

Machine Tools

Workshop Technology

Machine Tools

- A machine which performs the material removal operation with tools, to produce desired shape and size of the work piece is known as machine tool.
- Various types of machine tools used in workshop are:

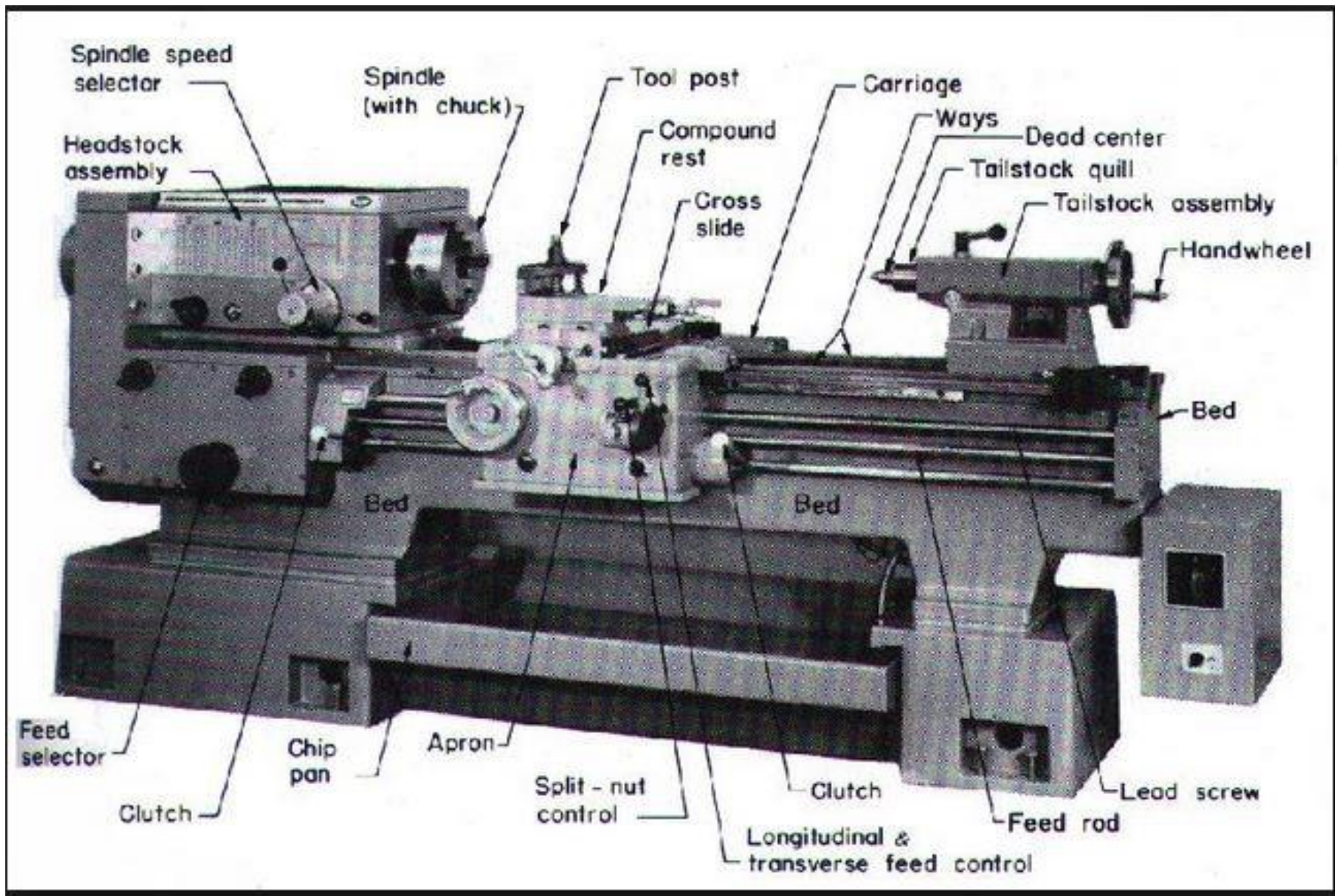
- Lathes
- Shapers
- Drilling Machines
- Milling machines
- Grinding machines

Machine Tools are used :

- To improve production rates
- To reduce cost of production
- To reduce fatigue of workers
- To achieve better quality
- To reduce wastage

Lathe

- Probably one of the most earliest machine tools.
- One of the most versatile and widely used machine tool, also called mother of machine tools.
- The job to be machined is held and rotated in a lathe chuck, a stationary cutting tool, which is harder than the job is advanced against rotating job.
- Some of the common operation performed on the lathe are facing, turning (step, taper, plain), drilling, threading, knurling and boring.
- Most of the operations are limited to circular profile.



TYPICAL ENGINE LATHE DIAGRAM

Principal Parts of Lathe

The Principal Parts are:

1. Bed
2. Headstock
3. Tailstock
4. Carriage
5. Feed Mechanism

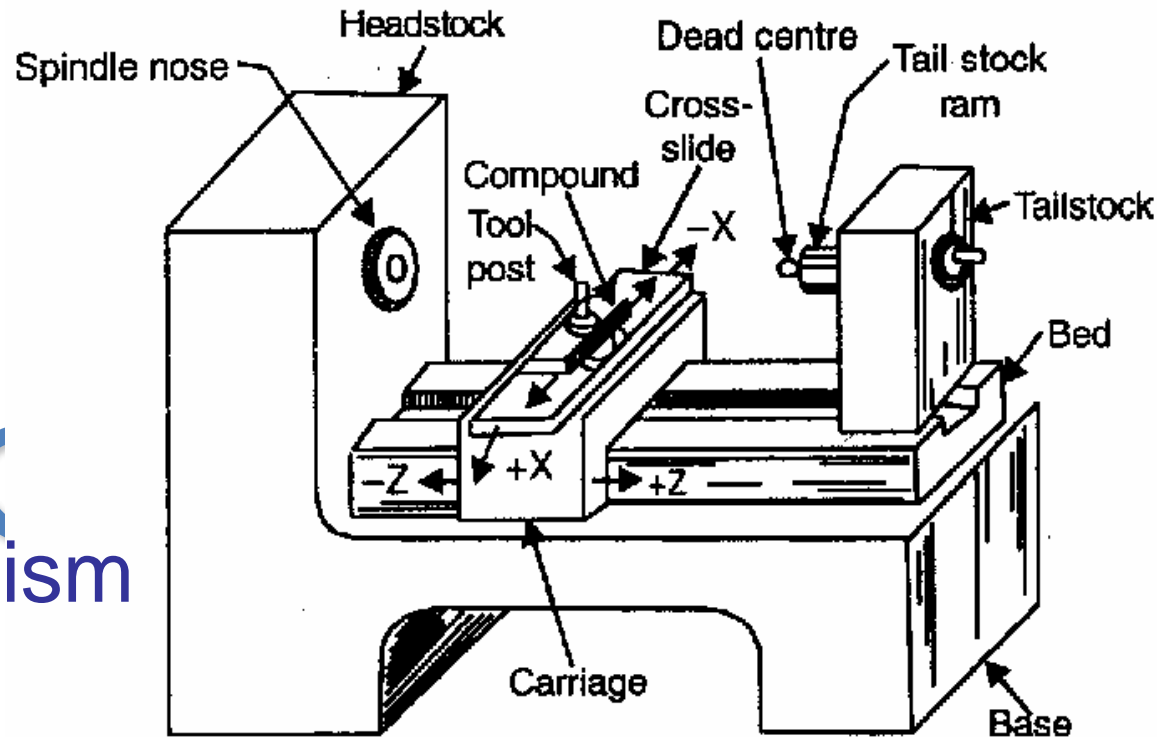


Fig. 29.2. Major Parts of a Lathe.

Principal Parts of Lathe

1. Bed:

- It is the base or foundation of lathe.
- It is heavy, rugged and single piece casting made to support other parts.
- Two sets of guide ways are at the top for carriage and tail stock.
- Outer ways is for carriage and inner ways is for the tailstock.
- Bed length is one of the specifications of lathe.

