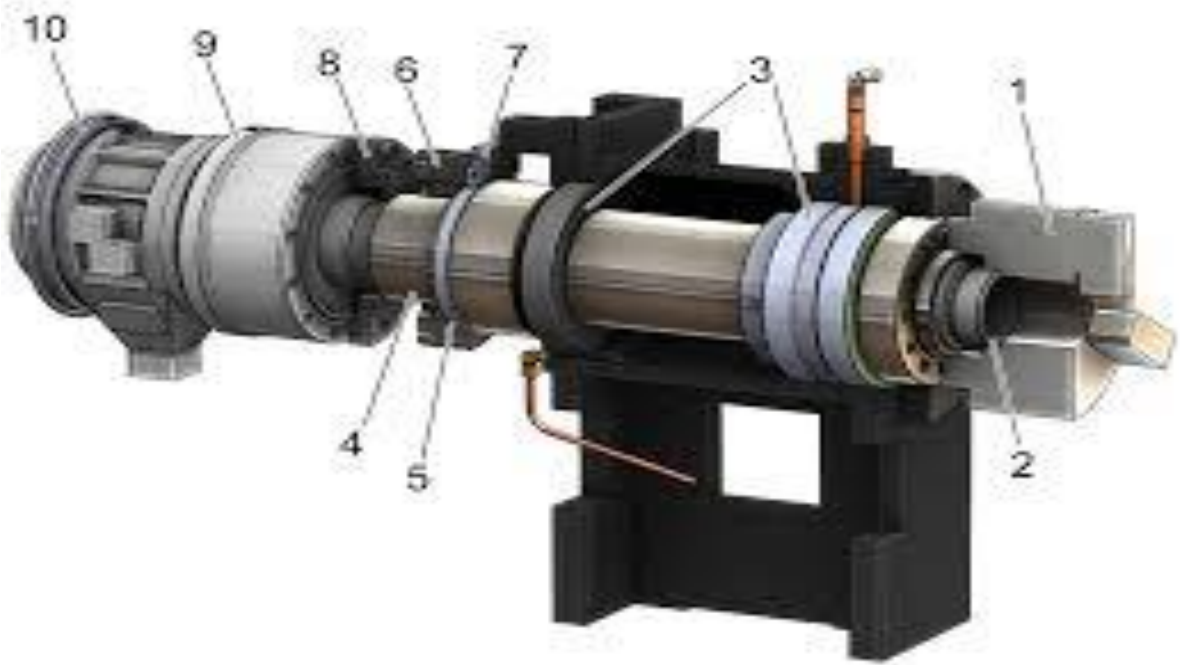
The main function of headstock is to transmit power to the different parts of a lathe.

It comprises of the headstock casting to accommodate all the parts within it including gear train arrangement.

The main spindle is adjusted in it, which possesses live centre to which the work can be attached.

It supports the work and revolves with the work, fitted into the main spindle of the headstock.



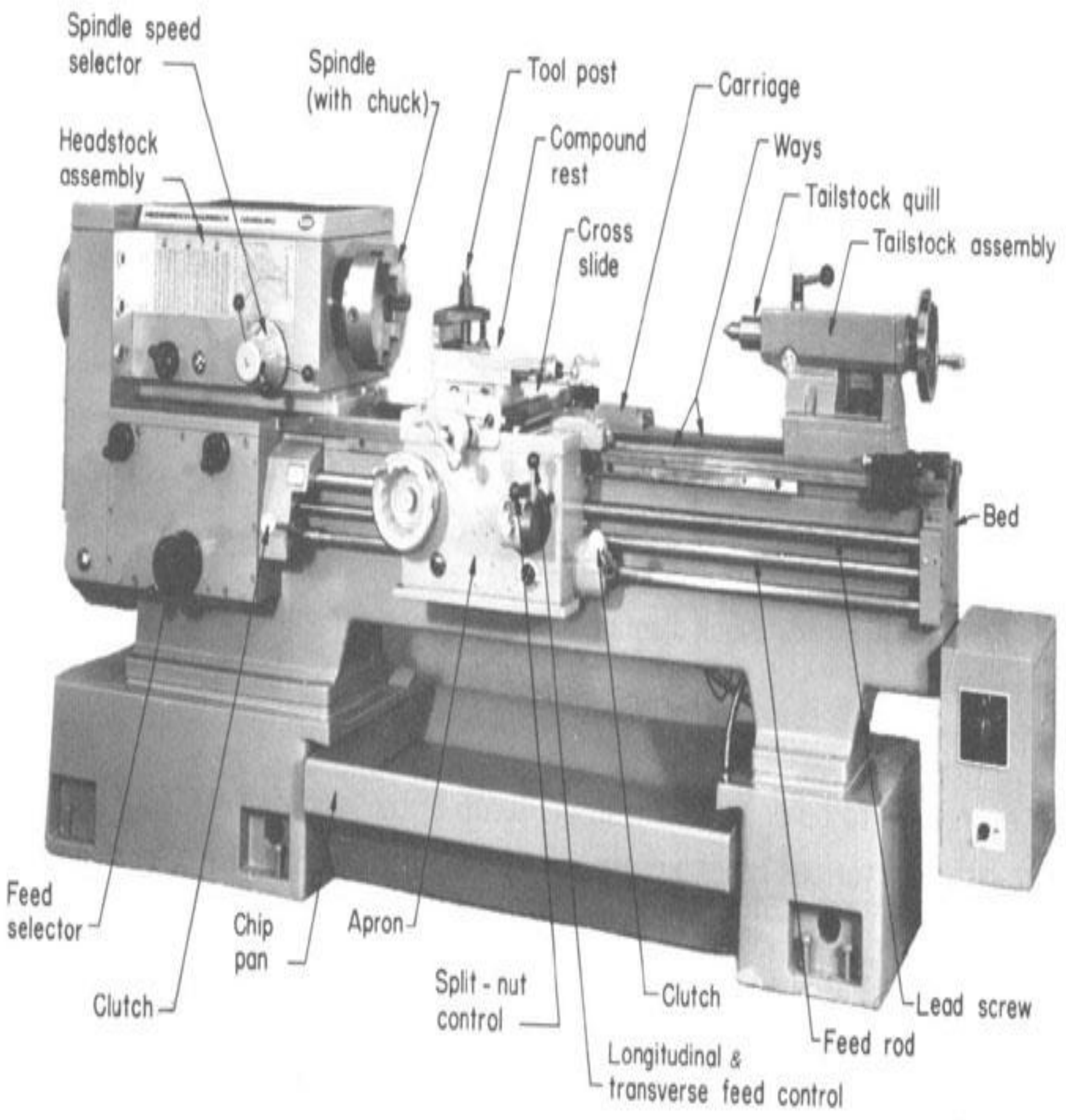


Headstock

The cone pulley is also attached with this arrangement, which is used to get various spindle speed through electric motor.

The back gear arrangement is used or obtaining a wide range of slower speeds.

Some gears called change wheels are used to produce different velocity ratio required for thread cutting.



Tailstock

It is commonly used for the objective of primarily giving an outer bearing and support the circular job being turned on centers.

Tail stock can be easily set or adjusted for alignment or non-alignment with respect to the spindle centre and carries a centre called dead centre for supporting one end of the work.

The dead centre can be mounted in ball bearing so that it rotates with the job avoiding friction of the job with dead centre as it important to hold heavy jobs.

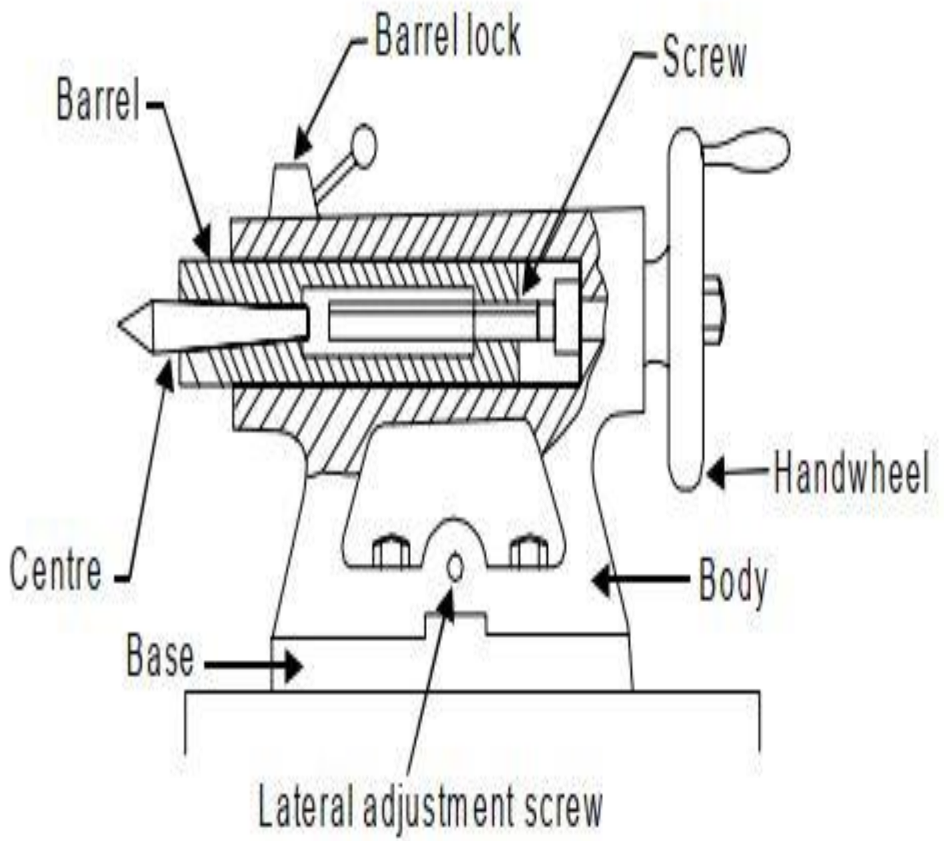


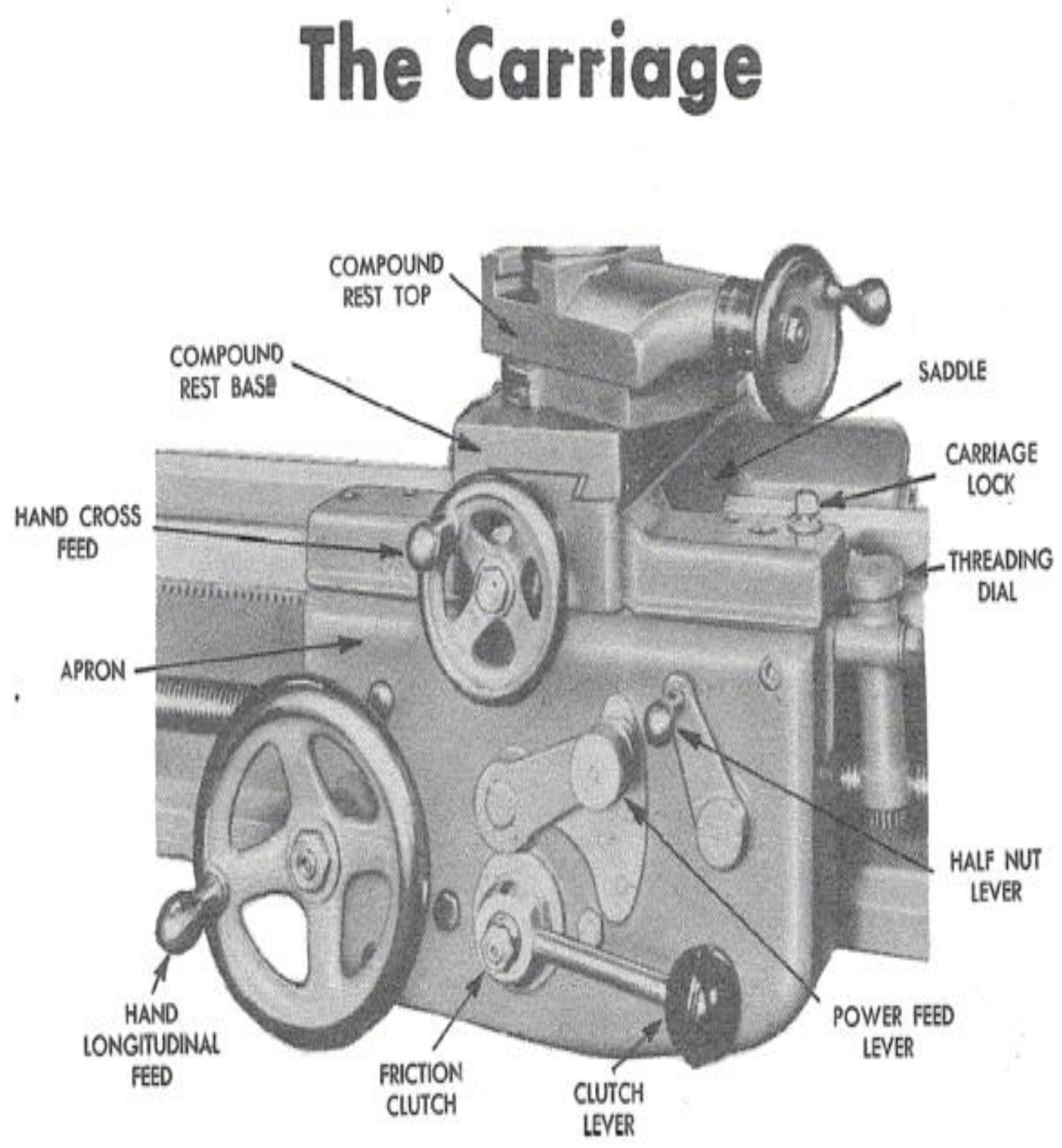
Fig. 21.4 Tail stock of central lathe.

