CHAPTER-3 THE LATHE

Lathe machine:

The lathe machine is the one of the oldest machine tools and came the early tree lathe which was a device for rotating and machining a piece of lathe between two adjacent trees. a rope would round the work with its one end attached to a flexible branch of trees and end is pulled by a man to rotate the job hard tools are used them.

Function of lathe machine:

The main function of lathe machine is to remove metal from a piece of work to give it the required shape and size. The work is held securely and rigidly on the machine and then turn against the cutting tools which is remove metal from the work in the forms of chips.

Types of lathe:

- **speed lathe:**
  - **Wood working**
  - **Centering**
  - **Polishing**
  - **Spinning**
- **Engine lathe:**
  - **belt drive**
  - **Individual motor drive**
  - **Gear head lathe**
- **Bench lathe:**
- **Tool room lathe**
- **Caps & turret lathe**
- **Special purpose:**
  - **Wheel lathe**
  - **Gap bed lathe**
  - **Turret lathe**
  - **Duplicating lathe**
- **Automatic lathe:**

The speed lathe:

- ➢ It is the simplest of all types of lathe.
- ➢ It consists of a bed, headstock, a tailstock and a too post mounted on an adjusted slide.
- ➢ There is a no feed box, lead screw or conventional type carriage.
- ➢ The tool is mounted on the adjustable slide and is fed into work purely by hard control.
- ➢ Spindle speed is very high.(range from 1200 to 3600 rpm).
- ➢ This is used for word working, spinning, centering, polishing.

The engine lathe or centre lathe:

- ➢ The engine lathe in the early ware driven by steam engines
- ➢ It consists of bed, head stork, and tail stork.
- ➢ More robust head stock and contains mechanism for driving the spindle at multiple speeds.
- ➢ Belt driving lathe – receives power from an overhead live shaft
- ➢ Individual motor drive- receiving power from an individual motor
- ➢ Gear head lathe –gets power from a constant speed motor.

The bench lathe:

- ➢ The small lathe mounted on a bench
- ➢ It consists of all the parts but small in size.
- ➢ It is used for small & precision work.

The tool room lathe:

- ➢ It is similar to engine lathe.
- ➢ It has spindle speeds ranging from very low to high up to 2500 rpm.
- ➢ It consists of chuck, taper turning attachment, thread charging dial, steady rest, coolant etc.
- ➢ This is used for precision work on tools, dies, gases & for accuracy works

Capstan and turret lathe:

- ➢ This is the development over engine lathe.
- ➢ The tail stock is replaced by a hexagonal turret, on the face of which multiple tools are fitted
- ➢ Several operations can be done on a work piece without resetting of work or tools & a no. of identical parts can be produced in minimum time.

Special propose lathe:

- ➢ They are used for special proposes.
- ➢ The Wheel lathe – for finishing journals &turning the thread on rail road car and locomotive wheels gap bed lathe- to swing extra large diameter pieces.
- ➢ T-lathe – for machining of motor for jet engines the axis of the lathe bed is right angles to the axis of the head store spade.
- ➢ Duplicating lathe used for duplicating the shape of a flat or round template on the work piece

Automatic lathe:

- ➢ These are high speed, heavy duty, mass production lathes with complete automatic control.
- ➢ After the tools are set and the machine is started is performs automatically all the operations to finish the job.
- ➢ The changing of tools, speed s and feeds are done automatically.
- ➢ After the job is complete, the machine will continue to repeat the cycles producing identical parts.

Specification of lathe :

- The height of the centres from the bed.
- The swing diameter over bed. This is the largest diameter of work that will revolve without touching the bed and is twice the height of the centre measured from the bed of the lathe.
- The length between the centers. This is the max height of work that can be mounted between the lathe centers.
- The swing dia over carriage. This is the biggest dia of work that can be less than the swing dia over bed. This is the maximum bar stock will pass through hole of the headstock spindle .
- The length of the bed: This indicates the approx. floor space occupied by the lathe

The work piece is held in a chuck or between centers and rotated its axis at uniform speed .the within tool held in the tool post is fed in to the work spices for a desired depth. the tool may be given linear motion in may direction salve there is a relative motion between the work piece and tool , the material is removed the form of chips & desired shape is obtained .

Different parts of a lathe :

