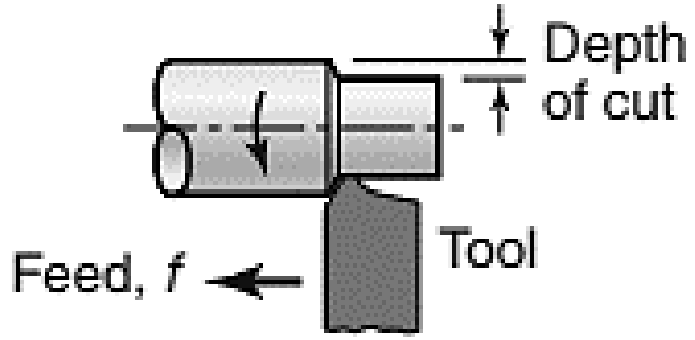
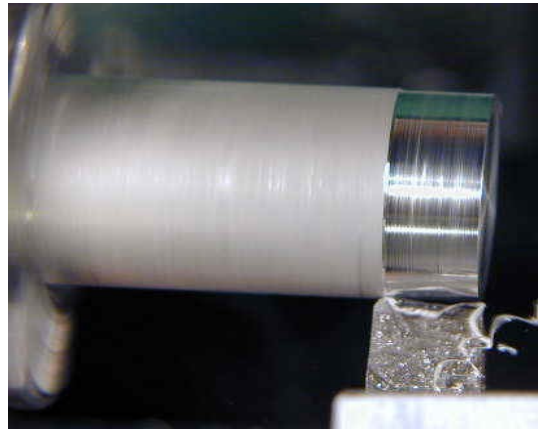
OPERATIONS ON LATHE

PLAIN TURNING



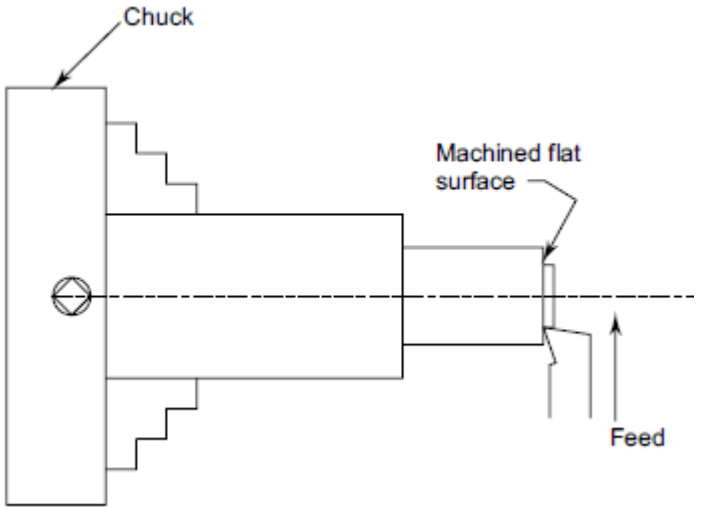
- Plain turning is by far the most commonly used operation in a lathe.
- In this the work held in the spindle is rotated while the tool is fed past the work piece in a direction parallel to the axis of rotation. The surface thus generated is the cylindrical surface as shown in Fig.
- It is usually done in two stages – rough turning and smooth or finish turning. **Rough turning** involves majority of material removal and it is usually done at high speeds while **smooth turning** is done at lesser speeds and it is involved in finishing the given job to required dimensions.