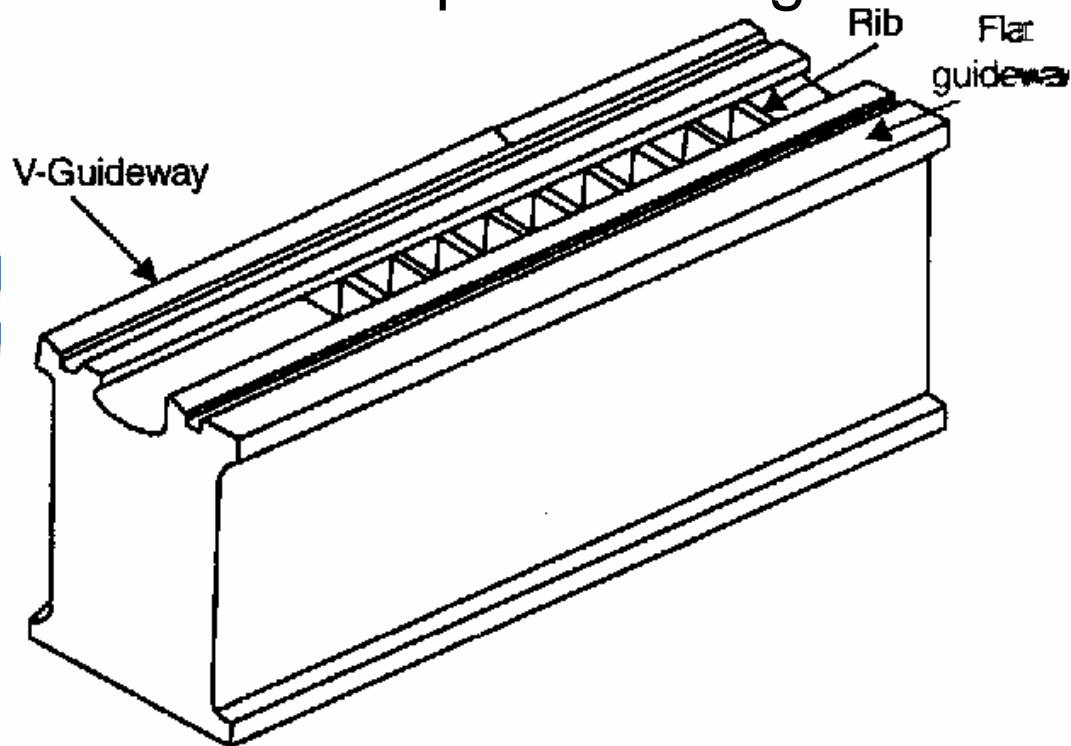


Fig. 29.3 Lathe Bed.

Principal Parts of Lathe

2. Headstock:

- Permanently fastened on the inner ways at the left side of the bed.
- Headstock spindle is hollow cylindrical shaft supported by bearing, and provides driving from motor to the holding device.
- A live center and sleeve, a face plate, or chuck can be fitted to the spindle nose to hold and drive the work.

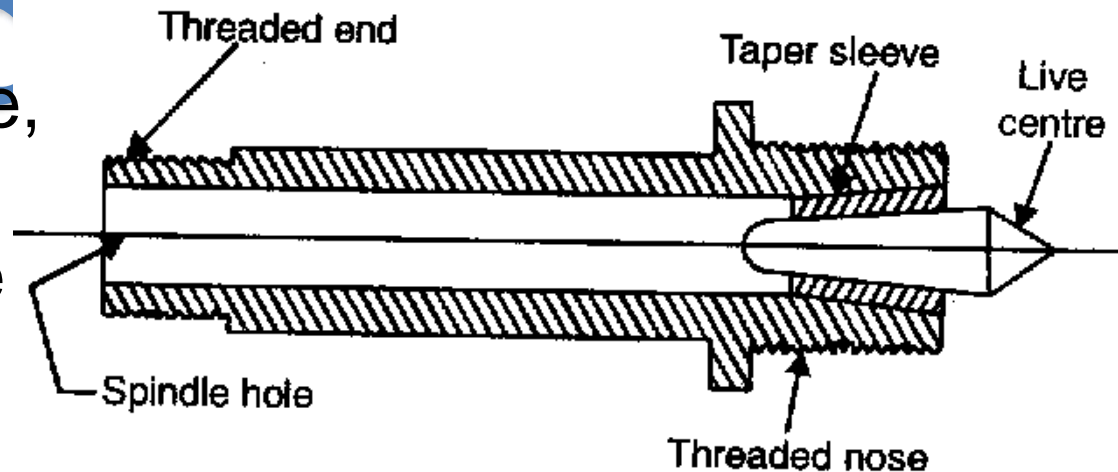


Fig. 29.4. Headstock Spindle.

Principal Parts of Lathe

3. Tailstock

- It is situated at opposite side of headstock, mounted on the inner guide ways of the lathe bed.
- It can be locked at any position along the bed.
- Tailstock spindle is hollow tapered shaft, that can be used to hold the dead center or other tools.
- Hand wheel is used to fix the position of the dead center with spindle.

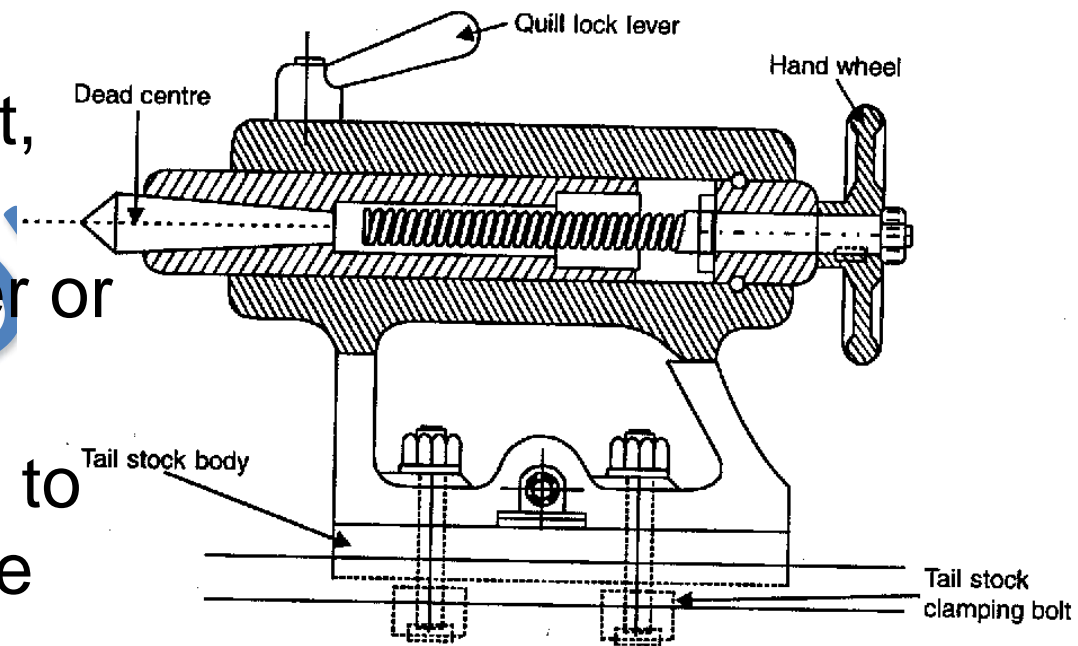


Fig. 29.5. Tailstock.

Principal Parts of Lathe

4. Carriage:

- Carriage controls and supports the cutting tool.
- By its help tool moves away or towards the headstock.

It has five major parts:

- Saddle (support the cross slide movements)
- Cross slide (
- Compound rest (support the tool post/can rotate any angle for taper turning)
- Tool post
- Apron