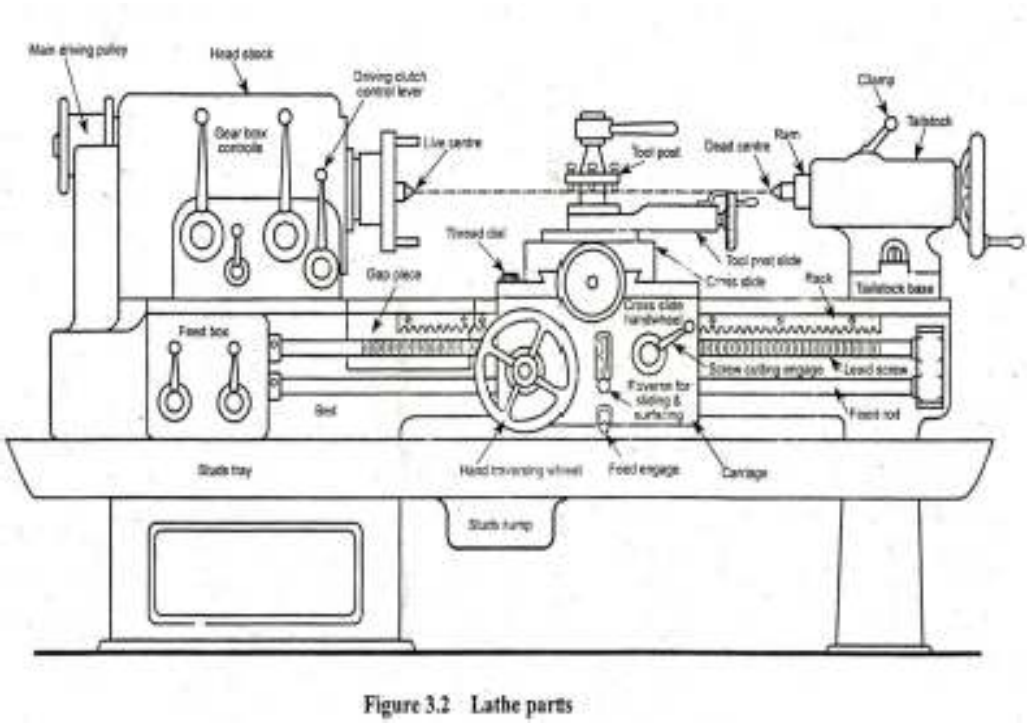

Figure 3.2 Lathe parts

1. **Bed**
2. **Head stock**
3. **Tail stock**
4. **Carriage**
5. **Feed mechanism**
6. **Screw cutting mechanism**

BED:

The bed is the base or foundation of the lathe. It is m de of cast iron. It is a massive and rigid casting made in one piece to resist deflection and vibrations. It supports the head stock, tail stock and carriage. On the top of the bed, there are two sets of slides or guide ways. The outer ways for carriage and inner ways for the tail stock. The guide ways may be flat and inverted –v having included angle of 90^0

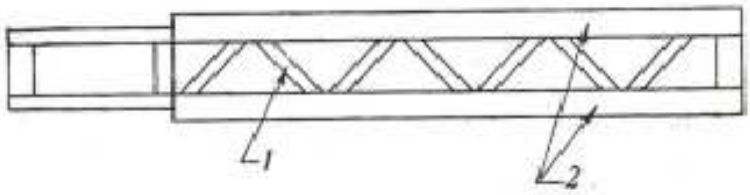

Figure Lathe bed diagonal ribs
1. Diagonal rib, 2. Bedways.

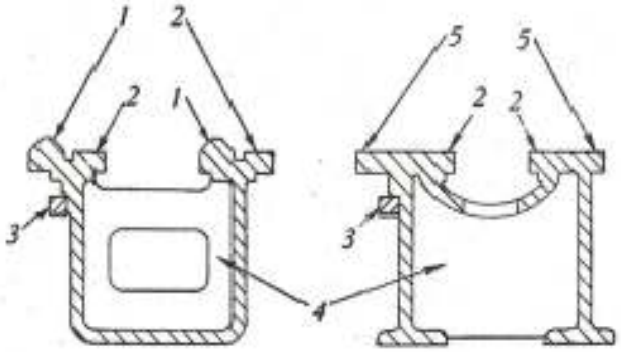

Figure Types of lathe bedways
1. Inverted-V bedway, 2. Flat bedways, 3. Rack, 4. Box section, 5. Flat bedways for saddle.

Head stock:

The head stock assembly is permanently fastened to the left hand end of the lathe. It provides mechanical means of work at multiple speeds. rotating the

The spindle of head stock is made of carbon or nickel chrome steel. It protrudes from gear box and contains means for fast ending work holding derives like chuck, face plate, dog plats, live centred spindle nose is turned so that face plate or chuck can be mounted on it hold and rotate the work piece. Hollow spindle is tapered at the nose to receive the live centre.

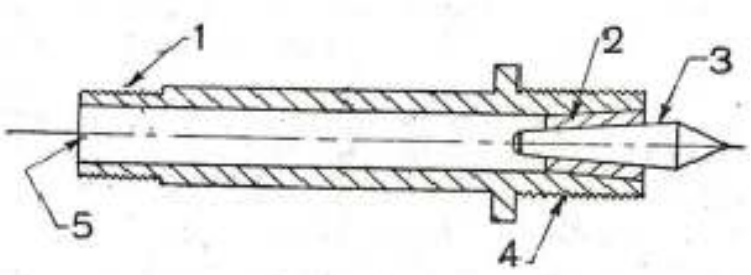

Figure 3.6 Headstock spindle
1. Threaded end, 2. Taper sleeve, 3. Live centre,
4. Threaded nose, 5. Spindle hole.