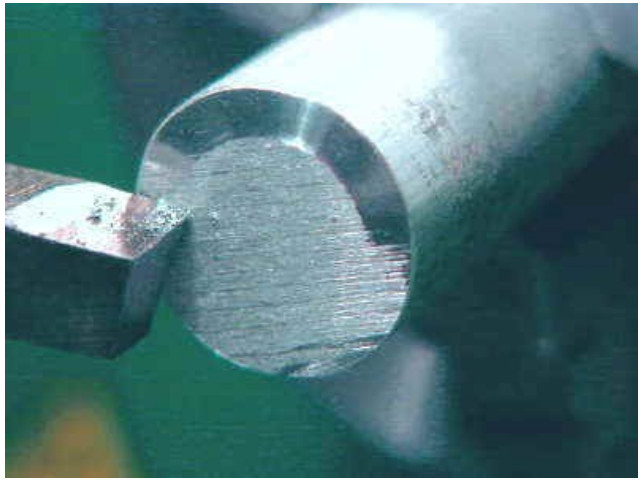


OPERATIONS ON LATHE

FACING

- Facing is an operation for generating flat surfaces in lathes.
- The feed in this case is given in a direction perpendicular to the axis of revolution.
- The tool used should have a suitable approach angle so that it would not interfere with the work piece during the tool feeding.

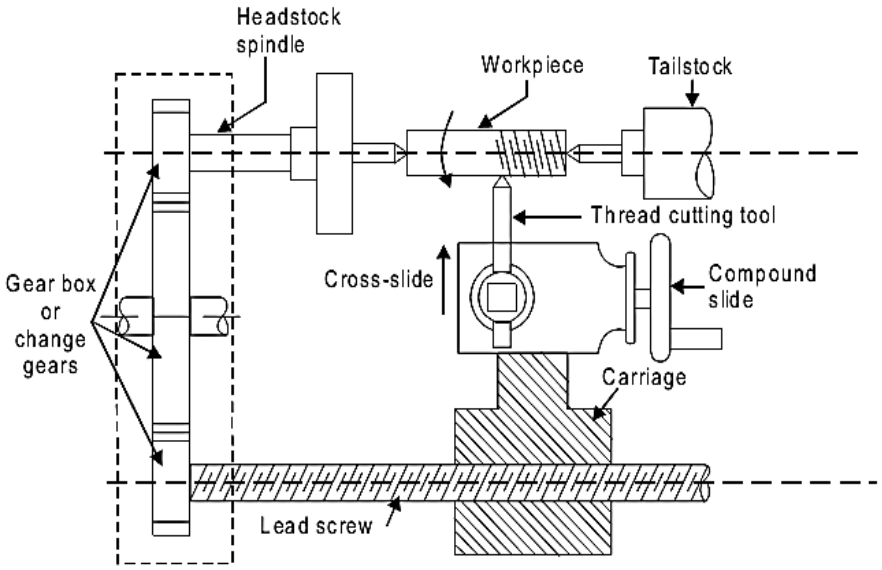




OPERATIONS ON LATHE

THREAD CUTTING

- A screw thread may be defined as a ridge of uniform cross section that follows a helical or spiral path on the outside or inside of a cylindrical surface.
- The cutting tool, the shape of which depends on the type of thread to be cut, is mounted on a holder and moved along the length of the workpiece by the lead screw on the lathe.
- This movement is achieved by the **engagement of a split nut (also called a half nut) inside the apron of the lathe.**
- The axial movement of the tool in relation to the rotation of the workpiece determines the pitch of the screw thread.



OPERATIONS ON LATHE

THREAD CUTTING

- The axial feed is automatically generated when cutting a thread by means of the lead screw, which drives the carriage. When the lead screw rotates a single revolution, the carriage travels a distance equal to the pitch of the lead screw.

- Consequently, if the rotational speed of the lead screw is equal to that of the spindle (that of the workpiece), the pitch of the resulting cut thread is exactly equal to that of the lead screw.