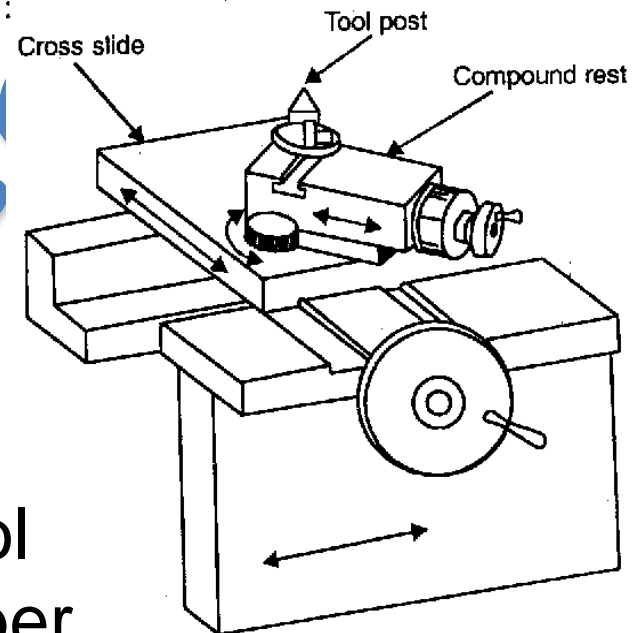
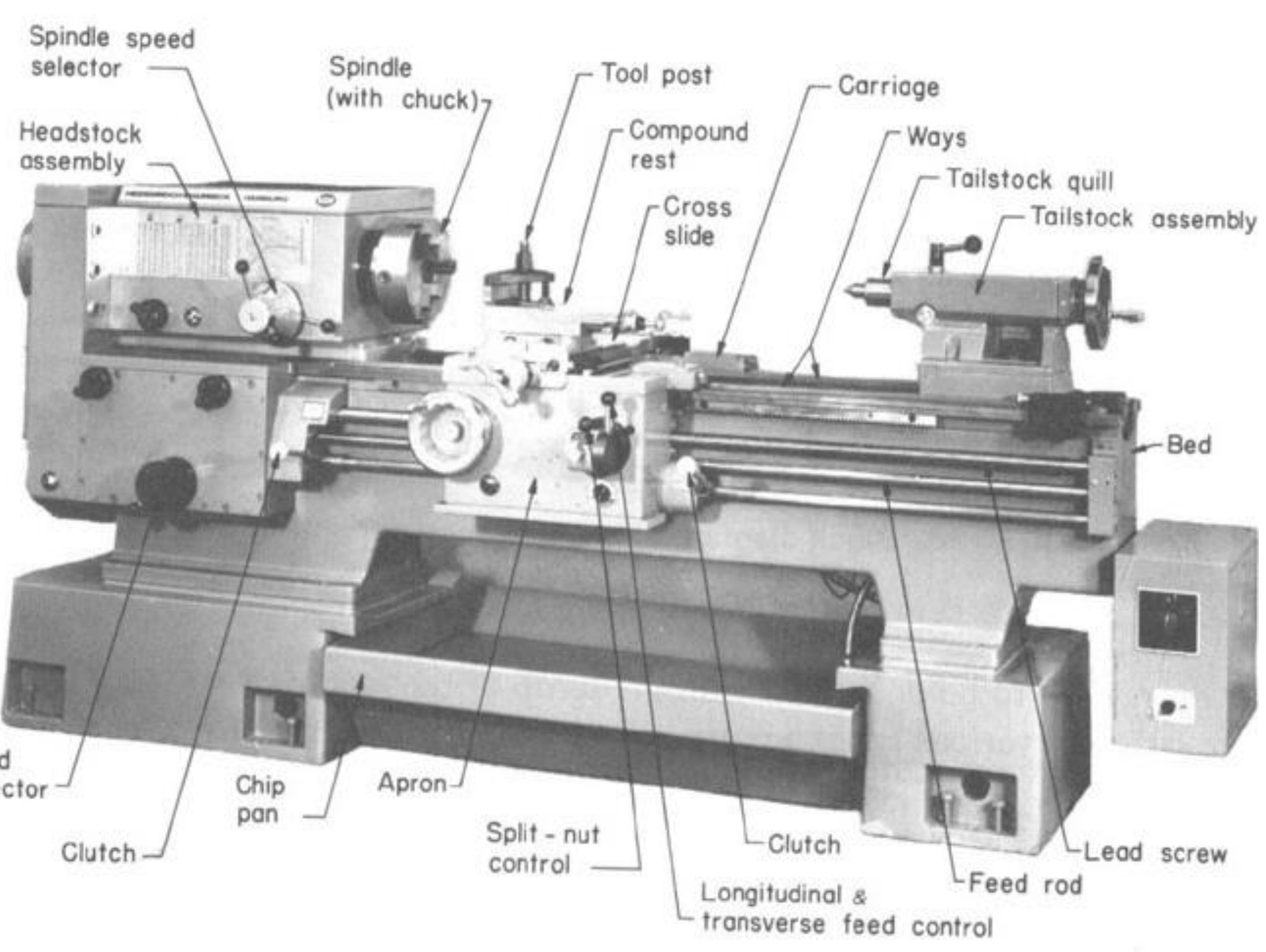


Fig. 29.6. Carriage.



Feed mechanism

The movement of tool relative to tool is called feed.

- **Longitudinal Feed:**

- Tool moves parallel to the work, i.e. towards or away from the headstock. (eg turning, knurling etc)

- **Cross Feed:**

- Tool moves perpendicular to the work, i.e. towards or away from the operator.

- **Angular Feed:**

- Tool moves at angle to the work, obtained by swiveling the compound rest.

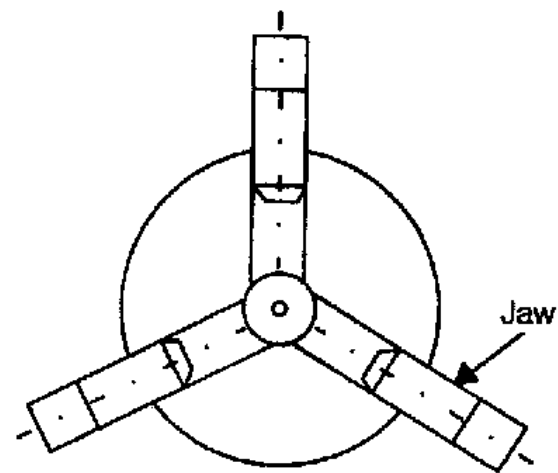
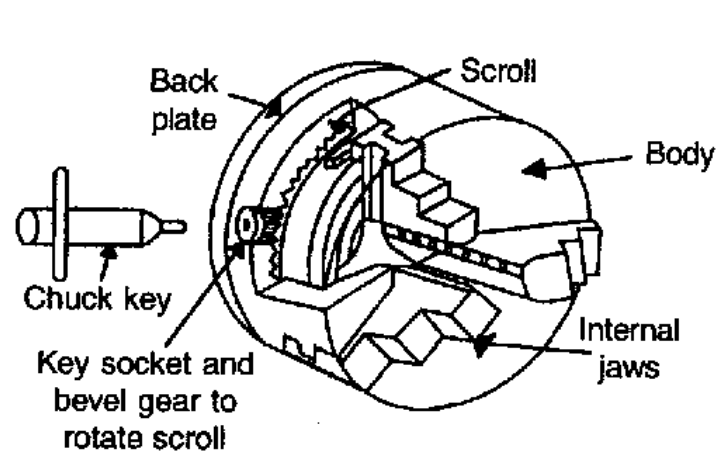
- Tool is feed by moving carriage and compound rest.

Lathe Accessories

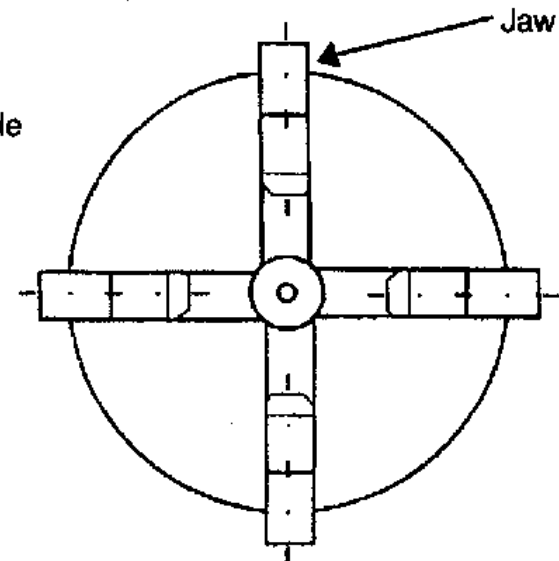
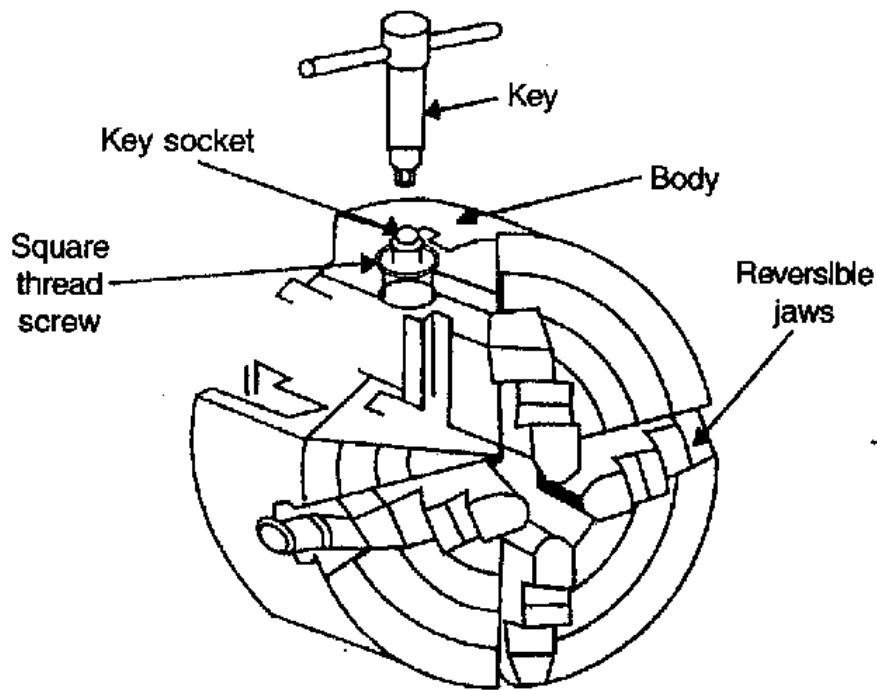
The devices, which are used for holding and supporting the work and the tool on the lathe are called Lathe accessories.