Spindle is hollow throughout its length throughout its length through which long bar stock can be fed. The size of spindle hole determines the max'm size of bar stock that can be machined

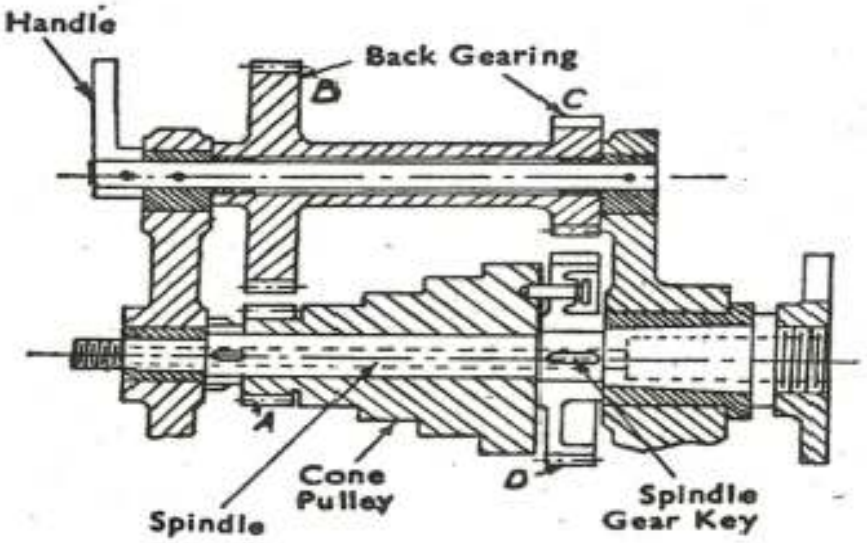

Figure Backgeared headstock
lever by simply pulling a cord.

Power is supplied from an electric motor or V-belt.

Tail stock or loose head stock:

The tail stock is located at on the inner ways at the right hand end of the bed and it is a non-rotating part which slides and can be clamped to it. any position to accommodate different lengths of work pieces.

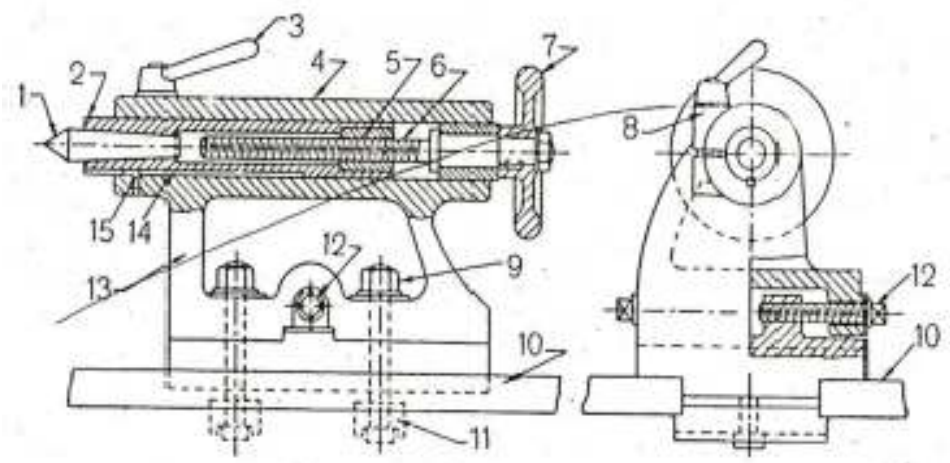

Figure Tailstock

1. Dead centre, 2. Spindle, 3. Spindle clamp, 4. Barrel, 5. Bush, 6. Square threaded screw, 7. Hand wheel, 8. Split lug, 9, Tailstock clamping bolt, 10. Lathe bedways, 11. Clamping plate, 12. Setover screw, 13. Body, 14. Keyway, 15. Key.

It has two uses:

1. Supports the other end of the work when it is machined between two centres.
2. To hold a tool for per forming operations such as drilling, reaming, tapping etc.

CARRIAGE:

In between the head stock and tail stock is the carriage. It is movable on the bed ways and its purpose is to hold the cutting tool and to impart to it either longitudinal or cross feed. It consists of the following parts:

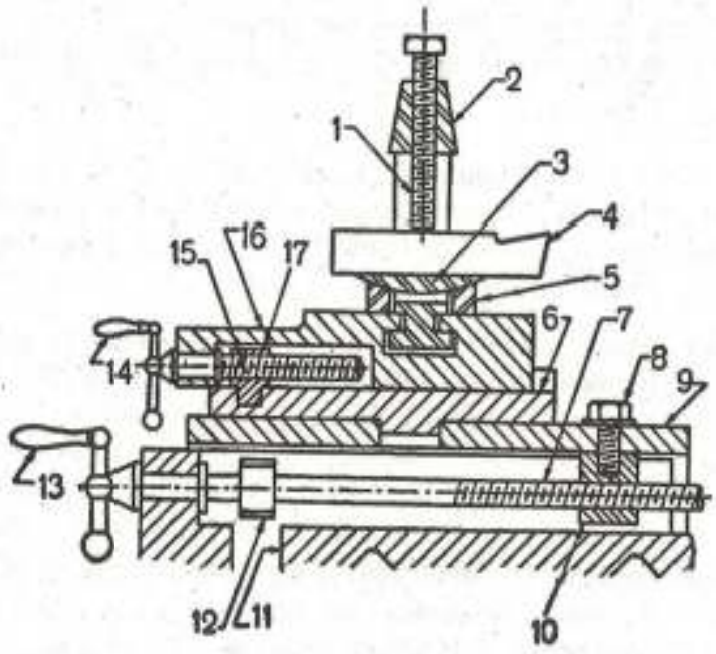

Figure 3.10 Carriage

1. Toolpost screw, 2. Tool post, 3. Rocker, 4. Tool, 5. Concave ring, 6. Compound rest swivel base, 7. Crossfeed screw, 8. Binder screw, 9. Cross slide, 10. Cross-slide nut, 11. saddle, 12. Pinion on Crossfeed screw for automatic feed, 13. Cross slide hand wheel, 14. Compound slide hand wheel, Compound slide feed screw, 16. Compound rest, 17. Compound slide nut.

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3. Compound rest:

It is mounted on the top of the cross slide. It supports the tool post. It has a graduated base and can be swiveled around a vertical axis. It can be swivelled around a vertical axis. It can be moved by means of a screw which is controlled by a wheel and small hand

graduated dia & not by power feed.

4. Tool post:

It is mounted on the top of the compound rest to hold the tool. The tool post can be moved on the compound rest and can be clamped in any position. It can be rotate cutter in also to hold the

desired angle.1. single tool post 2. Four bolt 3. Open side 4. Four way

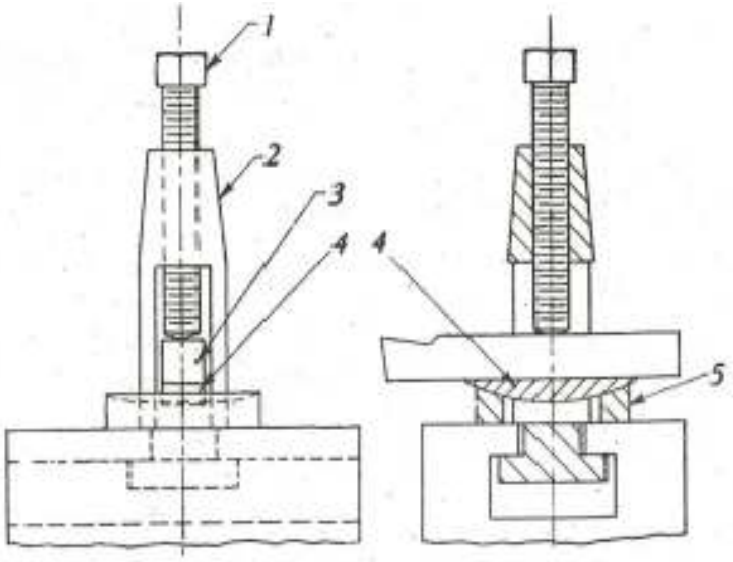


Figure Single screw toolpost

1. Toolpost screw, 2. Toolpost body, 3. Tool, 4. Convex rocker, 5. Concave ring.

The disadvantage with this type of tool post is that adjustment to height by tilting obviously alters all the cutting angles of the tool. The tool post is not also rigid enough for heavy work as only one clamping screw is used to clamp the tool.

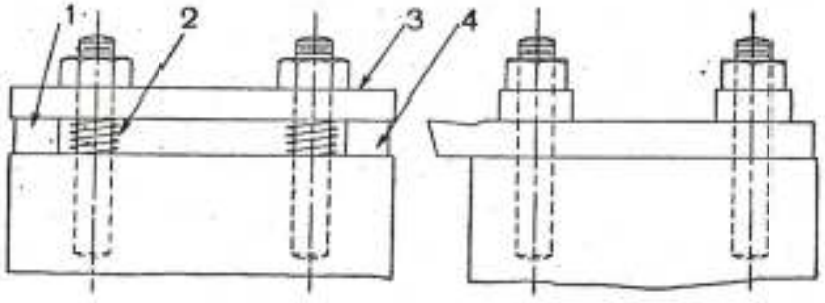


Figure Four bolt toolpost

1. Tool, 2. Coil spring, 3. Strap, 4. Fulcrum block.

Four bolt tool post : The four bolt tool post is illustrated in Fig.3.12. The tool is held in position by two straps and four bolts. Loose coil springs are fitted to each bolt to keep the straps in place and greatly facilitate the setting up of the tools. Adjustment for tool height can be made by using parallel packing strips under the tools.