Carriage

Carriage is mounted on the outer guide ways of lathe bed and it can move in a direction parallel to the spindle axis.

It comprises of important parts such as apron, cross-slide, saddle, compound rest, and tool post.

The lower part of the carriage is termed the apron in which there are gears to constitute apron mechanism for adjusting the direction of the feed using clutch mechanism and the split half nut for automatic feed.



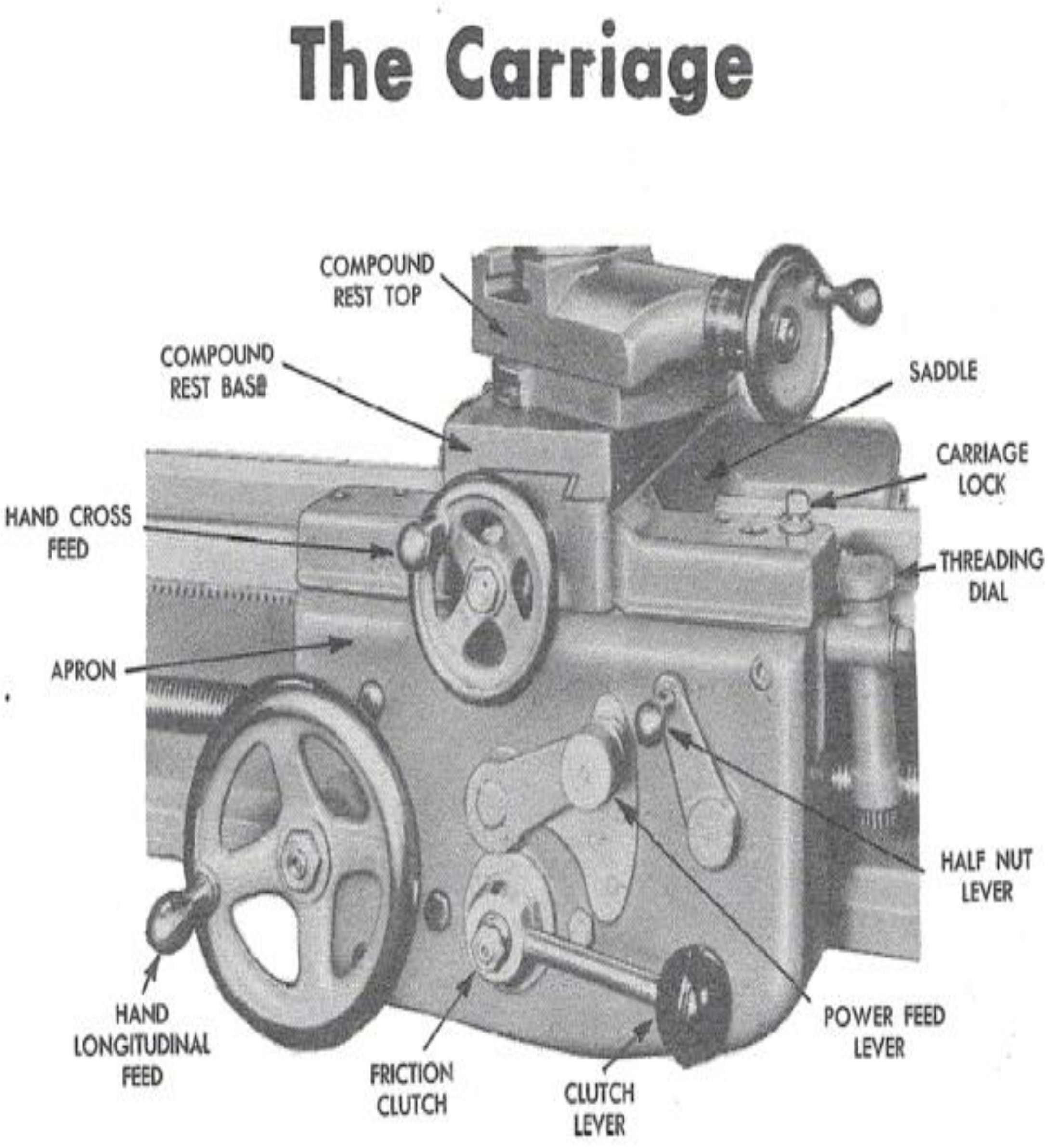
Carriage

The cross-slide is basically mounted on the carriage, which generally travels at right angles to the spindle axis.

On the cross-slide, a saddle is mounted in which the compound rest is adjusted which can rotate and fix to any desired angle.

The compound rest slide is actuated by a screw, which rotates in a nut fixed to the saddle.

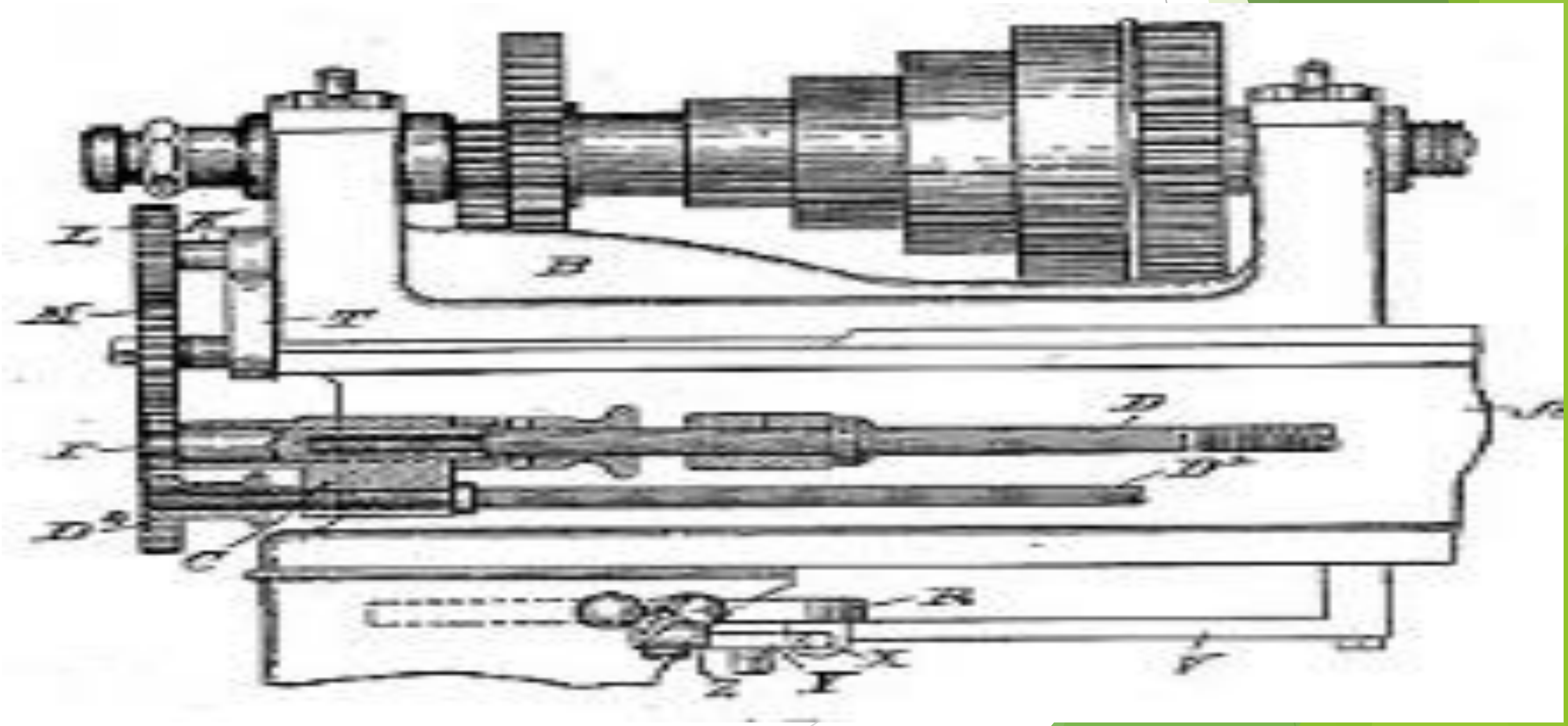
The tool post is an important part of carriage which fits in a tee-slot in the compound rest and holds the tool holder in place by the tool post screw.



Feed Mechanism

Feed mechanism is the combination of different units through which motion of headstock spindle is transmitted to the carriage of lathe machine.

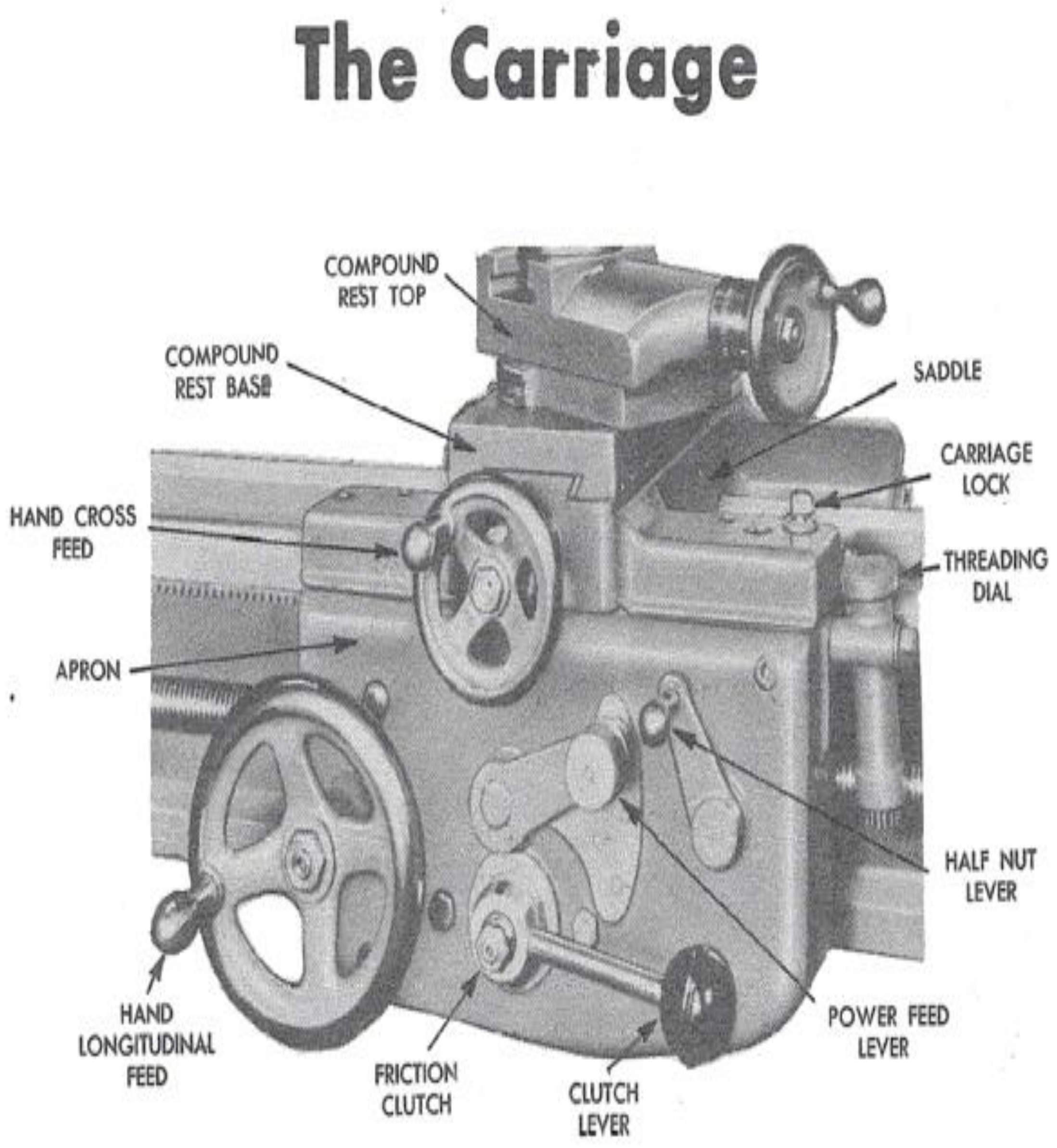
Following units play role in feed mechanism of a lathe machine
End of bed gearing
2. Feed gear box
3. Lead screw and feed rod
4. Apron mechanism



The gearing at the end of bed transmits the rotary motion of headstock spindle to the feed gear box.