1. Chucks:

- These are used for holding and rotating work piece.
- It is attached to lathe spindle with bolts.
- Several types of chucks are available according to the nature of work. Important ones are:
 - Three Jaw universal Chuck: Self centering chuck
 - Four Jaw Independent Chuck: Adjustable Center
 - Others are: Combination, Magnetic, Collet chucks



(a) Three Jaw Universal Chuck (Self Centering)



(b) Four Jaw Independent Chuck

Fig. 29.7. Chucks.

Log

Lathe Accessories

2. Centers:

- The lathe center is a hardened steel device with a taper shank on one end and point on the other
- The taper shank fits the taper spindle hole at headstock or tail stock.
- The center which fits at headstock and revolves with job is called live center and which fits with tailstock is called dead center.

Lathe Tools

LOGY

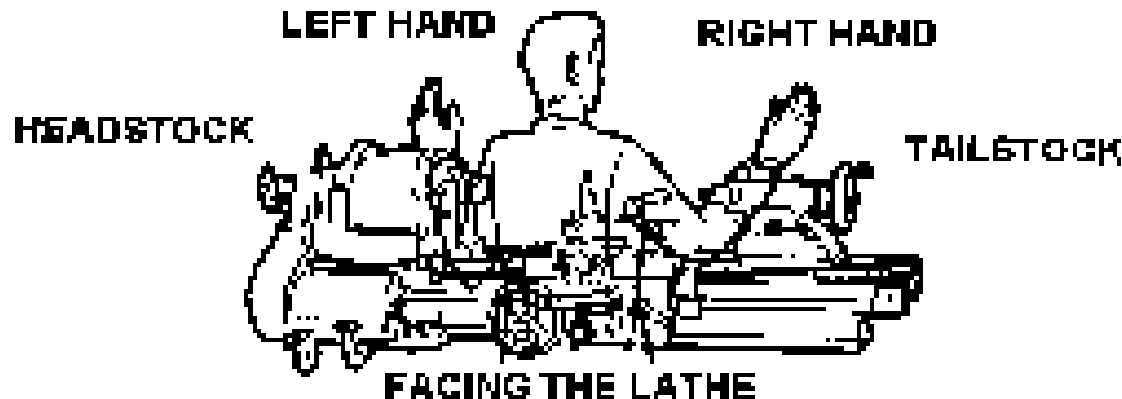
The principal cutting tool materials are :

1. Carbon steels
2. Medium alloy steels
3. High speed steels
4. Satellites
5. Cemented carbides
6. Ceramics
7. Diamonds
8. Abrasives Aluminium oxide

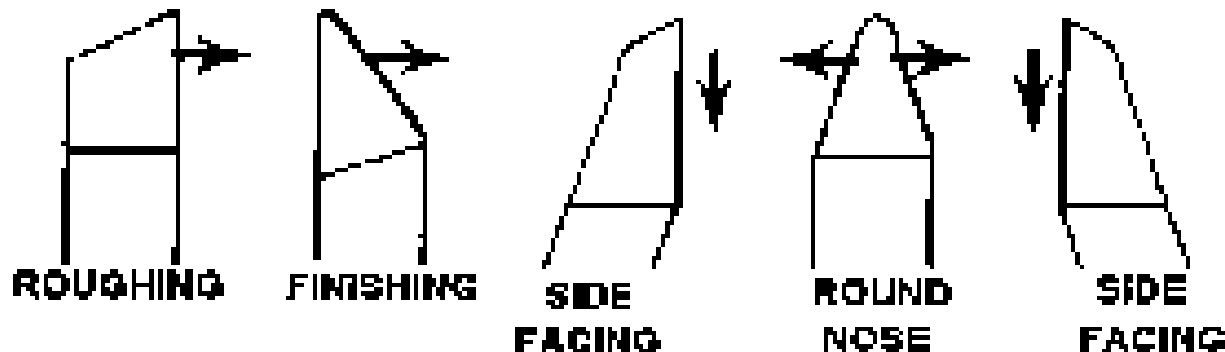
WORKS

Lathe Tools

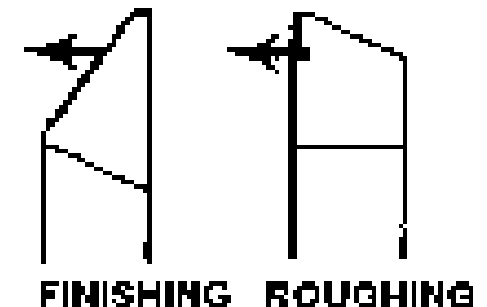
Lathe Tools are available as left hand and right hand tool for roughing and finishing operation.



LEFT CUT



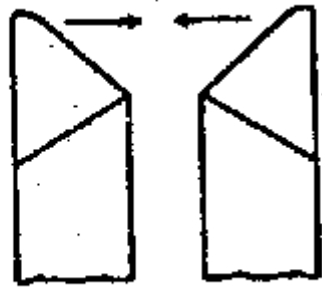
RIGHT CUT



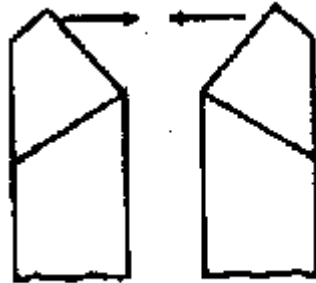
Lathe Tools

- For general purpose works as turning, facing, threading, single point cutting tool is used.
- Multipoint cutting Tools are used for the operations as drilling, knurling etc.
- Depending upon the nature of operation, Lathe tools are classified as follows:
 - ❖ Turning tool (left hand or right hand)
 - ❖ Facing tool (left hand or right hand)
 - ❖ Chamfering tool (left hand or right hand)
 - ❖ Form or profile tool
 - ❖ Parting or necking tool
 - ❖ External threading tool
 - ❖ Internal threading tool
 - ❖ Boring tool
 - ❖ Knurling tool.

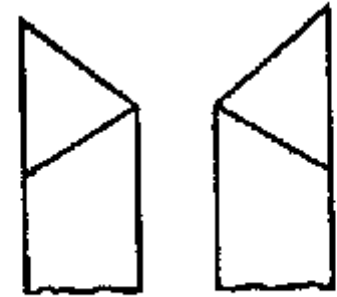
Lathe Tools



Left hand right hand
(a) Turning Tool



Left hand right hand
(b) Facing Tool



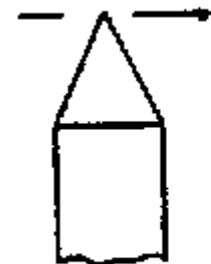
Left hand right hand
(c) Chamfering Tool



(d) Form or Profile Tools



(e) Parting or Necking Tools



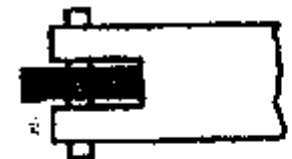
(f) Chamfering Tools



(g) Internal Threading Tools



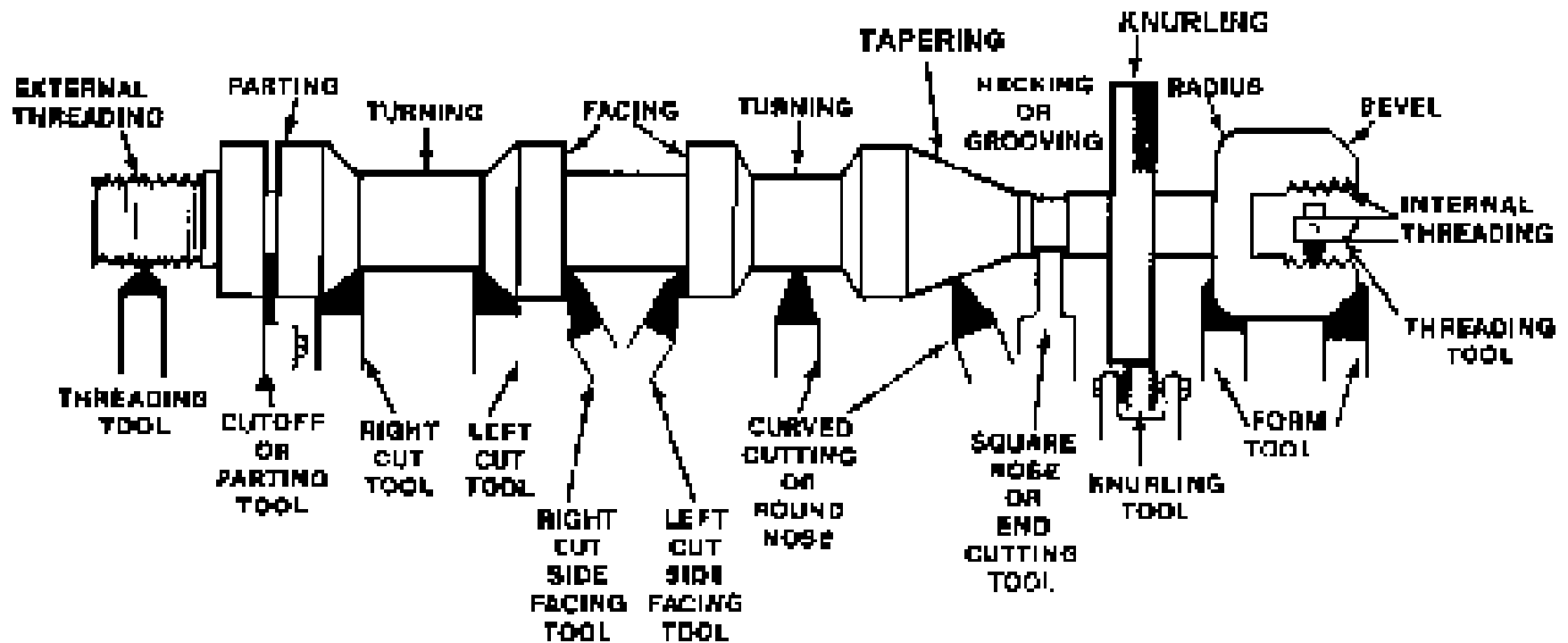
(h) Boring Tools



(i) Knurling Tools

Fig. 29.14. Lathe tools.