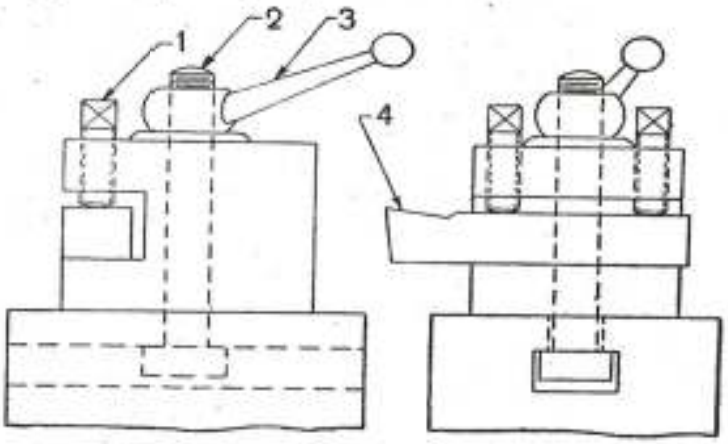


Figure Open side toolpost

1. Setscrew, 2. Central clamping bolt, 3. Clamping bolt handle, 4. Tool.

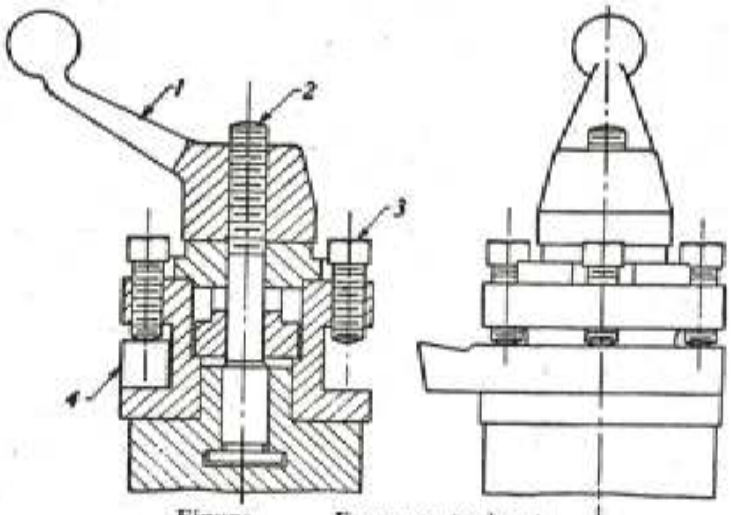


Figure **Four way toolpost**

1. Clamping handle, 2. Central locking bolt, 3. Set screws, 4. Tool.

5. Apron:

The portion of the carriage which extends in front of lathe is called apron. It contains the gears, clutches. And levers for operating the carriage by hand or power feeds. The apron also contains friction clutches for automatic feed of a split nut or half nut which is closed over for cutting screw threads.

FEED MECHANISM:

Feed is the distance the tool advances into the work piece through one revolution of head stock spindle a lathe tool has 3 types- longitudinal, cross and angular.

Longitudinal feed:

When the tool moves parallel to the lathe axis, the movement is termed as longitudinal feed. It is used in cylindrical turning operations and is effected by movement of carriage.

Cross feed:

When the tool moves parallel to the lathe axis, the movement is termed as cross feed. It is used in facing operation & affected by movement of cross slide.

Angular feed:

When the tool moves at an angle to the lathe axis, it is termed as angular feed. It is used in taper turning and affected by movement of compound rest.

Angular feed is hand operated where cross feed & longitudinal feed can be both hand & power operated.

Third cutting mechanism:

The rotation of the head screw is used to transverse the tool along were to produce screw thread. The half nut mechanism makes the carriage to engage or disengage or disengage with the lead screw. The two halves of the nut are connected in the cam slots in a circular disc by two pins. When the disc is rotated by a hand lever attached to it, the pins being guided in the cam slots serve to open or close the split nuts and thus engages or disengages with the lead screw.

The half nuts slide within the guide or frame. Closing the half nuts causes the carriage to move a fixed distance for each revolution of the spindle. The direction in which it moves depends upon the position of the feed reverse lever on the head stock. The split nut is used only for thread cutting and never for any other operation.

Lathe operation:

Lathe operations are performed by following methods.

Operations which are performed in a lathe either by holding the work piece between centers or by a chuck:

1. **Straight turning**
2. **Shoulder turning**
3. **Chamfering**
4. **Thread cutting**
5. **Facing**
6. **Knurling**
7. **Filling**
8. **Taper turning**

9. **Eccentric turning**
10. **Polishing**
11. **Grooving**
12. **Spinning**
13. **Spring winding**
14. **Forming**

Operations which are performed by holding the work by a chuck or a face plate :

1. **Drilling**
2. **Reaming**
3. **Boring**
4. **Counter boring**
5. **Taper boring**
6. **Internal thread cutting**
7. **Tapping**
8. **Under cutting**
9. **Parting off**

Operations which are performed by using special attachments:

1. **Grinding**
2. **Milling**

Facing:

Facing is the operation of for generation flat surface perpendicular to the rotational axis of spindle. The tool is fed to the axis of rotation of the work piece. A properly ground facing tool is used. A regular turning tool may also be used. a spindle speed is selected and the lathe is started. The tool is brought in to clean stock from the centre and fed out word by hand. Feed is given by cross slide.