Through the feed gear box the motion is further transmitted either to the feed shaft or lead screw, depending on whether the lathe machine is being used for plain turning or screw cutting.

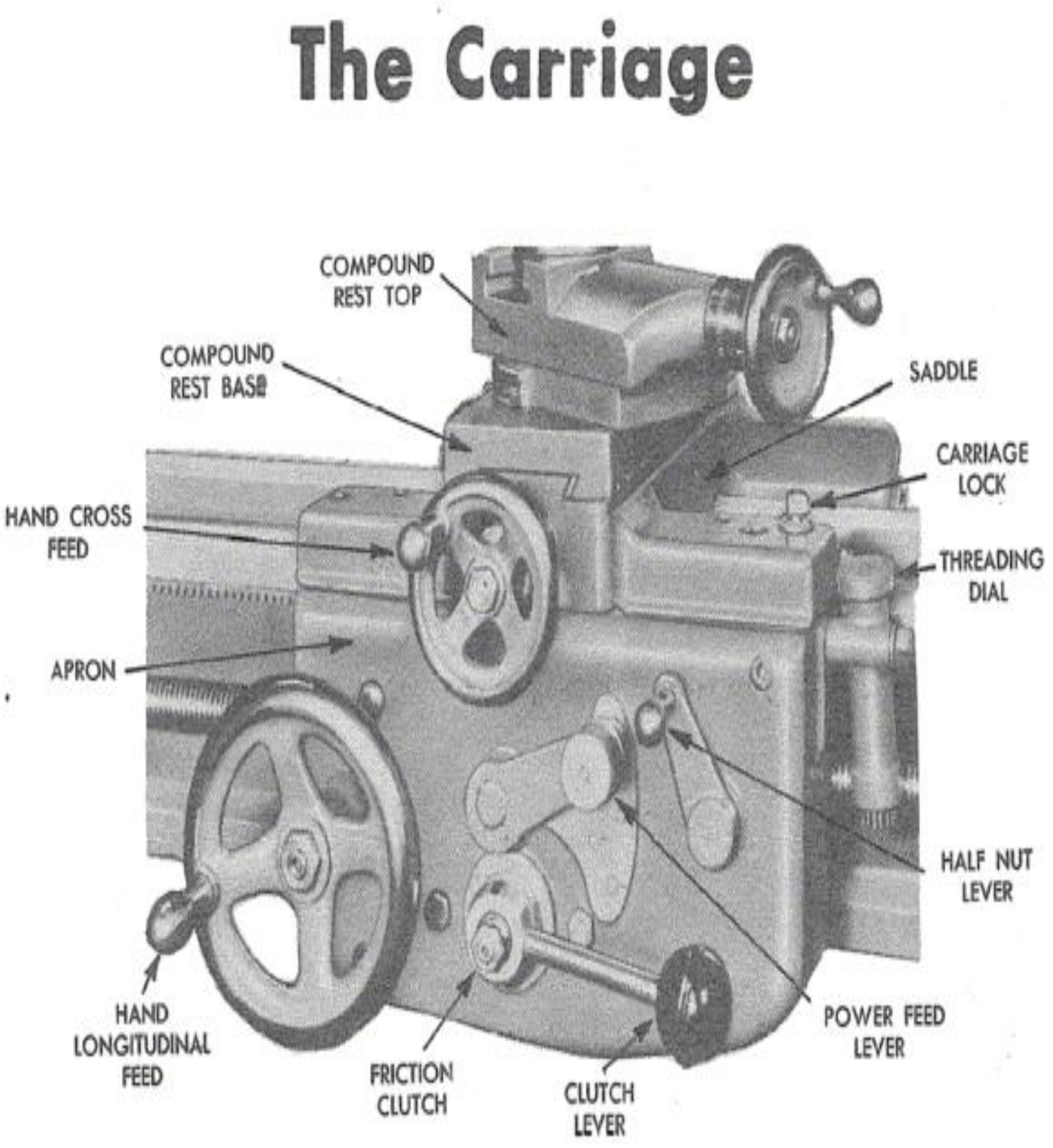
The feed gear box contains a number of different sizes of gears.



Feed Mechanism

The feed gear box provides a means to alter the rate of feed, and the ratio between revolutions of the headstock spindle and the movement of carriage for thread cutting by changing the speed of rotation of the feed rod or lead screw.

The apron is fitted to the saddle. It contains gears and clutches to transmit motion from the feed rod to the carriage, and the half nut which engages with the lead screw during cutting threads.



Thread Cutting Mechanism

The half nut or split nut is used for thread cutting in a lathe.

It engages or disengages the carriage with the lead screw so that the rotation of the leadscrew is used to traverse the tool along the workpiece to cut screw threads.

The direction in which the carriage moves depends upon the position of the feed reverse lever on the headstock.

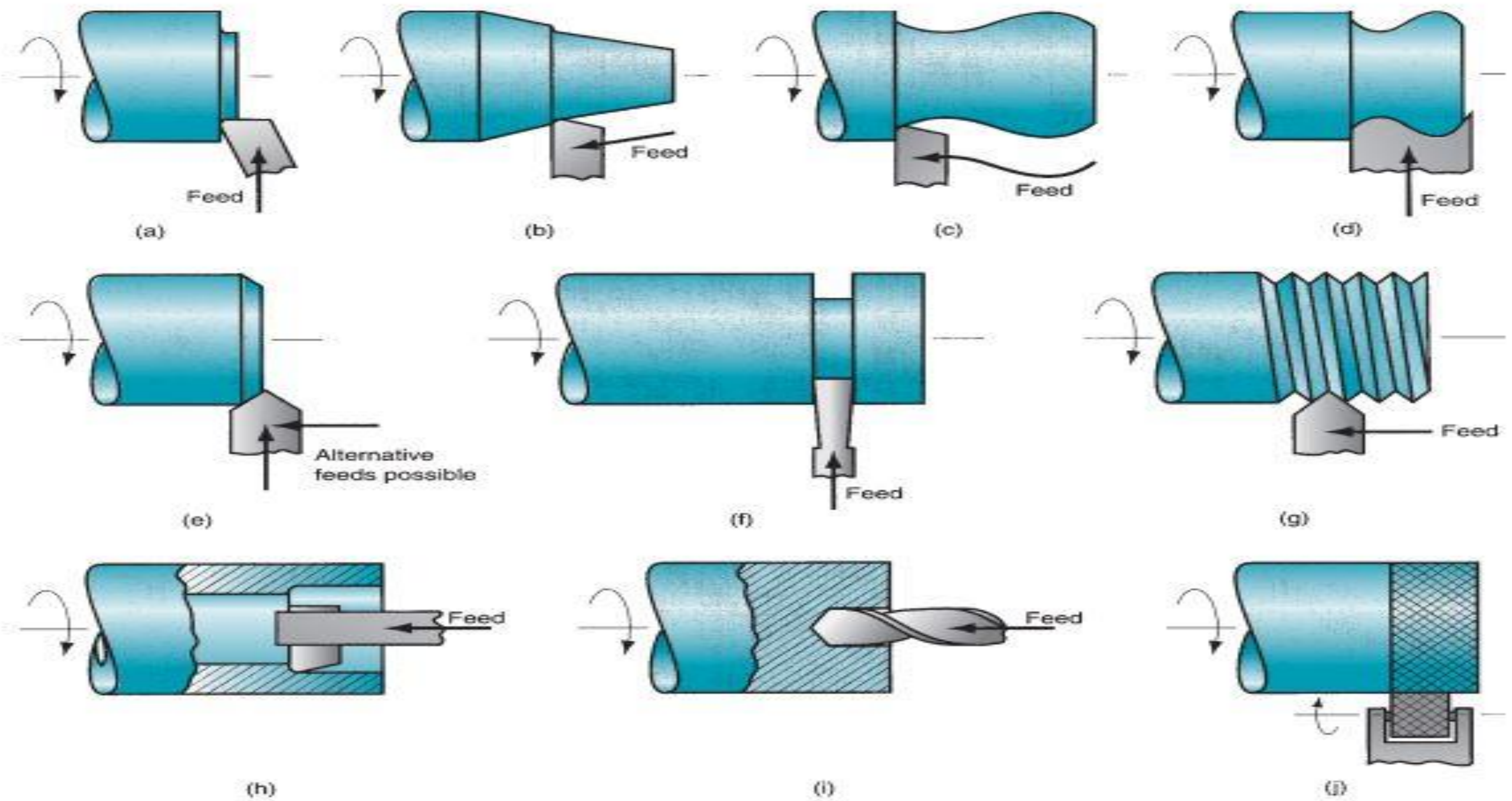


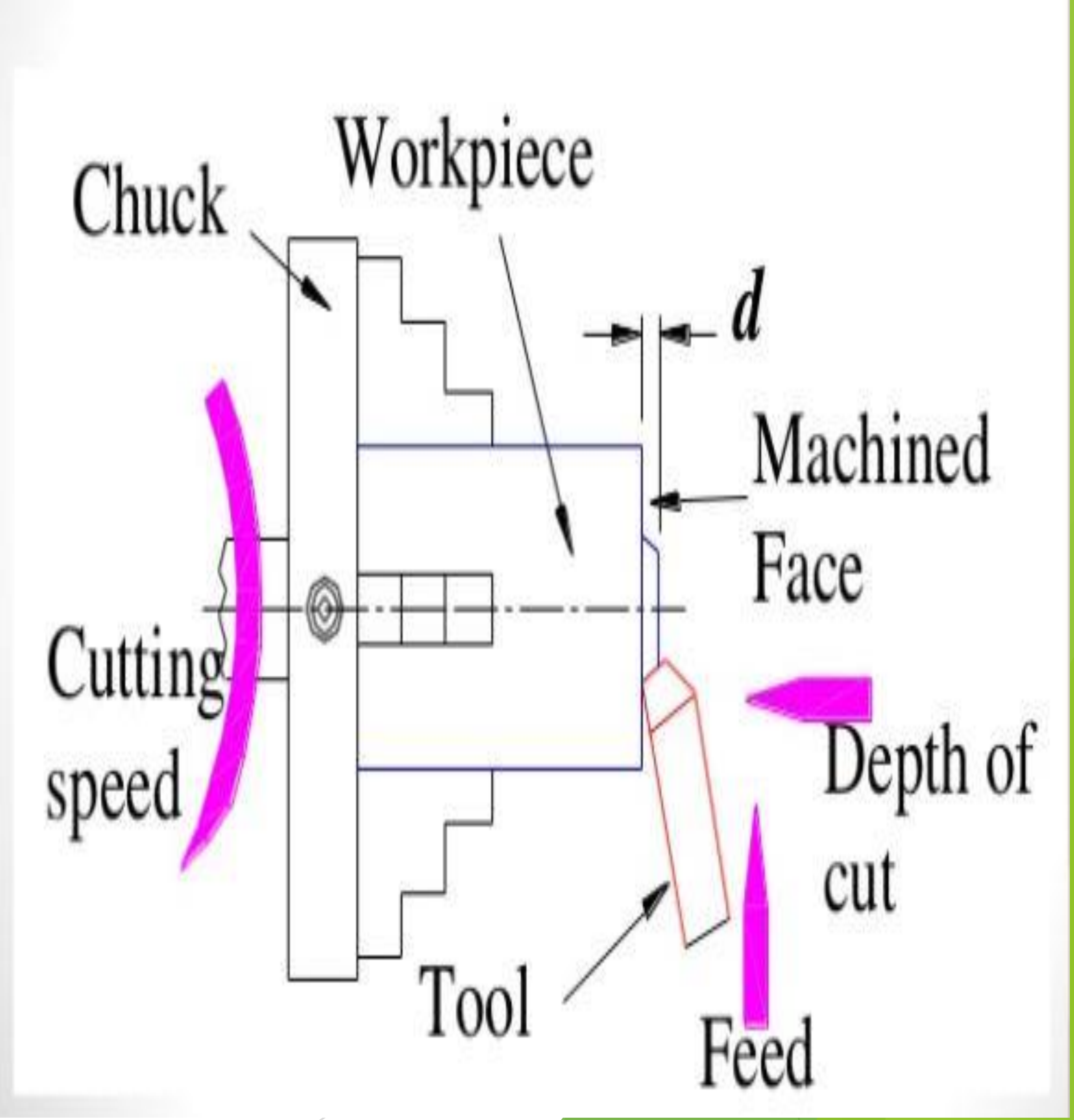
FIGURE 22.6 Machining operations other than turning that are performed on a lathe: (a) facing, (b) taper turning, (c) contour turning, (d) form turning, (e) chamfering, (f) cutoff, (g) threading, (h) boring, (i) drilling, and (j) knurling.