Lathe Tools Vs Operations



Adjustable cutting factors in turning

Speed:

- Refers to the spindle and the work piece.
- For a particular turning operation, surface speed is important
- Every different diameter on a work piece will have a different cutting speed, even though the rotating speed remains the same.

Feed:

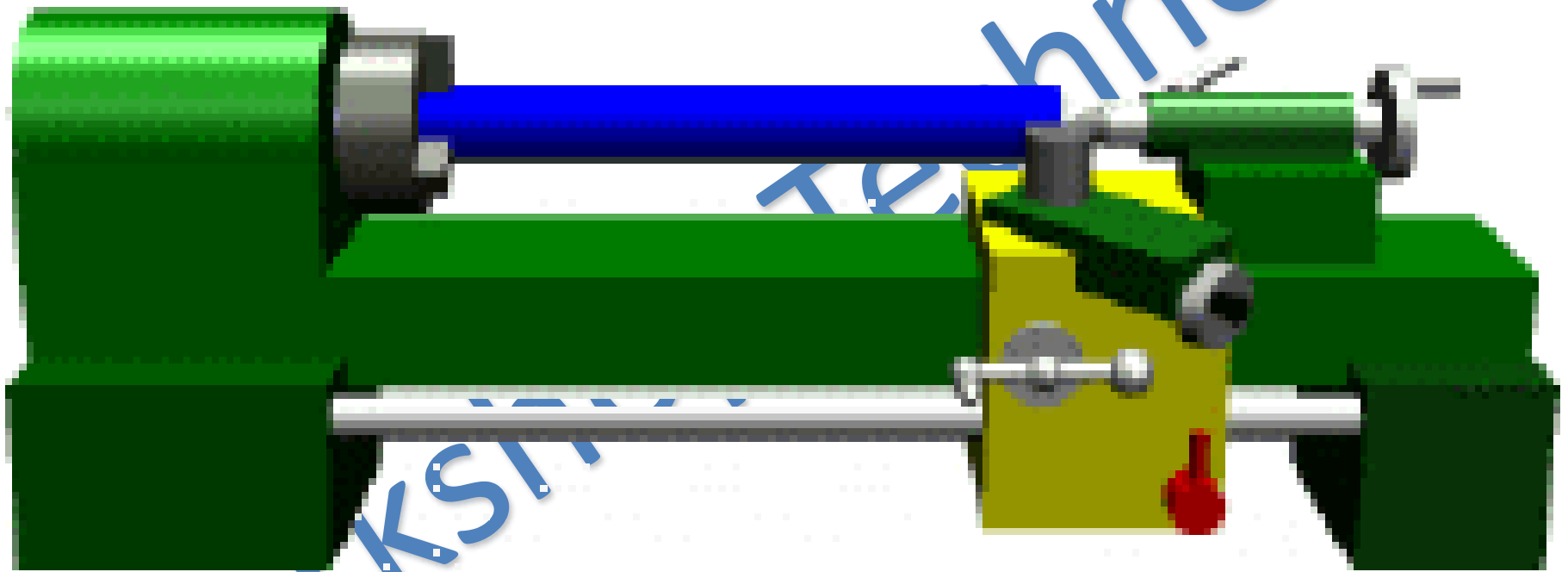
- Refers to the cutting tool, and it is the rate at which the tool advances along its cutting path. is expressed in mm / rev

Adjustable cutting factors in turning

Depth of Cut:

- It is the thickness of the layer being removed from the work piece or the distance from the uncut surface of the work to the cut surface
- Expressed in mm.
- The diameter of the work piece is reduced by two times the depth of cut because this layer is being removed from both sides of the work.

Working of Engine Lathe



Lathe Operations

1. Centering:

- Not required for three jaw type.
- For four jaw chucks center is located by means of using combination set or using a bell center punch.
- After locating center, center holes are produced by countersunk tool or drill.

2. Facing:

- It is operation of machining ends of a piece of work to produce the flat surface.
- Facing tool is fed through cross slide from center of tool to outwards or vice versa.

Lathe Operations

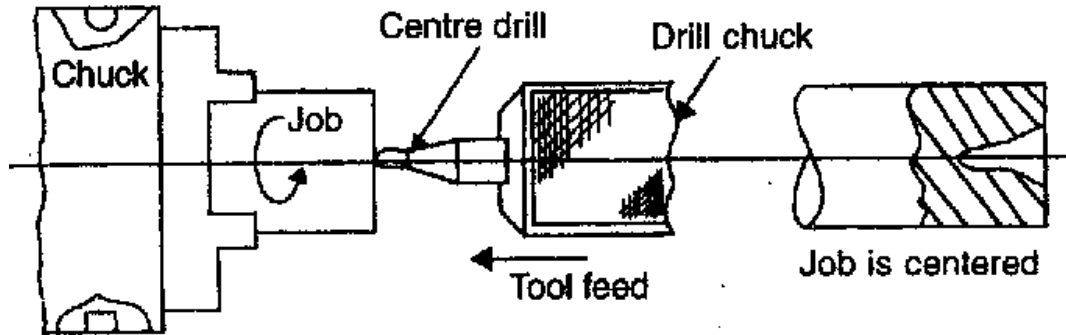


Fig. 29.15. Centering.

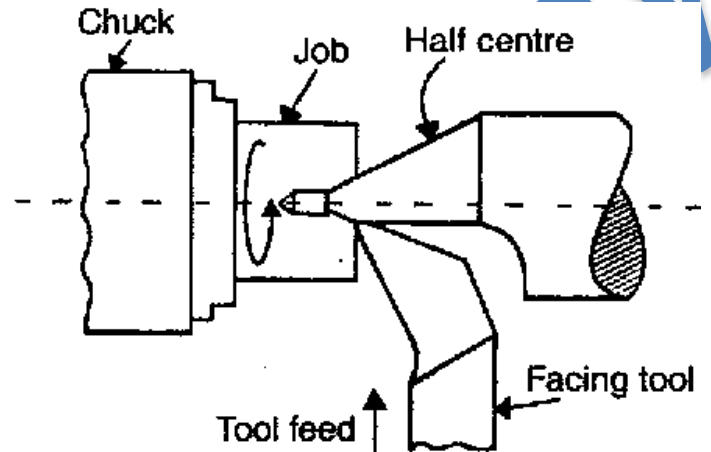


Fig. 29.16. Facing.

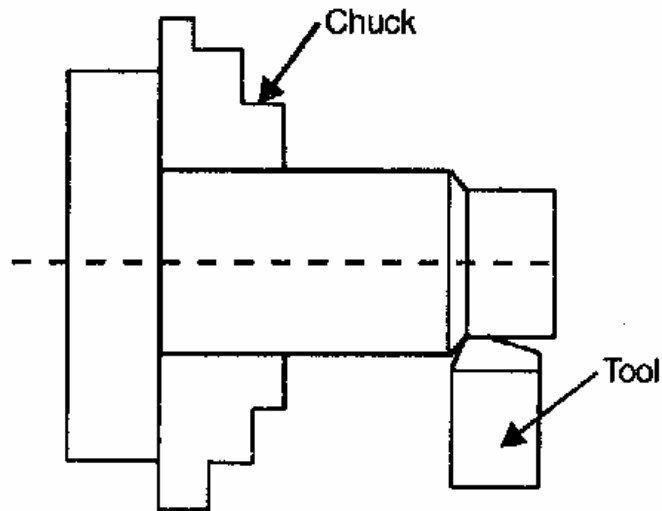


Fig. 29.17. Plain Turning.