Turning:

Turning in lathe is to remove excess material from the work piece to produce a cone-shaped or a cylindrical surface.

Straight turning:

The work is turned straight when it is made to rotate about the lathe axis, and the tool is fed parallel to the lathe axis. It produces a cylindrical surface by removing excess metal from the work piece.

After facing the ends and drilling the centre, the job is carefully mounted between the centres using a lathe dog attached to the work piece, the bent tail of the dog fitting into the slot provided on the catihplat. A properly ground a right hand turning tool selected. The machine is started after the work piece and tool is properly set and correct spindle speed is determined.

The automatic feed is engaged to move the carriage to the desired length, then the feed is dis engaged and the carriage is brought back to the starting position. The process is repeated until the job is finally finished after two or three similar cuts.

There are two kinds of cuts in a machine shop work.

1. Roughing cut or rough turning.
2. Finishing cut or finish turning.

Rough turning:

It is the process of removal of excess material from the work piece in a machine time by applying high rate of feed and heavy depth of cut. The doc is from 2 to 5 mm & feed rate is 0.3 to 1.5 mm per over.

Finish turning:

It requires high cutting speed, small feed and a very small depth of cut to generate a smooth surface. The doc is from 0.5 to 1 mm & feed 0.1 to mm per rev.

Shoulder turning:

When a work piece having different diameters is turned, the surface forming the step from one diameter to other is called shoulder turning

The principle of thread cutting is to produce a helical groove on a cylindrical or conical surface by feeding the tool longitudinal when the job is revolved between centres or by a chuck. The longitudinal feed should be equal to the pitch of the thread to be cut per revolution of the work piece.

The lead screw of lathe, through which saddle receives its traversing motion, has a definite pitch. A definite ratio between the longitudinal feed and rotation of the headstock spindle should therefore be found out. So that the relative speeds of rotation of the work and the lead screw will result in the cutting of a screw of the desired pitch.

This is affected by change gears arranged between the spindle and the lead screw or by the change gear mechanism or feed box used in a modern lathe where it provides a wider range of feed and the speed ratio can be easily and quickly changed

Taper Turning:

A taper may be defined as a uniform increase or decrease in diameter of a piece of work mannered along its length.

In lathe taper turning means to produce a conical surface by gradual reduction in dia from a cylindrical work piece. The amount of taper is specified by the ratio of the difference in dia of taper to its length let it be denoted by k and termed as concity,

$$K = D-d/l$$

There are different methods for taper turning in lathe:

1. **By a broad nose tool.**
2. **By setting over the tail stock centre.**
3. **By swivelling the compound rest**
4. **By a taper turning attachment.**
5. **By combining longitudinal feed & cross feed in a special lathe**.

Taper turning in a form tool:

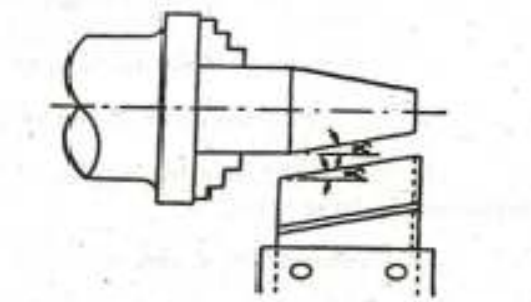


Figure Taper turning by a form tool

Abroad nose tool having straight cutting edge is set on to the work at half taper angle, and is feed straight into the work to generate a tapered surface. The half angle of taper will correspond to (90-SCEA) of the tool. The work is held in a chuck or clamped on a face plate.

It is used to turn short length of taper only.

Taper turning by setting over the tailstock:

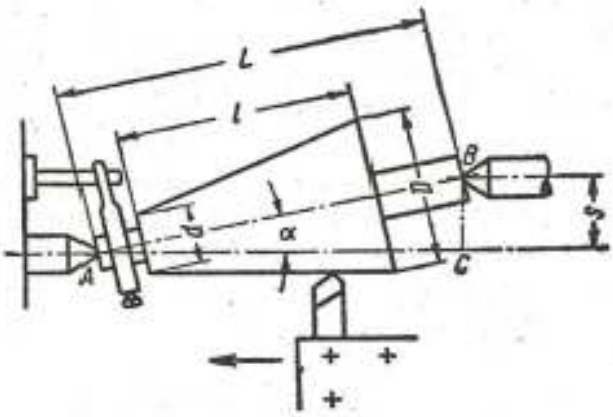


Figure Taper angle by setover method

D. Large diameter of taper, d. Small diameter of taper, L. Length of the work, l. Length of the taper, α. Half taper angle, S. Setover.

The axis of rotation of the work piece is shifted at an angle to the lathe axis and the tool is fed parallel to the lathe axis. The angle at which the axis of rotation of the work piece is shifted is equal to half angle of the taper.

This is done by the tail stock is made to slide on its base or away from the operation by a set over screw.