Fig: Operations in Lathe

For performing the various machining operations in a lathe, the job is being supported and driven by anyone of the following methods.

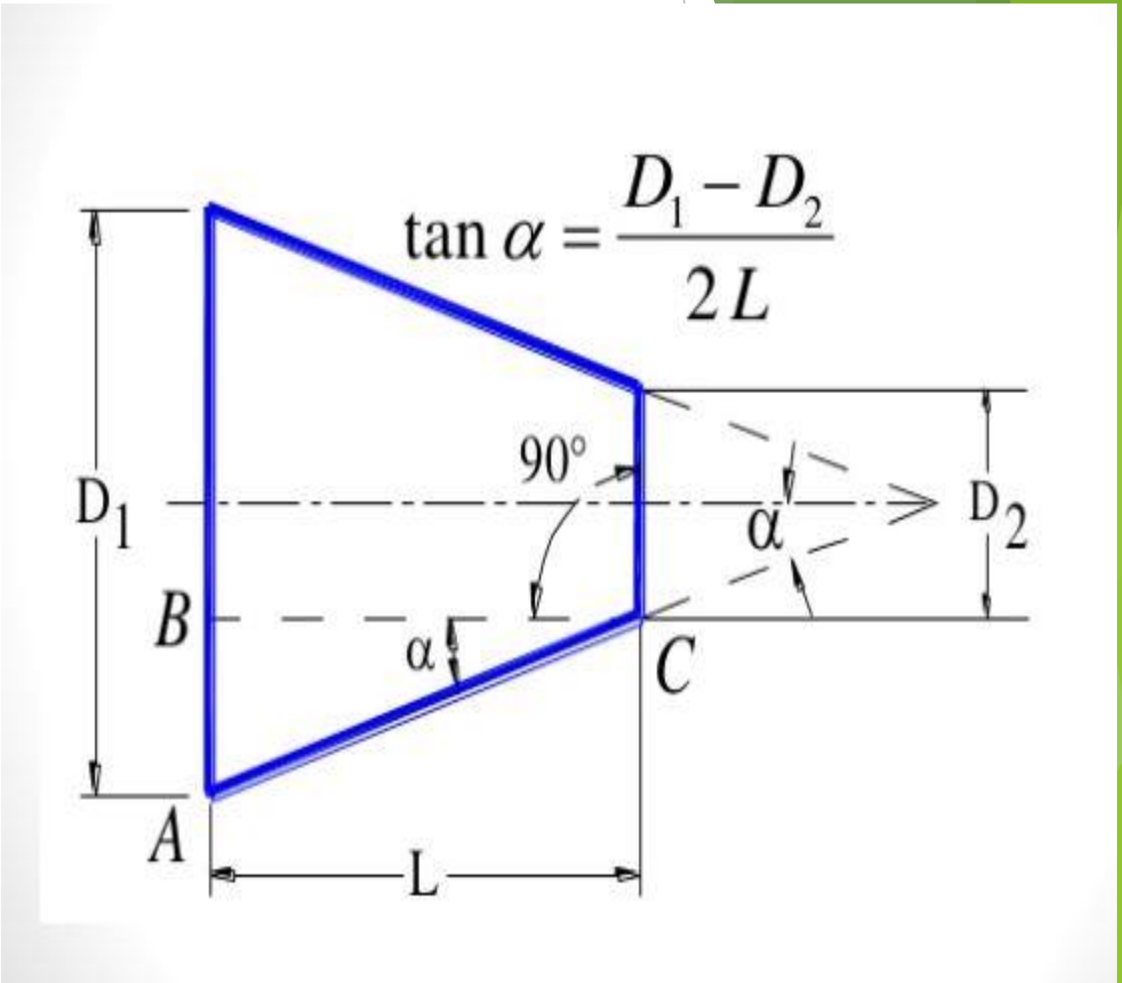
1. Job is held and driven by chuck with the other end supported on the tail stock centre.
2. Job is held between centers and driven by carriers and catch plates.
3. Job is held on a mandrel, which is supported between centers and driven by carriers and catch plates.
4. Job is held and driven by a chuck or a faceplate or an angle plate.

Facing. The tool is fed radially into the rotating work on one end to create a flat surface on the end.



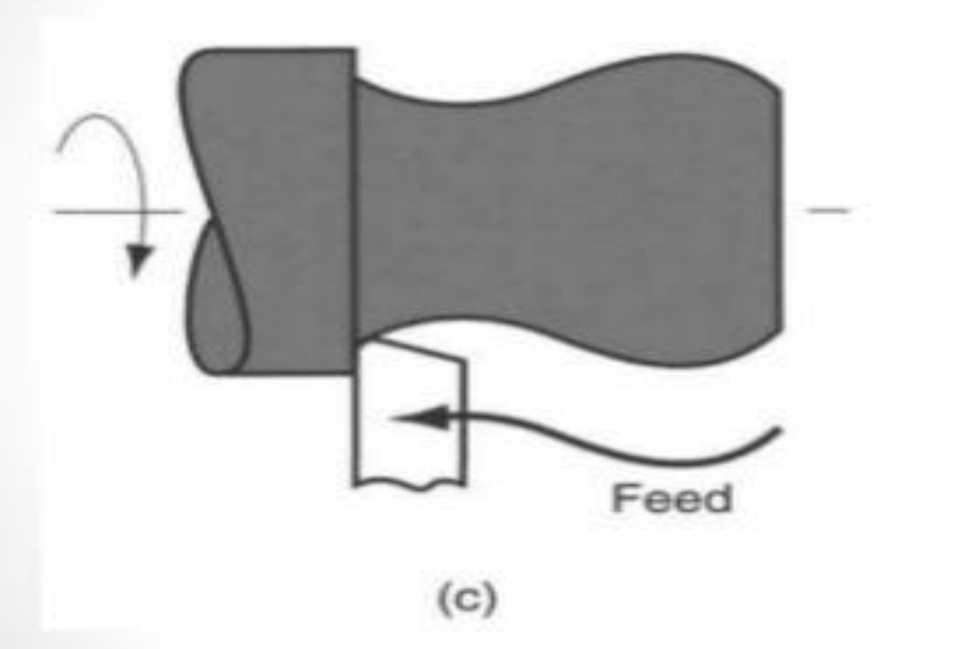
Taper Turning

Instead of feeding the tool parallel to the axis of rotation of the work, the tool is fed at an angle, thus creating a tapered cylinder or conical shape.



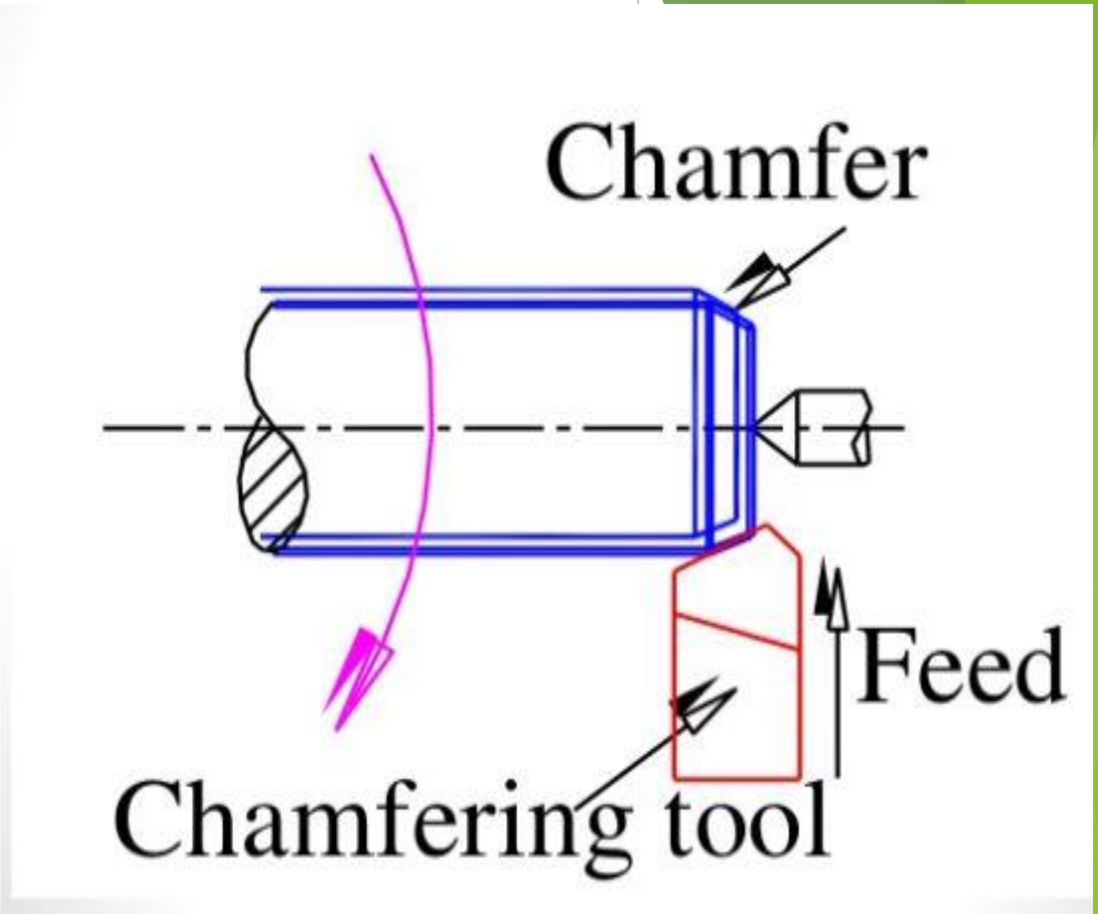
Contour turning

Instead of feeding the tool along a straight line parallel to the axis of rotation as in turning, the tool follows a contour that is other than straight, thus creating a contoured form in the turned part.