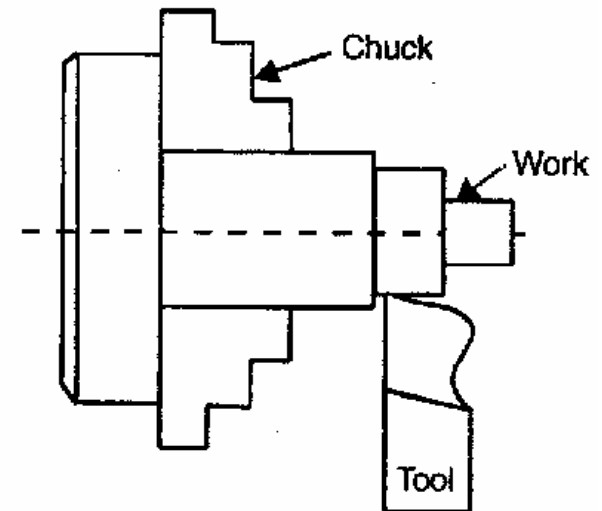
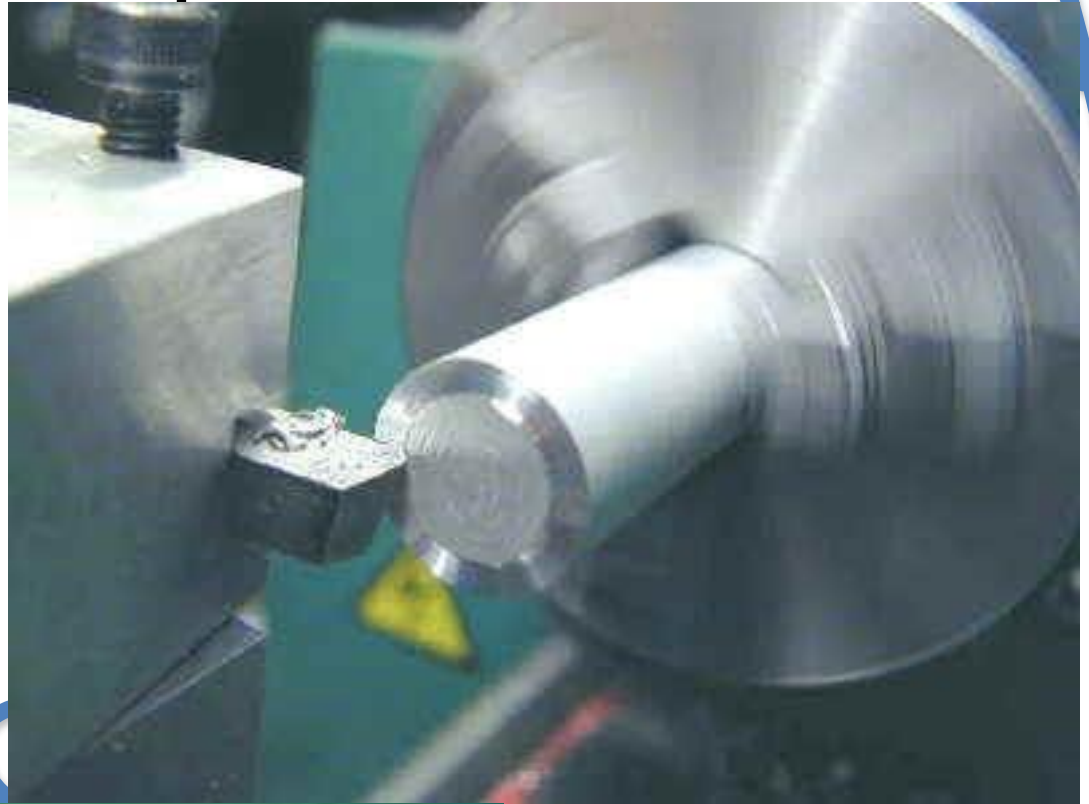


Fig. 29.18. Step Turning.

Lathe Operations



Lathe Operations

3. Plain Turning:

- It is an operation of removing excess amount of material from the surface of the cylindrical work piece.
- This operation is done for reducing the diameter of the work piece.

4. Step turning:

- It is an operation of producing different diameters in the work piece.

5. Taper Turning:

- It is an operation of producing an external conical surface on work piece.
- Can be performed by tail stock set over method, by swiveling the compound rest, or using taper turning attachment.

Lathe Operations

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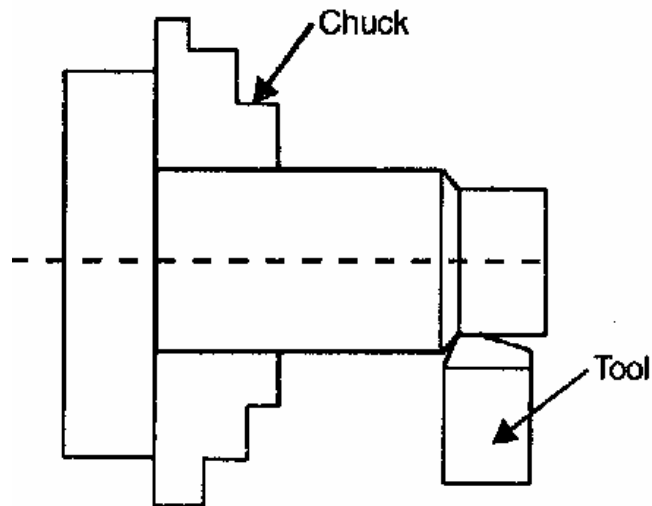


Fig. 29.17. Plain Turning.

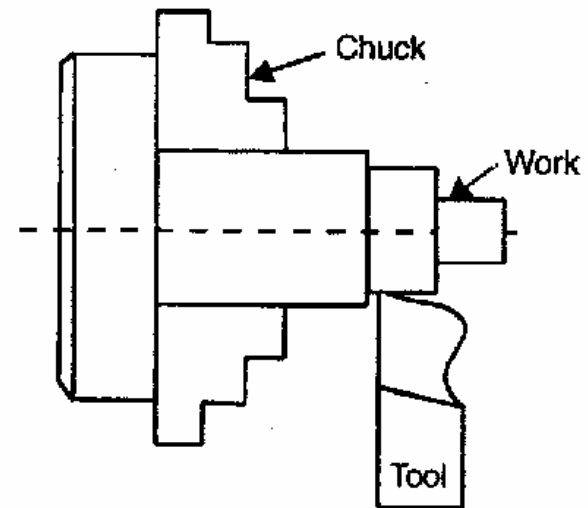
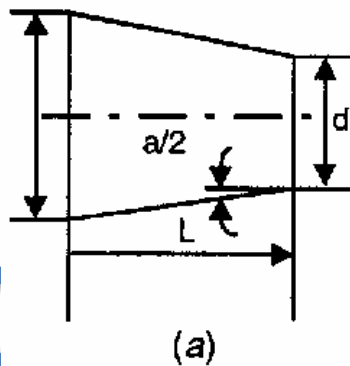
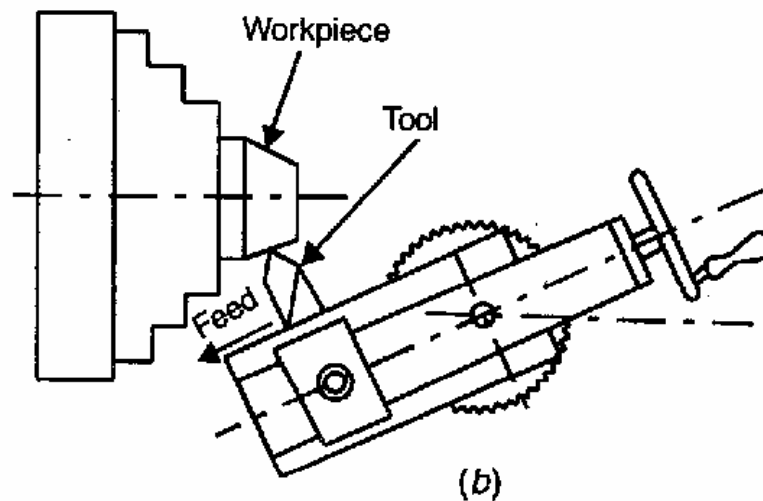


Fig. 29.18. Step Turning.