This is used for turning small taper (not exceed 8^0) on long jobs.

By swivelling the compound rest:

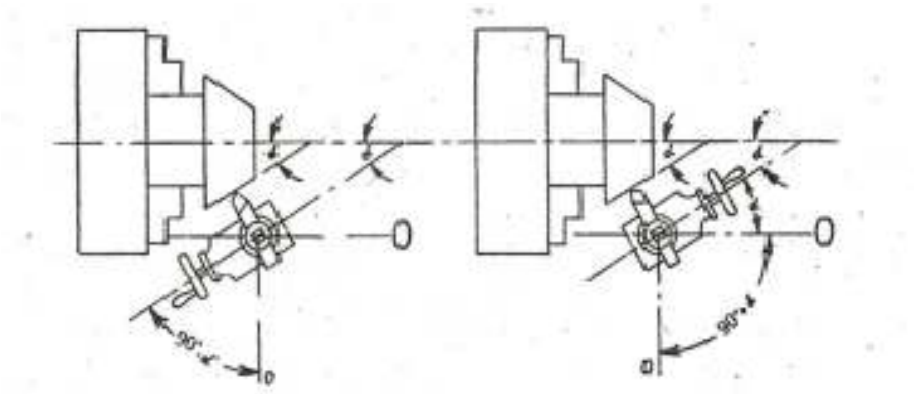


Figure Taper turning by swivelling the compound rest.

In this method the taper is formed by rotating the work piece on lathe axis and feeding the tool at an angle to the axis of rotation of work piece.

The tool mounted on the compound rest is attached to a circular base, graduated in degree, which may be swivelled and clamped at any desired angle the compound rest car be swivelled at 45 on either side of the lathe axis to turn a steep taper. The angle is determined by

KNURLING:

Knurling is the process of embossing a diamond shaped pattern on the surface of a work piece. The purpose of knurling is to provided an effective gripping surface or a work piece to prevent it from slipping when operated by hand.

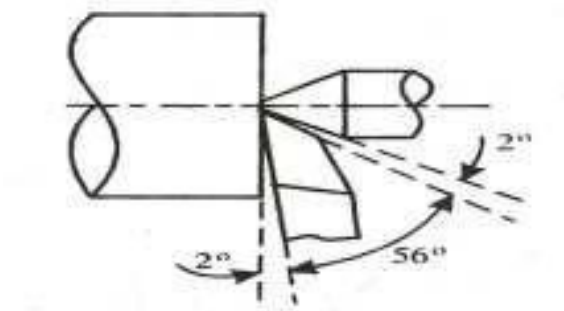


Figure Facing operation

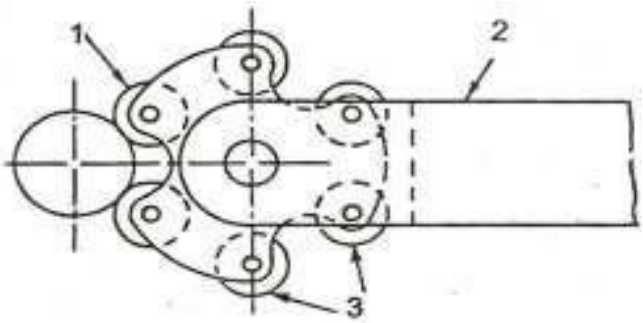


Figure Revolving knurl holder
1. First set of Knurl, 2. Knurl holder,
3. Second set of knurl.

The operation is perturbed by a special knurling tool which consists of 1 set of steel rollers in a holder. The tool is pressed against the revolving workpiece producing depressions in a regular pattern. On the surface of the work piece it is done at the speed ¼ th of that of turning and planty of oil is flowed on the tool and work piece feed varies from 1to 2mm per rev.

Parting off:

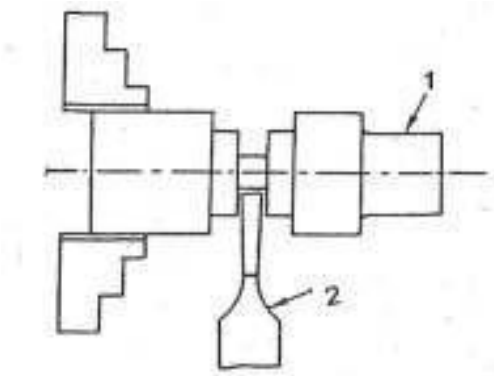


Figure 3.69 Parting off operation
1. Work, 2. Parting off tool.

Parting off is the operation of cutting a work piece after it has been machined to the desired size & shape the job rotated on a chuck or face plate at half the speed that of turning and a narrow parting of tool is feed to the lathe axis by. Hand feed. The feed varies from 0.07 to 0.15 mm per rev. And depth at let ranges from 3 to 10 mm .

Internal machining:

Drilling:

Drilling is the operation of production a cylindrical hole in a work piece by rotating cutting edge of a cutter known as drill .