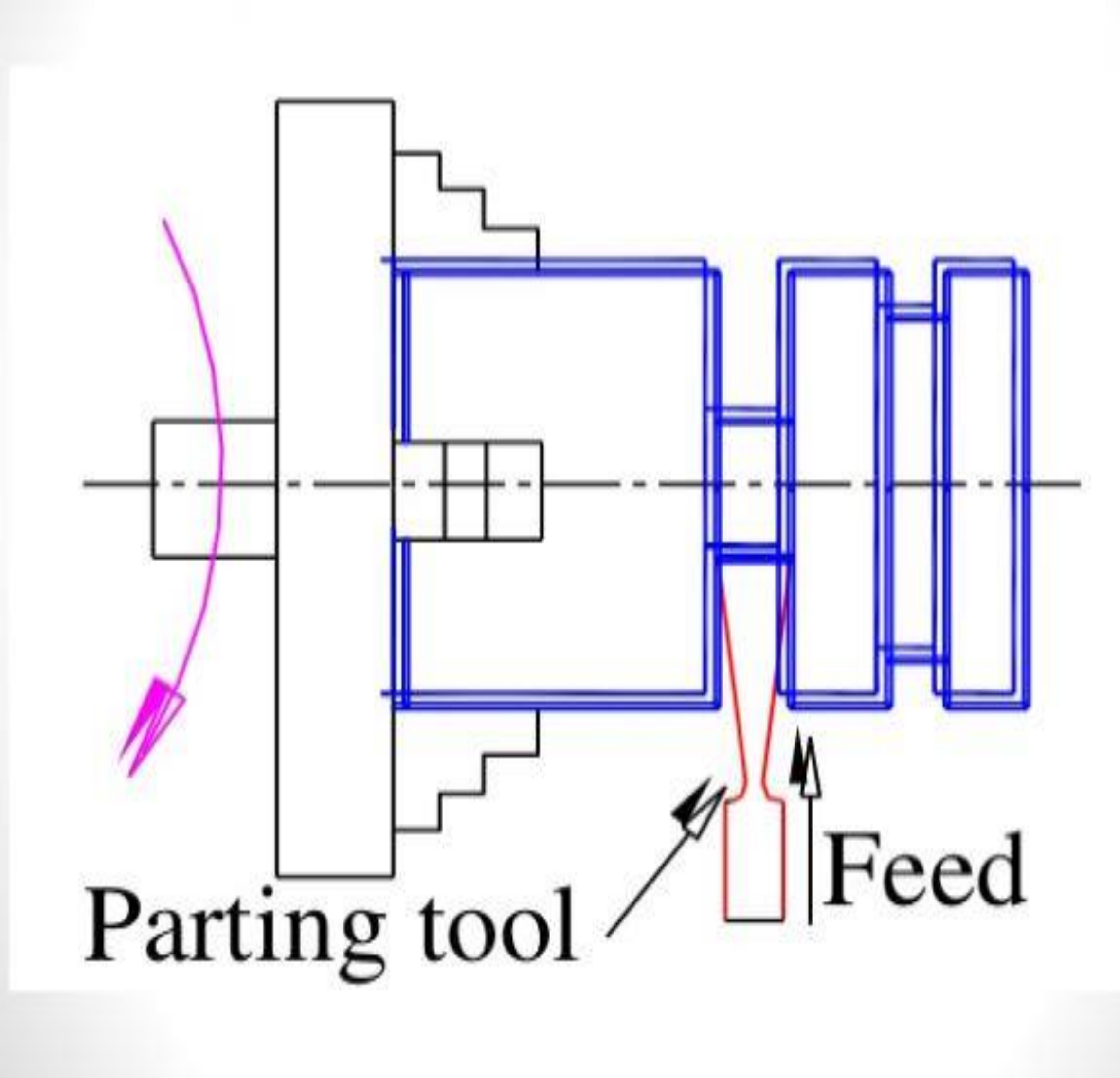


Form turning. In this operation, sometimes called forming, the tool has a shape that is imparted to the work by plunging the tool radially into the work.

Chamfering. The cutting edge of the tool is used to cut an angle on the corner of the cylinder, forming what is called a chamfer.

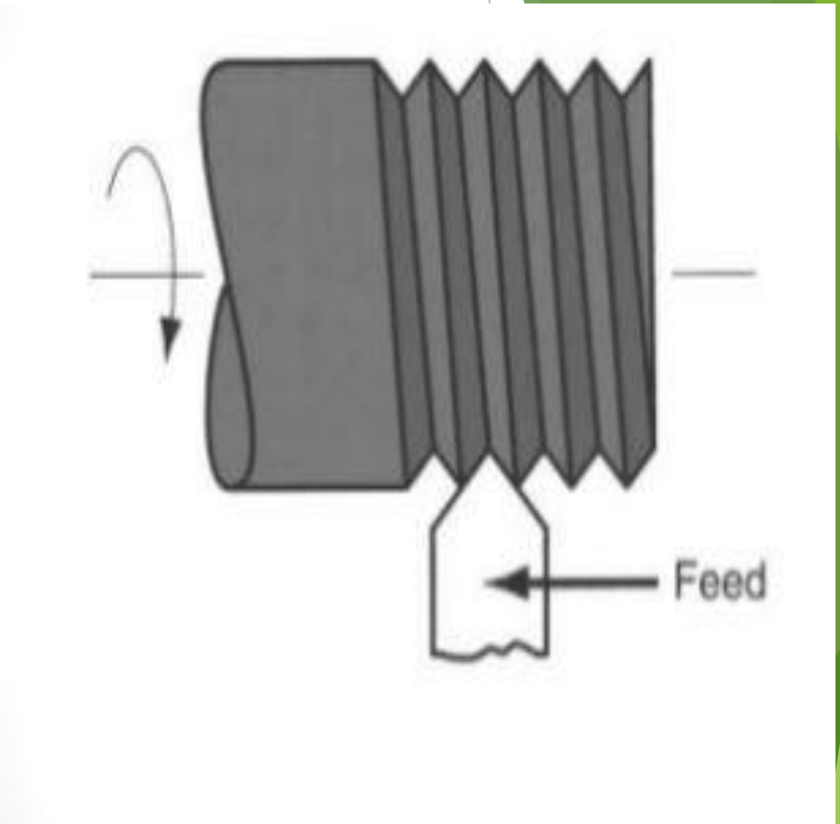


Cutoff. The tool is fed radially into the rotating work at some location along its length to cut off the end of the part. This operation is sometimes referred to as parting.



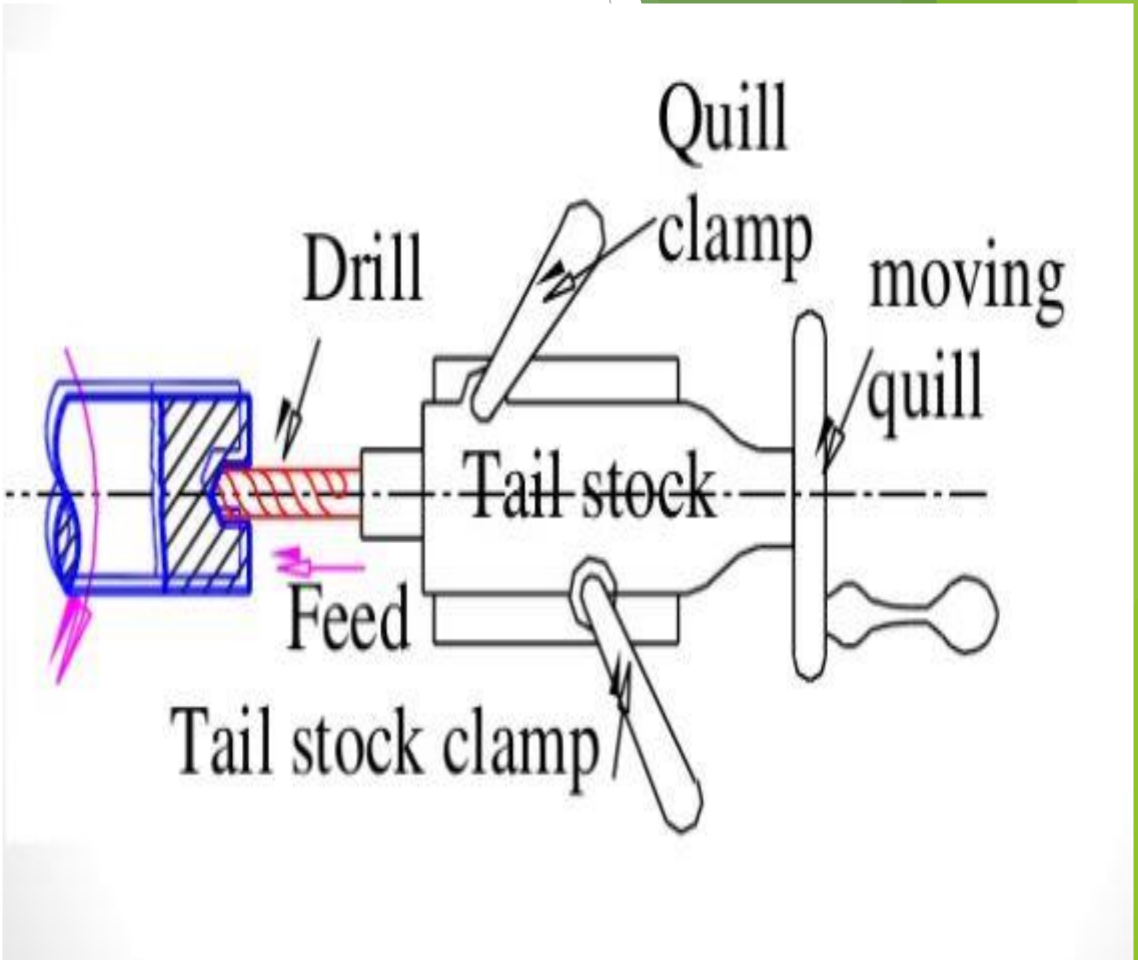
Threading

A pointed tool is fed linearly across the outside surface of the rotating workpart in a direction parallel to the axis of rotation at a large effective feed rate, thus creating threads in the cylinder.



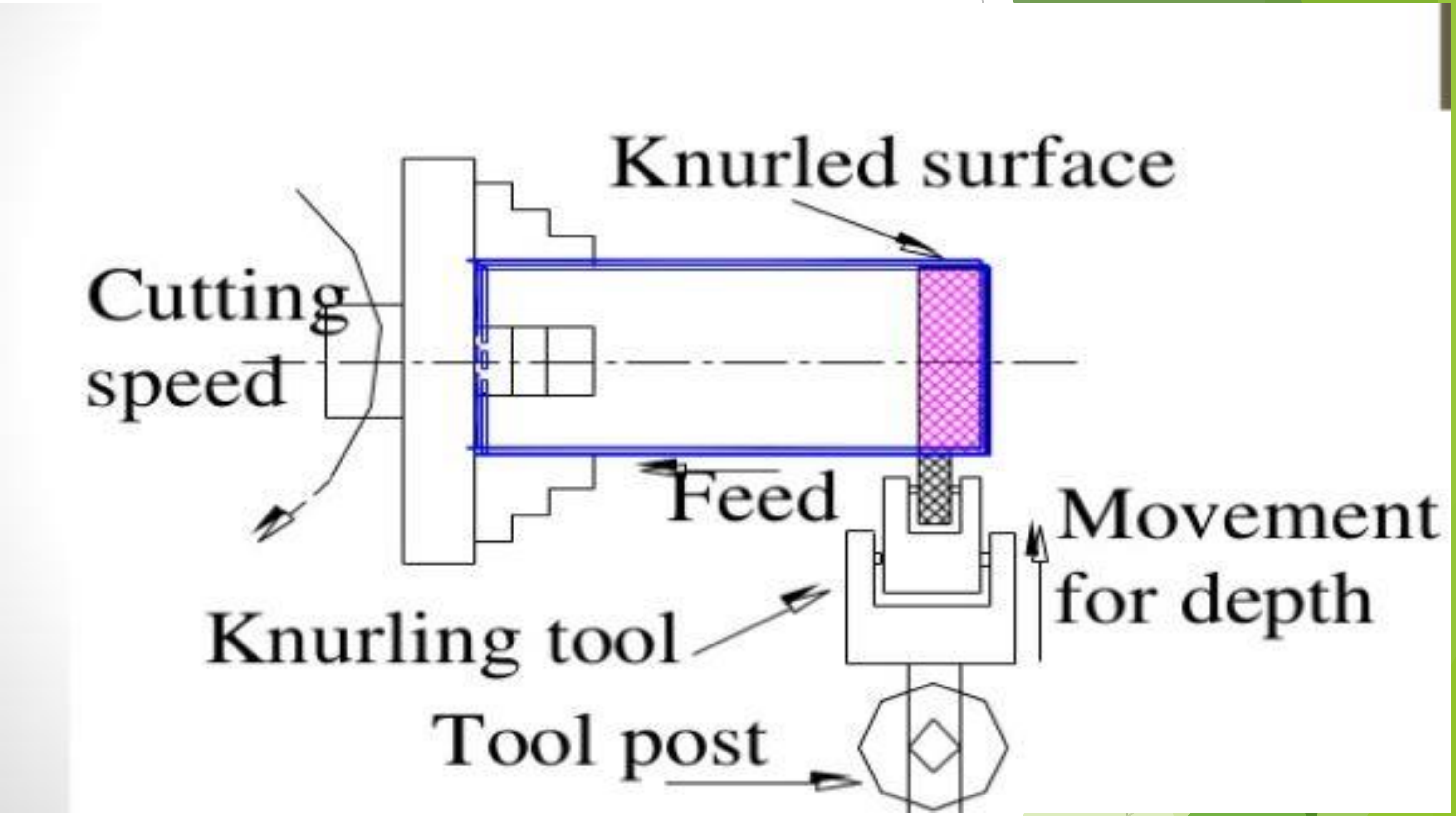
Drilling. Drilling can be performed on a lathe by feeding the drill into the rotating work along its axis.