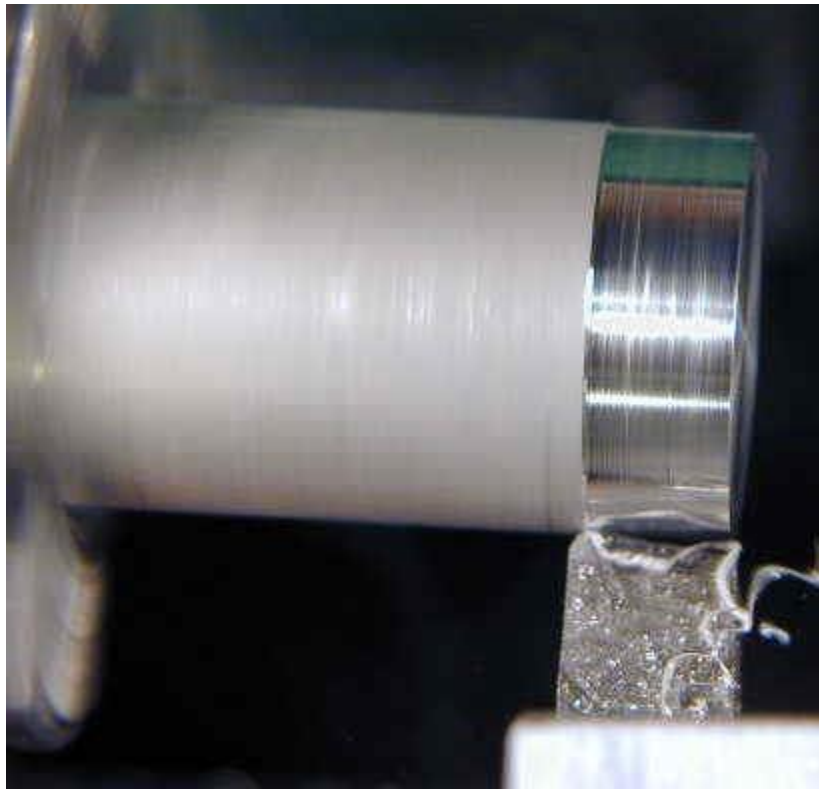
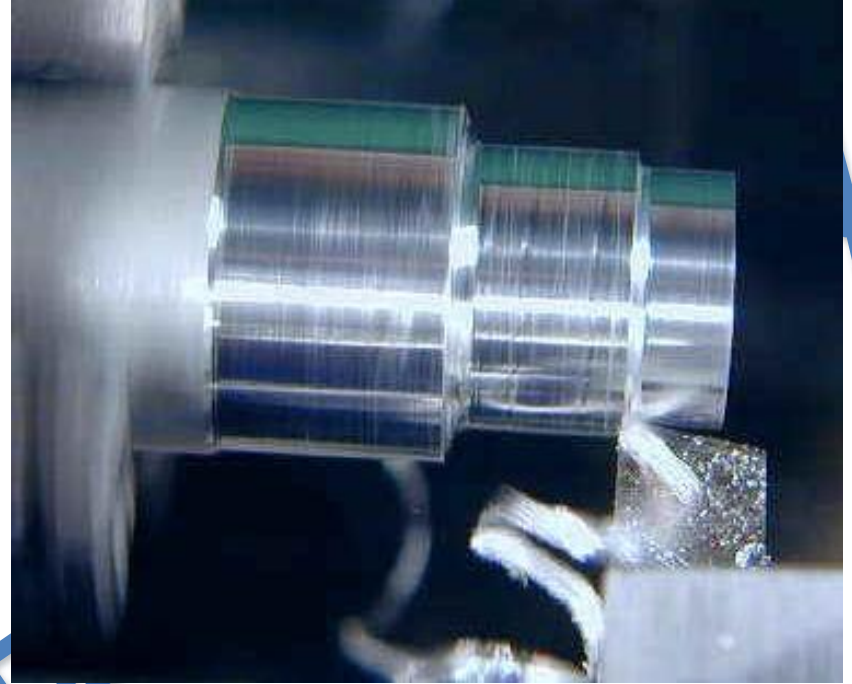
(a)



(b)

Fig. 29.19. Taper Turning.

W



Lathe Operations

6. Drilling:

- It is an operation of making holes in the work piece with help of drill bit.
- Work is held in chuck and drill is held in tailstock and drill is fed manually into the rotating work piece, by rotating tailstock handle.

Lathe Operations

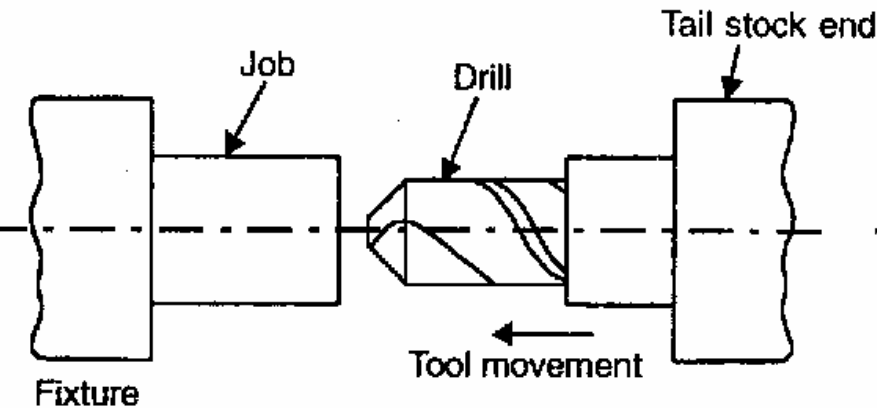


Fig. 29.20. Drilling.

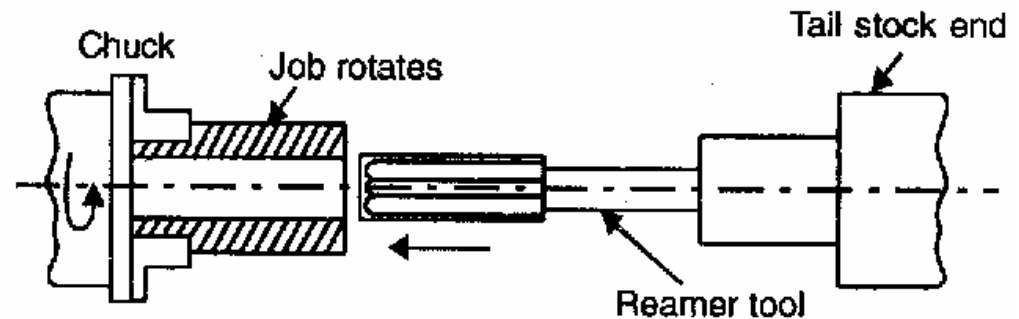


Fig. 29.21. Reaming.

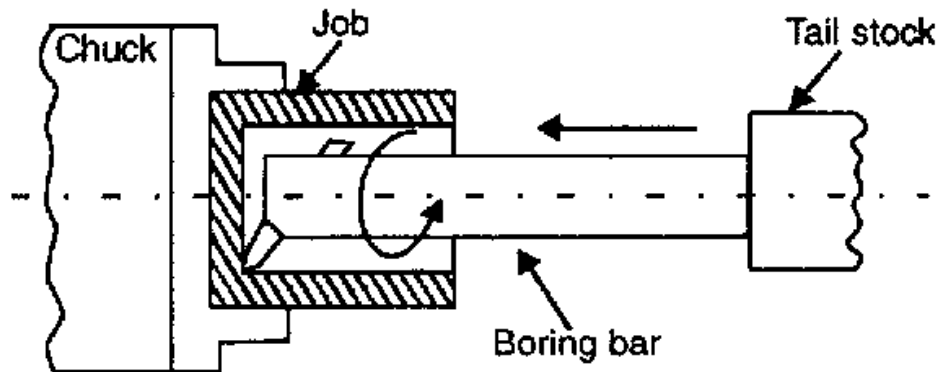


Fig. 29.22. Boring.

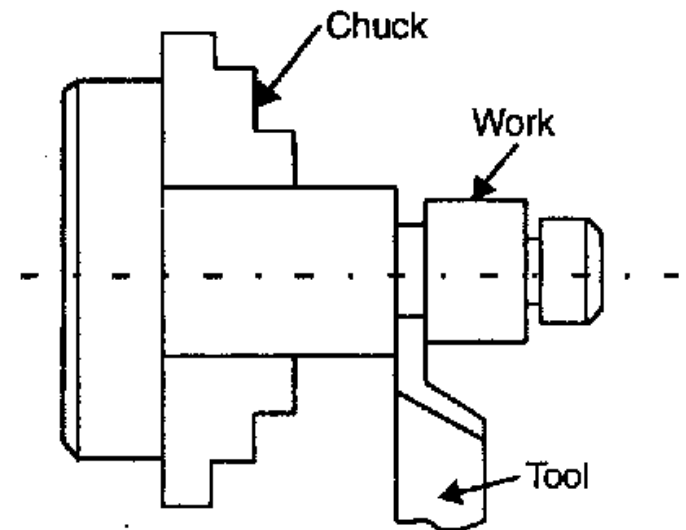


Fig. 29.23. Undercutting or Grooving.

Lathe Operations

7. Boring:

- It is an operation of enlarging a hole already made in a work piece. Boring tool is held in the tool post and is fed into the work as similar to plain turning.

8. Undercutting or Grooving:

- It is an operation of reducing diameter of a work piece over a very narrow surface.
- Tool is fed into a revolving work up to the desired depth at right angles to the work piece.
- The job may be completely parted by the similar operation called as **parting off** with **parting off tool**

Lathe Operations

9. Threading:

- Both external and internal threads can be cut on lathe.
- Some lathe are provided with quick change gear box (back gear mechanism), which enables the establishment of the required speed ratio very quickly.
- Chart is provided to inform about the speed and feed to produce threads of different pitch.