- The pitch of the resulting thread being cut, therefore, always depends upon the ratio of the rotational speeds of the lead screw and the spindle.

$$\frac{\text{Pitch of lead screw}}{\text{Desired pitch of workpiece}} = \frac{\text{rpm of workpiece}}{\text{rpm of lead screw}}$$

OPERATIONS ON LATHE

THREAD CUTTING

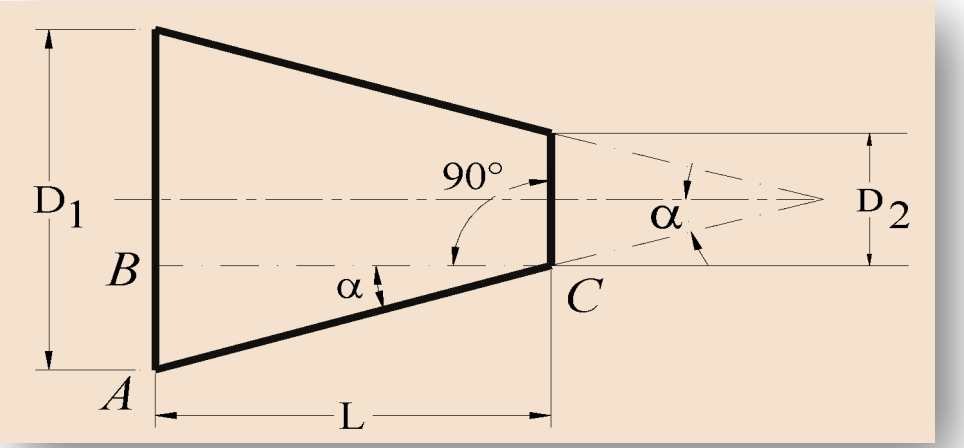
It is required to cut screw threads of 2 mm pitch on a lathe. The lead screw has a pitch of 6 mm. If the spindle speed is 60 rpm, then the speed of the lead screw will be

(A) 10 rpm (B) 20 rpm (C) 120 rpm (D) 180 rpm

OPERATIONS ON LATHE

TAPER TURNING

- Taper turning is the process of producing a conical surface from a cylindrical shaped workpiece.
- The taper to be produced is usually represented in terms of half taper angle.



$$\tan\alpha = \frac{D_1 - D_2}{2L}$$

OPERATIONS ON LATHE

TAPER TURNING

- A number of methods are available for cutting tapers in a lathe. They are:

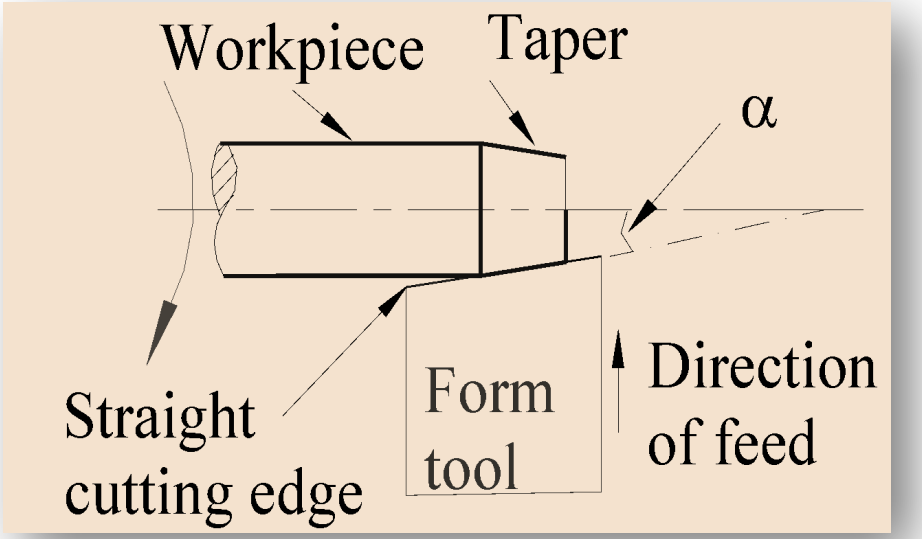
- **using form tools**
- **swivelling the compound rest**
- **offsetting the tailstock**
- **using taper turning attachment**

OPERATIONS ON LATHE

TAPER TURNING

Form tool method –

- A method that is normally used for production applications is the use of special form tool for generating the tapers.
- The feed is given by plunging the tool directly into the work. This method is useful for short tapers, where the steepness is of no consequence, such as for chamfering.