Boring. A single-point tool is fed linearly, parallel to the axis of rotation, on the inside diameter of an existing hole in the part.



Knurling:

It is a metal forming operation used to produce a regular crosshatched pattern in the work surface.



Specifications of Lathe

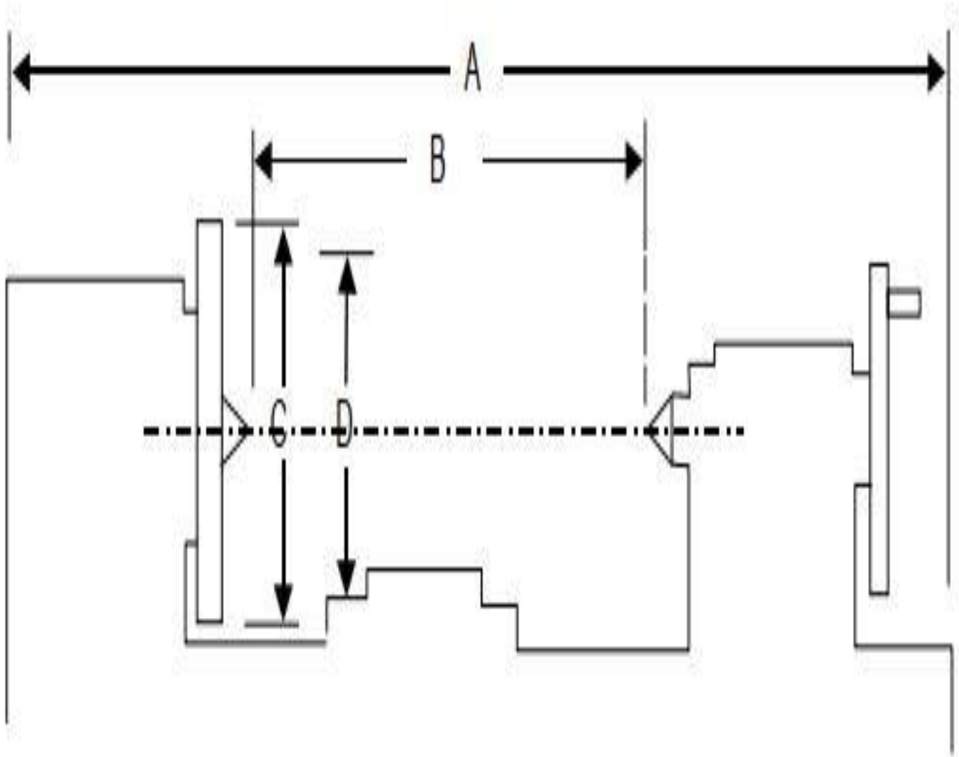
The size of a lathe is generally specified by the following means:

(*a*) Swing or maximum diameter that can be rotated over the bed ways

(*b*) Maximum length of the job that can be held between head stock and tail stock centres

(*c*) Bed length, which may include head stock length also.

(*d*) Maximum diameter of the bar that can pass through spindle or collect chuck of capstan lathe.



A - Length of bed.
B - Distance between centres.
C - Diameter of the work that can be turned over the ways.
D - Diameter of the work that can be turned over the cross slide.

Fig. 21.7 Specifications of a lathe

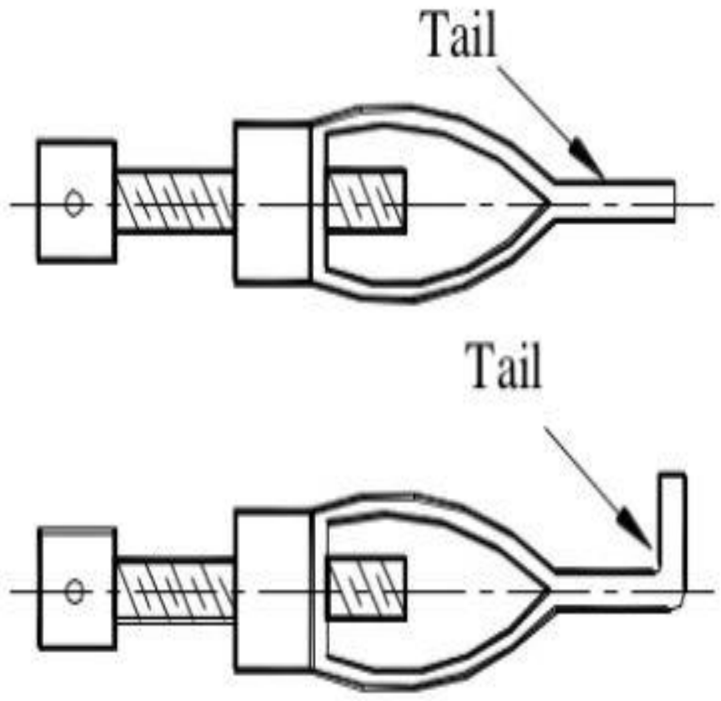
Lathe centers

The most common method of holding the job in a lathe is between the two centers generally known as live centre (head stock centre) and dead centre (tailstock centre).

They are made of very hard materials to resist deflection and wear and they are used to hold and support the cylindrical jobs.

Carriers or driving dog and catch plates

These are used to drive a job when it is held between two centers.



Carriers or driving dogs are attached to the end of the job by a setscrew.

A use of lathe dog for holding and supporting the job is shown.

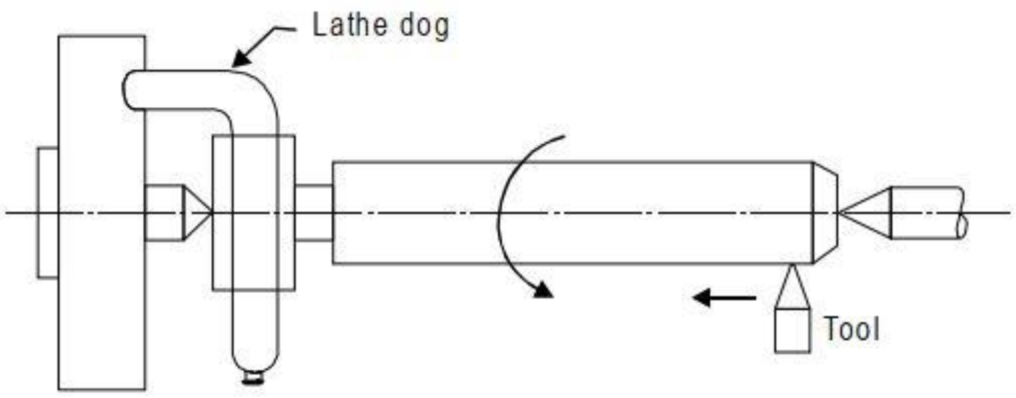


Fig. 21.6 Lathe dog

Catch plates are either screwed or bolted to the nose of the headstock spindle.

A projecting pin from the catch plate or carrier fits into the slot provided in either of them.

This imparts a positive drive between the lathe spindle and job.

Chucks

Chuck is one of the most important devices for holding and rotating a job in a lathe.

It is basically attached to the headstock spindle of the lathe.

The internal threads in the chuck fit on to the external threads on the spindle nose.

Jobs of short length and large diameter or of irregular shape, which cannot be conveniently mounted between centers, are held quickly and rigidly in a chuck.

There are a number of types of lathe chucks, e.g.

(1) Three jaws or universal

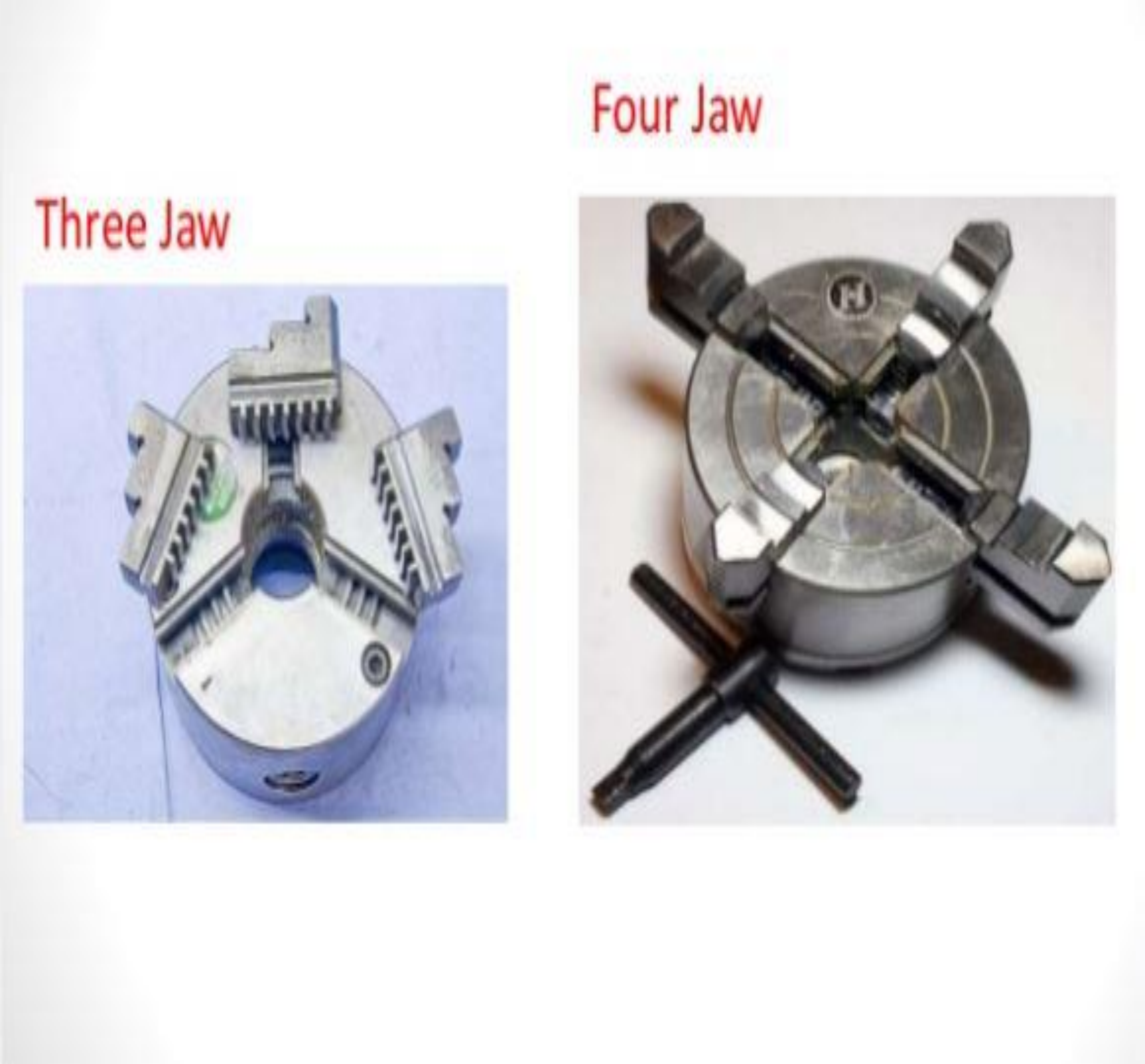
(2) Four jaw independent chuck

(3) Magnetic chuck

(4) Collet chuck

(5) Air or hydraulic chuck operated chuck

(6) Combination chuck



Face plates

Face plates are employed for holding jobs, which cannot be conveniently held between centers or by chucks.