10. Knurling:

- Knurling produces a regularly shaped, roughened surface on a work piece called knurl.
- It is raised diamond shape and gives better grip.

Lathe Operations

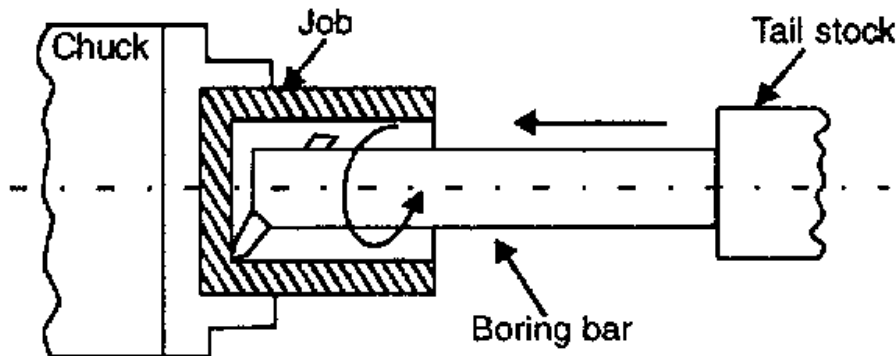


Fig. 29.22. Boring.

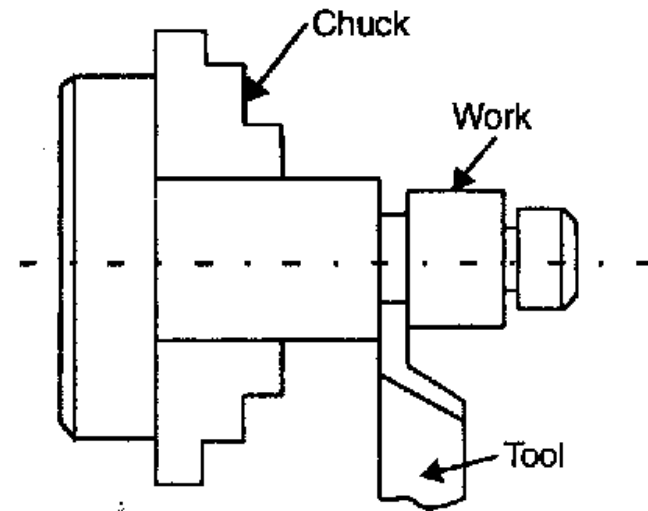


Fig. 29.23. Undercutting or Grooving.

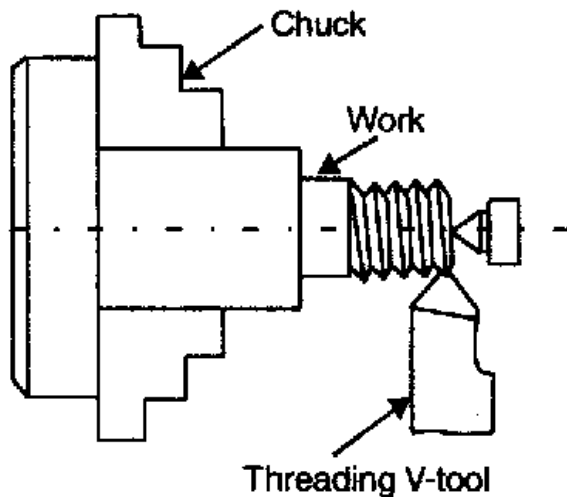


Fig. 29.24. Threading.

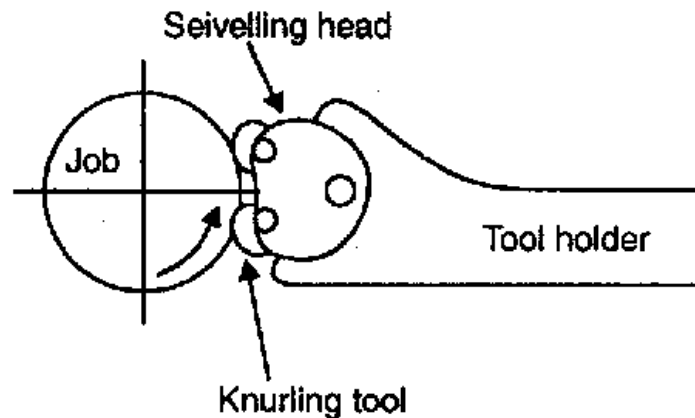
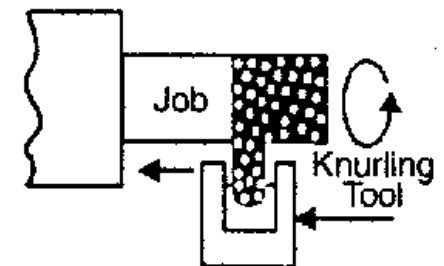
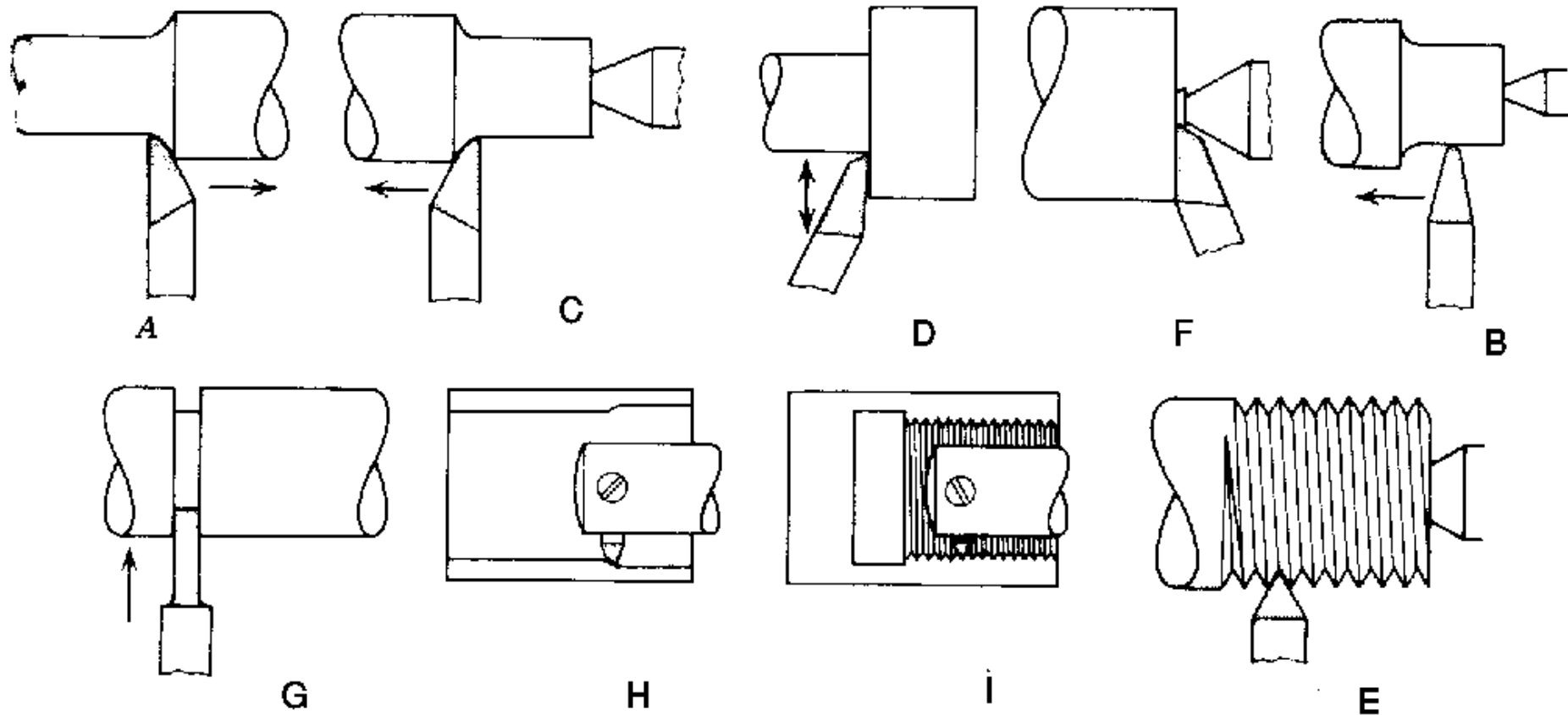


Fig. 29.25. Knurling.



Lathe Operations Vs. Tools



Lathe tools and applications. A, Left-hand turning tool. B, Round-nose turning tool. C, Right-hand turning tool. D, Left-hand facing tool. E, Threading tool. F, Right-hand facing tool. G, Cutoff tool. H, Boring tool. I, Inside-threading tool.

Lathe Operation Video



FACING OPERATION