OPERATIONS ON LATHE

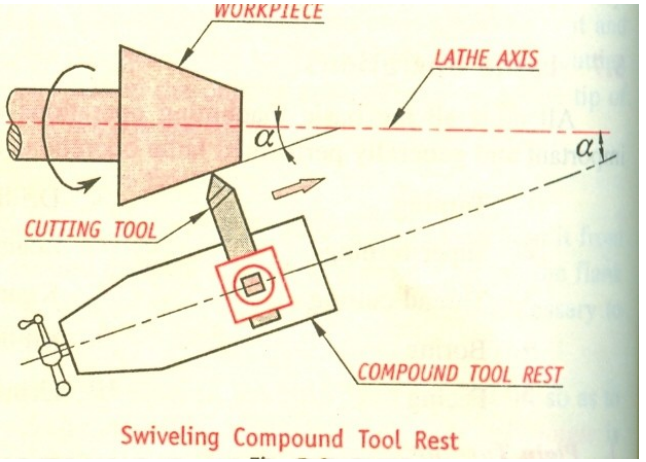
TAPER TURNING

Swivelling compound rest –

- It is possible to swivel the compound rest to the desired angle of the taper for cutting the tapers. The compound rest has a circular base graduated in degrees.

- The tool is then made perpendicular to the work piece and feed is given manually by the operator.

- Some of the features of this method are:
  - Short and steep tapers can be easily done.
  - Limited movement of the compound rest
  - Feeding is by hand and is non-uniform. This is responsible for low productivity and poor surface finish.



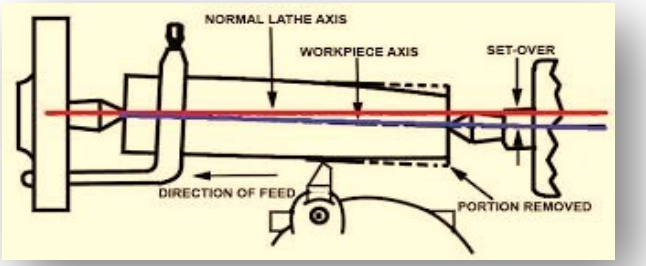
Swiveling Compound Tool Rest

OPERATIONS ON LATHE

TAPER TURNING

Offsetting the tailstock –

- Still another method sometimes used is the method of offsetting the tailstock from the centre position.



- By offsetting the tailstock, the axis of rotation of the job is inclined by the half angle of taper as shown in Figure.

- The feed to the tool is given in the normal manner parallel to the guideways. Thus the conical surface is generated. The offset that is possible is generally limited, and as such this method is suitable for small tapers over a long length.

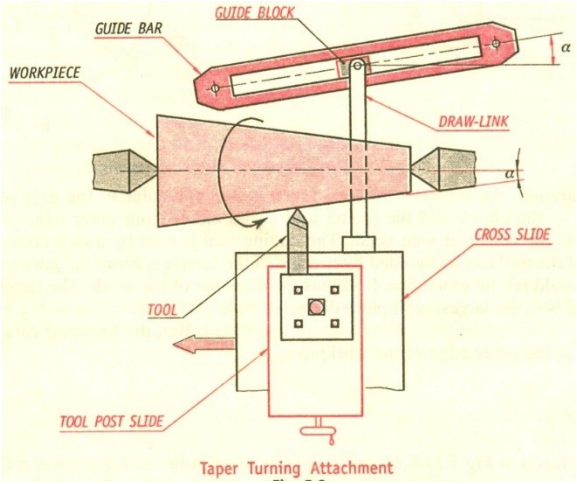
- The disadvantage is that the centres are not properly bearing in the centre holes and as such there would be non-uniform wearing taking place.

OPERATIONS ON LATHE

TAPER TURNING

Taper turning attachment method –

- Still another method for turning tapers over a comprehensive range is the use of taper turning attachment.