A face plate possesses the radial, plain and T slots for holding jobs or work-pieces by bolts and clamps. Face plates consist of a circular disc bored out and threaded to fit the nose of the lathe spindle.

They are heavily constructed and have strong thick ribs on the back.

They have slots cut into them, therefore nuts, bolts, clamps and angles are used to hold the jobs on the face plate.

They are accurately machined and ground.

Mandrel

A mandrel is a device used for holding and rotating a hollow job that has been previously drilled or bored. The job revolves with the mandrel, which is mounted between two centers.

It is rotated by the lathe dog and the catch plate and it drives the work by friction.

Different types of mandrels are employed according to specific requirements.

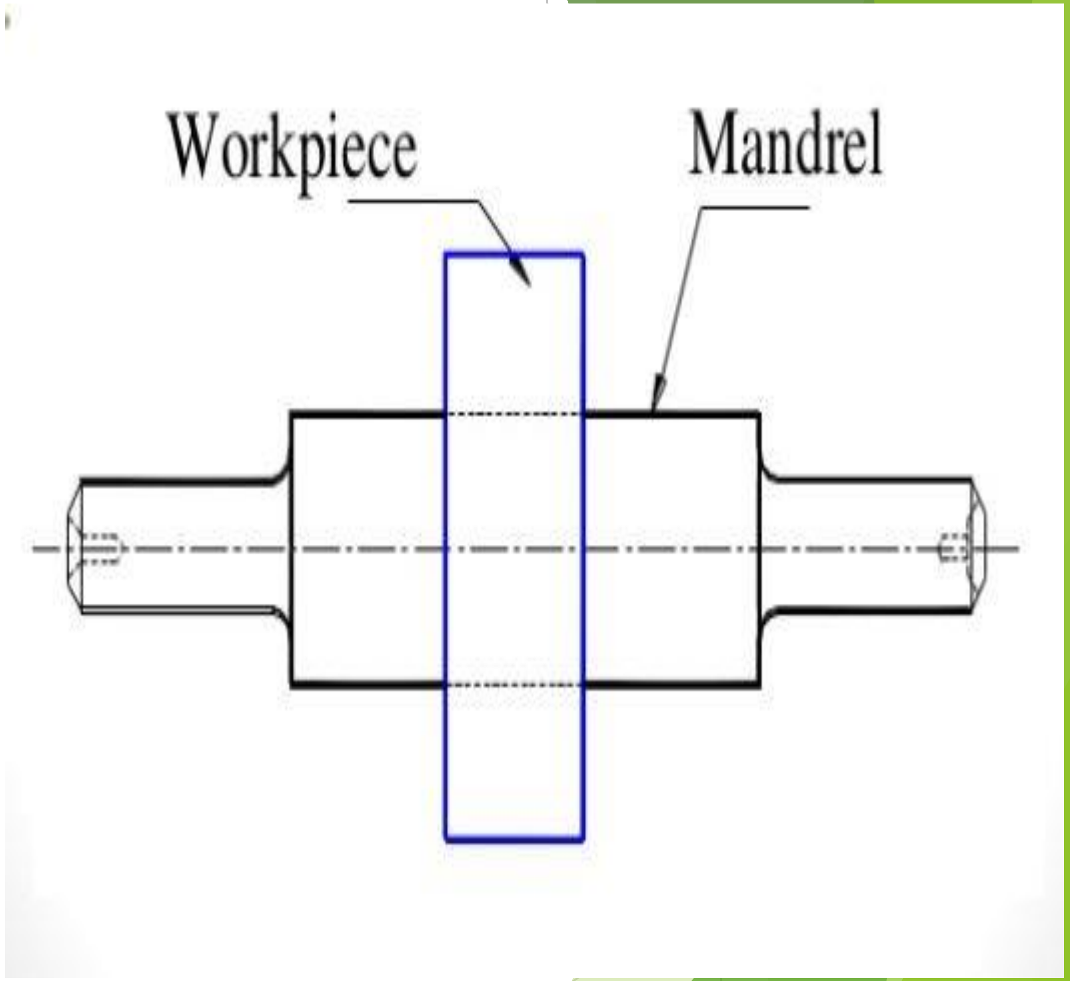
It holds and locates a part from its center hole.

Mandrel

The mandrel is always rotated with the help of a lathe dog; it is never placed in a chuck for turning the job.

A mandrel is a job holding device rather than a cutting tool holder.

It is generally used in order to machine the entire length of a hollow job.



Rest

A rest is a lathe device, which supports a long slender job, when it is turned between centers or by a chuck, at some intermediate point to prevent bending of the job due to its own weight and vibration set up due to the cutting force that acts on it.

The two types of rests commonly used for supporting a long job in an engine lathe are the steady or centre rest and the follower rest.

Steady Rests

These rests are mounted on the lathe bed and do not move with the lathe.

Although they limit the supporting cut length, they ensure concentricity.

It provides the support while turning to reduce vibration.

Follower rests

Attach to the lathe component that holds the tool, also called as the "saddle" and move along or “follow” the lathe.

It is fastened to the carriage and moves along with the cutting tool.

It is used when the flexible shafts are threaded.

Figure I-399 Both steady and follower rests being used.

Taper Turning

A taper is defined as a uniform increase or decrease in diameter of a piece of work measured along its length.

In a lathe machine, taper turning means to produce a conical surface by gradual reduction in diameter from a cylindrical job.

Taper = $(D – d) / l$

Where,

D = is the diameter of the large end of cylindrical job,

d = is the diameter of the small end of cylindrical job, and

l = is the length of the taper of cylindrical job

A taper can be turned by anyone of the following methods:

1. By swivelling the compound rest
2. By setting over the tailstock centre
3. By a broad nose form tool
4. By a taper turning attachment
5. By combining longitudinal and cross feed in a special lathe
6. By using numerical control lathe.

Taper Turning by swivelling the Compound Rest

This method uses the principle of turning taper by rotating the work piece on the lathe axis and feeding the tool at an angle to the axis of rotation of the work piece.

The tool is mounted on the compound rest which is attached to a circular base, graduated in degrees.

The compound rest can easily be swivelled or rotated and clamped at any desired angle.

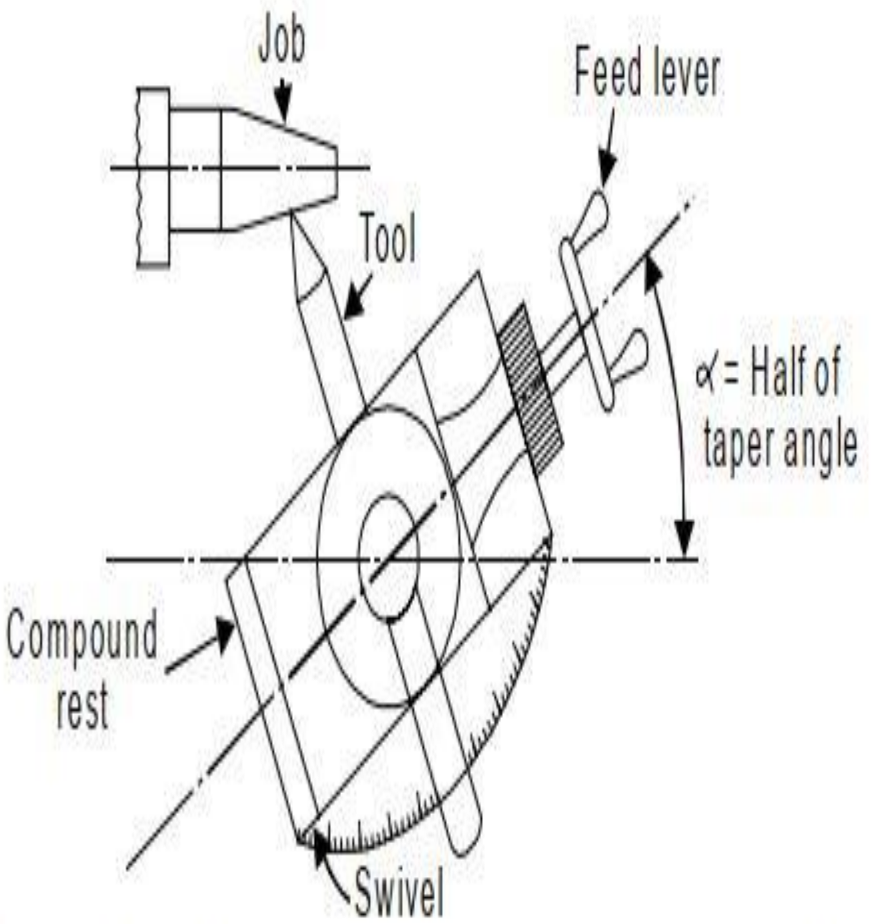


Fig. 21.9(a) Taper turning by swiveling compound rest

Once the compound rest is set at the desired half taper angle, rotation of the compound slide screw will cause the tool to be fed at that angle and generate a corresponding taper.

This method is limited to turn a short but steep taper because of the limited movement of the cross-slide.

The compound rest can be swiveled at 45° on either side of the lathe axis enabling it to turn a steep taper.

The movement of the single point cutting tool in this method is being purely controlled by hand. Thus it provides a low production capacity and poor surface

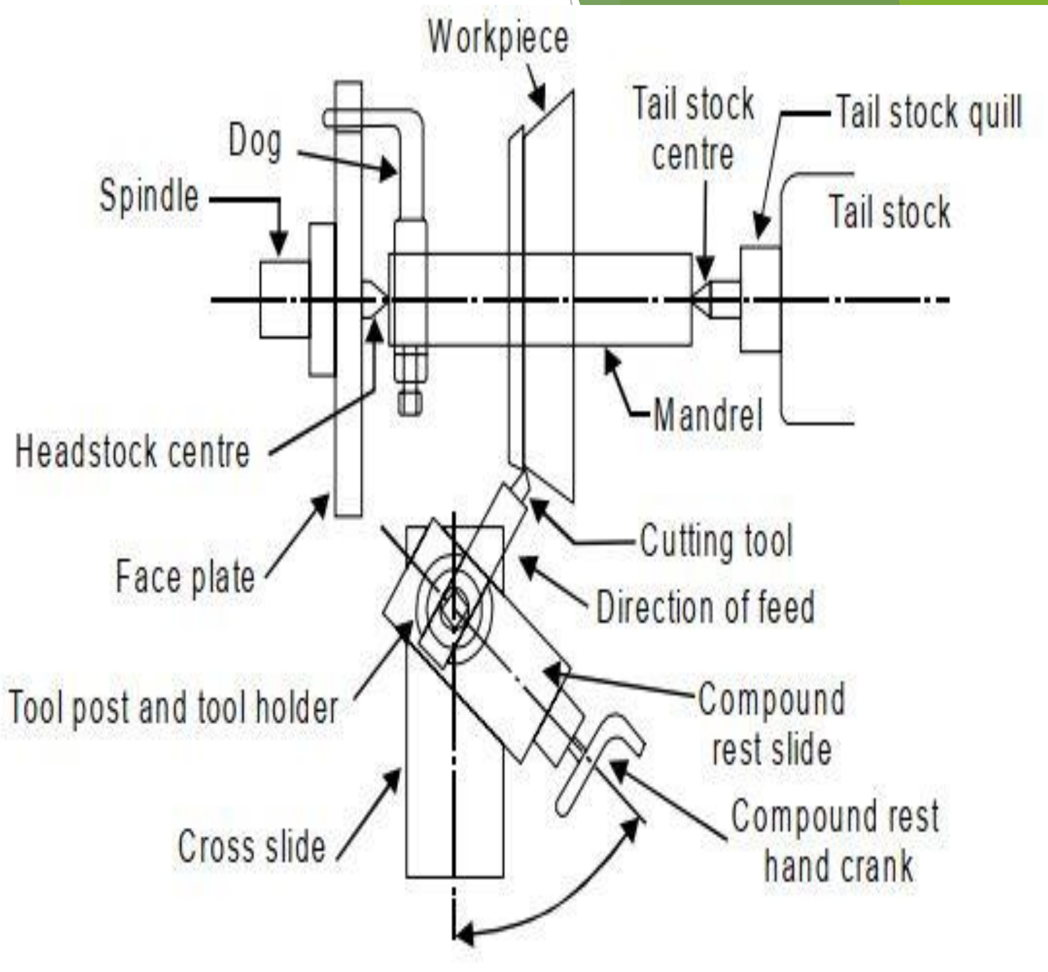


Fig. 21.9(b) Swiveling compound rest set-up

The movement of the single point cutting tool in this method is being purely controlled by hand. Thus it provides a low production capacity and poor surface finish.

The positioning or setting of the compound rest is accomplished by swivelling the rest at the half taper angle, if this is already known.

If the diameter of the small and large end and length of taper are known, the half taper angle can be calculated.

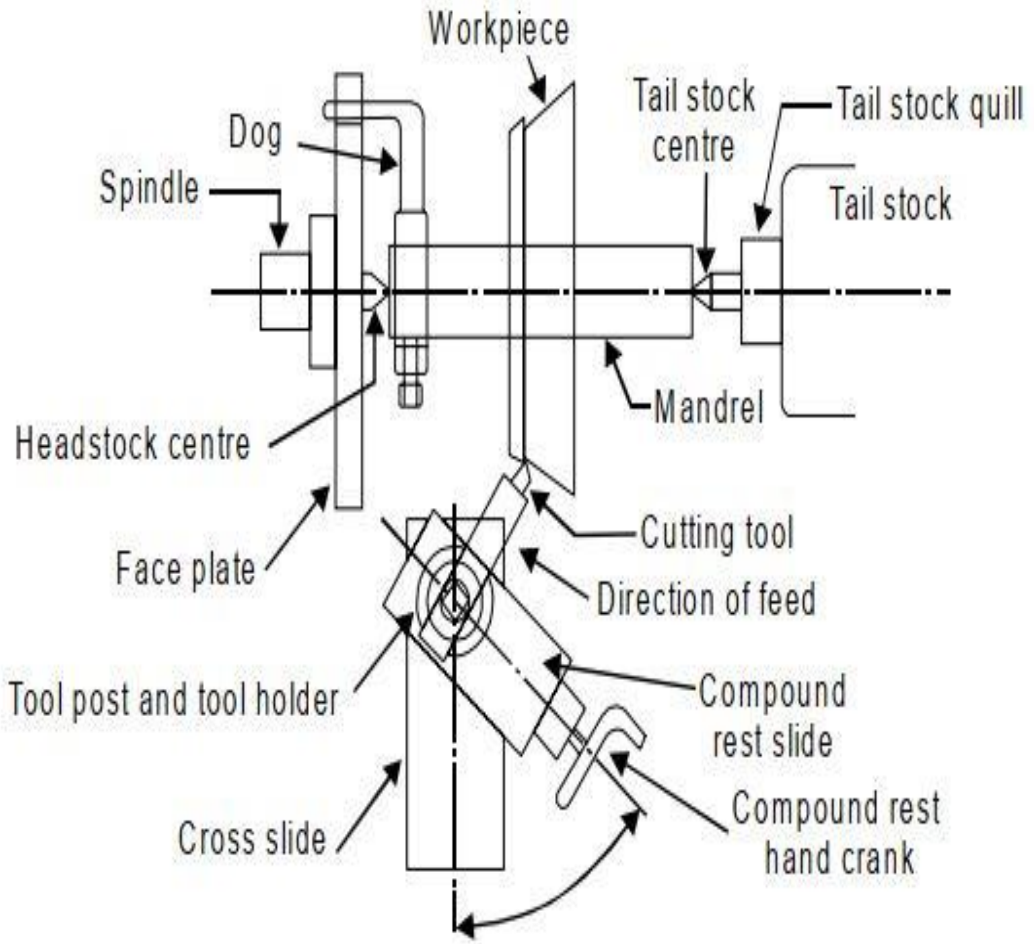


Fig. 21.9(b) Swiveling compound rest set-up

2. Taper Turning Attachment

This method is commonly employed for generating external tapers only.

In this method, the taper turning attachment is bolted back of the lathe machine.

It has guide bar which may be set at any desired angle or taper.

As the carriage moves along the bed length aside over bar causes the tool to move in and out according to setting of the bar.

The taper setting on the bar is duplicated on the job or work.

The merit of this method is that the lathe centres are kept in alignment.

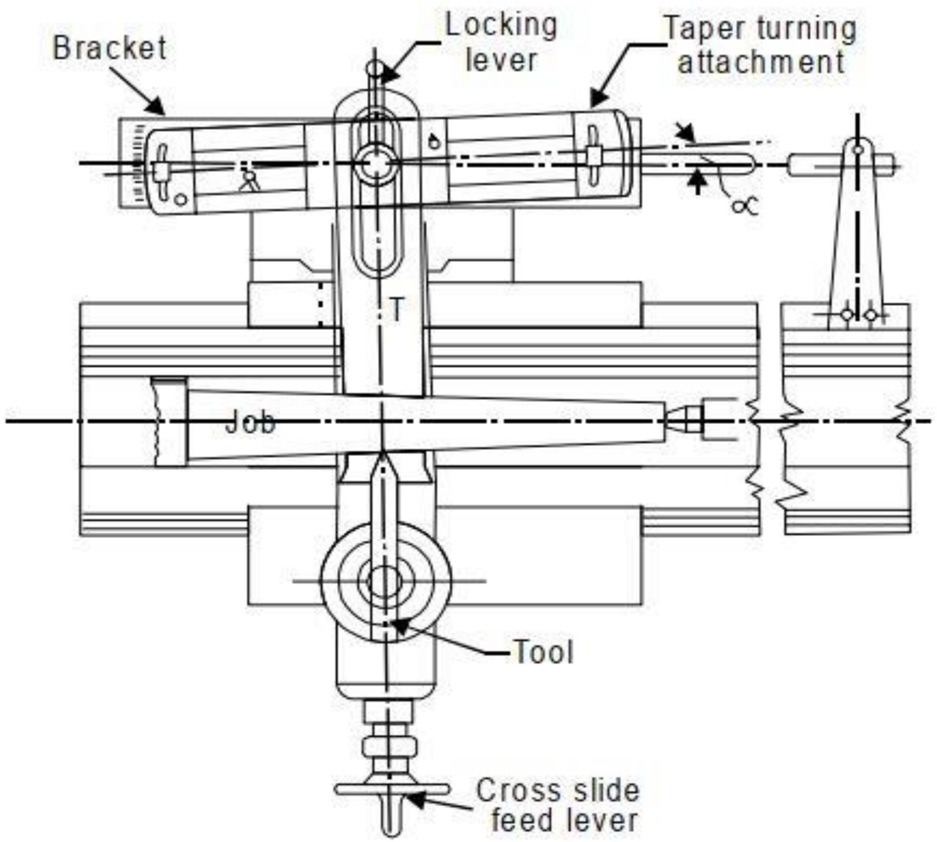


Fig. 21.10 Taper turning attachment

2. Taper Turning by Tailstock Set over Method

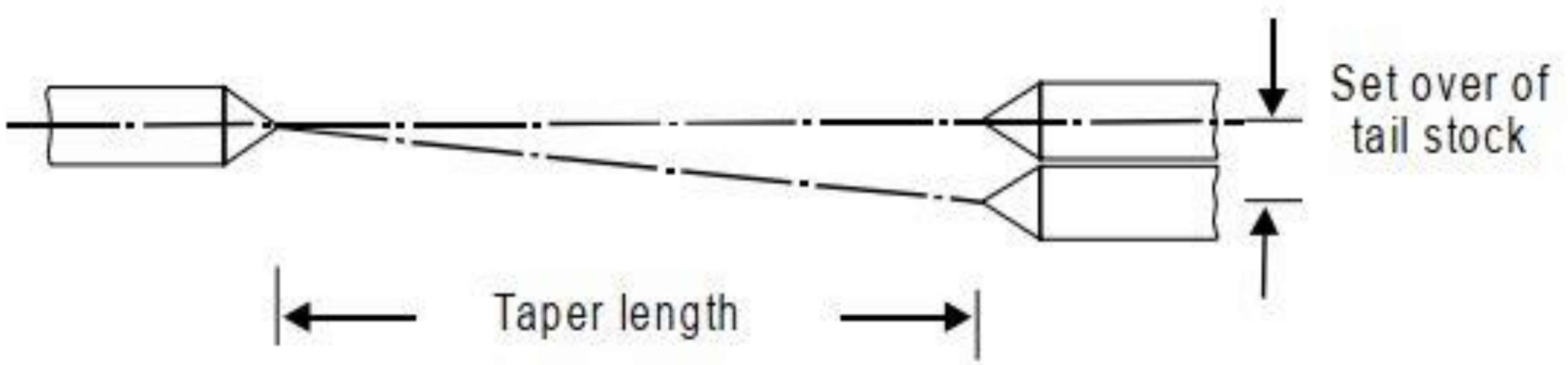


Fig. 21.11 Tailstock set over

$$(D - d) / 2 = l \times \sin(a/2)$$

D = is the diameter of the large end of cylindrical job
d = is the diameter of the small end of cylindrical job
l = is the length of the taper of cylindrical job
a = taper angle

This method is basically employed for turning small tapers on longer jobs and is confined to external tapers only.
In this method, the tailstock is set over is calculated and by loosening the nut from its centre line equal to the value obtained by formula.

4. Form Tool Method

It is limited to short external tapers.

The edge tool must be exactly straight for accurate work.

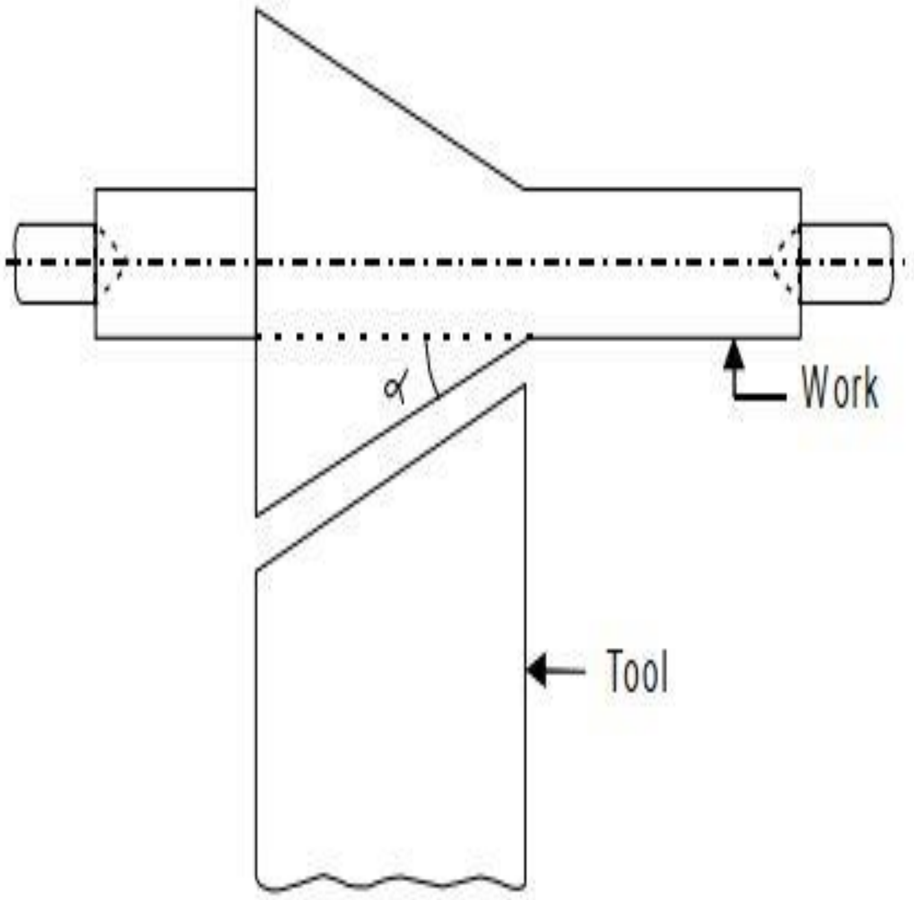


Fig. 21.12 Form tool taper turning


Thank You