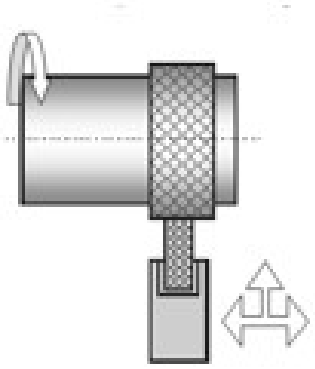
- In this method a separate slideway is arranged at the rear of the cross slide. This slide can be rotated at any angle to be setup. The block that can slide in this taper slide way is rigidly connected to the cross slide.

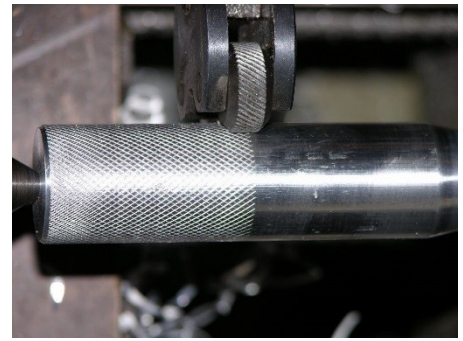
- As the carriage moves for feeding, the block moves in the inclined track of the slide, it gets the proportional cross movement perpendicular to the feed direction, the cross slide and in turn the cutting tool gets the proportional movement. Thus the tool tip follows the taper direction set in the attachment.

- This method is most commonly used for a range of tapers.

OPERATIONS ON LATHE

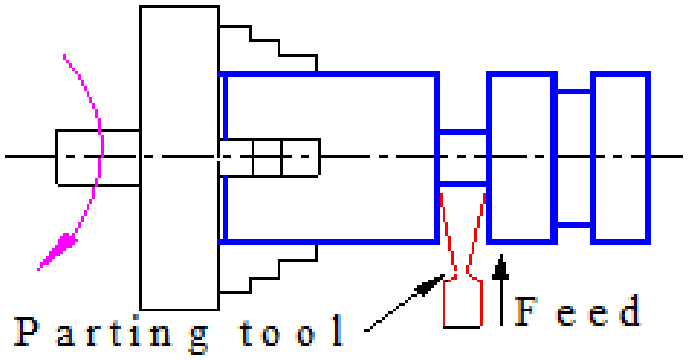
KNURLING





- Knurling is a metal working operation done in a lathe.
- In this a knurling tool having the requisite serrations is forced on to the work piece material, thus deforming the top layers. This forms a top surface, which is rough and provides a proper gripping surface.

PARTING



- Parting and grooving are similar operations. In this a flat nosed tool would plunge cut the work piece with a feed in the direction perpendicular to the axis of revolution. This operation is generally carried out for cutting off the part from the parent material.

WORK HOLDING DEVICE

- The most common form of work holding device used in a lathe is the **chuck**.
- Chucks come in various forms with a varying number of jaws. Of these the **three jaw chuck** or the **self-centering chuck** is the most common one.
- The main advantage of this chuck is the quick way in which the typical round job is centred. All the three jaws move radially inward or outward by the same amount.

- Thus, the jaws will be able to centre any job, whose external locating surface is cylindrical or symmetrical, like hexagonal.
- The independent jaw chuck has **four jaws**, which can be moved in their slots independent of each other, thus clamping any type of configuration. Since each of these jaws could move independently any irregular surface could be effectively centred.

MACHINING TIME

- To estimate the machining times, it is necessary to select the proper process parameters. For this purpose it is necessary to know the work piece material and the cutting tool material combinations to arrive at the right combination of the process parameters, cutting speed, feed and depth of cut.

- The cutting speed in turning is the surface speed of the work piece. Thus,

$$V = \frac{\pi D N}{1000}$$

where, V = cutting speed (surface), m/min
D = diameter of the work piece, mm
N = rotational speed of the work piece, rpm

- The diameter, D to be used can be either the initial diameter of the blank or the final diameter of the work piece after giving the depth of cut. However, there is practically not much change in the values obtained by using either of the values. To be realistic, the average of the two diameters would be better.