The work piece is revolved in a chuck or faceplate and the drill is held in the tailstock drill holder or in a drill chuck. Feeding is effected by the movement of the tail stock spindle (adopted for regular shaped work pieces)

The drill is held and driven by a drill chuck attached to the headstock spindle and the work is held against a pad supported by the tailstock spindle. Feeding is effected by the movement of the tailstock spindle (adopted for irregular shaped work pieces

Boring:

It is the operation of enlarging and truing a hole produced by drilling, punching, casting co-forging the

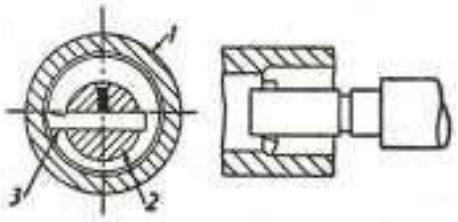


Figure Boring operation

The work is revoluted in a chuck or a face plate and the tool which is flitted to the tool post is fed in to the work . One piece forged tool is used for boring small hole , whereas a boring bar with a tool bit attached to it is suitable for machining a large hole the doc is giver by the cross slide screw and the fade is feeder by the longitudinal travel of the carriage .

The work is clamped on the carriage and a boring bar holding the tool is supported between the centres made to revolute. Longitudinal movement of the carriage provides feeding movement and the doc is given by adjusting the position of the tool insert.

Internal thread to external forced cutting operation , the different being in the carriage provides feeding movement and the doc is given adjusting the position of the tool insert .

Internal thread cutting:

It is similar to external thread cutting operation , the different being is the tool used . the tool is similar to boring tool with the cutting edges ground to the shape conforming to the type of thread to be cut the hole is first bored to the root dia of the thread for cutting metric to read the compound slide is swivelled 30○ to words the headstock . the tool is fixed on the toolpost or on the boring bar after strive it at tught angle to the lathe axis

, using a trove gauge the do is given by compound slide and the to read is finished in the usual manner.

Safety measures during machining:

Some safety precautions should be needed while working on lathe.

- ➢ Before operating the machine, one should fully understand its operations controls and how to stop it.
- ➢ All gears and gear ends of the lathe should be properly guarded.
- ➢ Safety goggles are preferred to avoid damage to eyes by flying chips.
- ➢ Avoid wearing rings, bracelet or watch.
- ➢ Machine should not be left running and operator should be alert during a job.
- ➢ Before starting a lathe spindle by power, spindle should be rotated by one revolution by hand to make it sure that no fouling is there.
- ➢ Safe distance from revolving chuck should be maintained.
- ➢ Tools and instruments should not be placed over lathe bed.
- ➢ Sliding parts of the lathe should be cleaned and lubricated periodically.
- ➢ Chips should never be removed by hand. It can be removed by brush.
- ➢ Before starting the machine, the work should be clamped properly.
- ➢ Before moving the carriage, the carriage clamping screw should be unlocked.
- ➢ On hearing unusual noise, machine should be stopped immediately and should not be operated till the fault is clear.

Capstan & Turret lathes:

A capstan or a turret lathe is a production lathe used to manufacture any number of identical pieces in the minimum time. The main feature is the six sided block mounted on one end of the bed replacing the normal tailstock six tools can be mounted at on cross slide two tool posts are mounted, one in the font and the other in the rear. Each one can hold four tools .Thus the total carrying capacity is a maximum 14 tools

Difference between CAPSTAN &TURRET and an ENGINE LATHE

CAPSTAN &TURRET	ENGINE LATHE
1. The head stock possesses wider range of speeds and in heavier in construction it require 15 hp power to drive the spindle.	1. It requires 3hp to drive the spindle.
2. The tool post mounted or the cross slide is a four way & a rear tool post is mounted on the rear side which also holds 4 tools.	2. In engine lathe one tool can be mounted at one time for different operation.
3. In turret lathe, the tail stock is replaced by a turret which is a hexagonal block which contains 6 tools on each face.	3. It can accommodate one tool of limited size.
4. The feed movement of each tool set on square or hexagonal turret is regularity by stops & feed strips.	4. The feed movement is given by hand.
5. Combination cuts can be taken by mounted two or more tools on the same face of the turret.	5. Combination cuts cannot be done.

6. The labour cost is less.	6. Labour cost is more.

7. The threads are cut by die heads & taps.	7. The threads are cut by lead screws Centre lathe is suitable for odd jobs having different shapes & sizes.
8. Turret lathes are suitable for producing large no. Of identical pieces.	8. The threads are cut by lead screws.

Difference between capstan & turret lathe:

Capstan lathe	Turret lathe
1. Its turret head is mounted in slide, which moves on the guide ways produced on the saddle. 2. For feeding the tool to the work, the saddle is fixed at convenient distance from the work. 3. It is suitable for smaller size & lighter jobs. It is not suitable for heavy cutting condition. 4. It is suitable to work for smaller bar upto 60 mm dia. 5. The turret head may hexagonal or circular. 6. It is smaller in size compound to turret lathe. 7. The tool traverse is faster and offer less fatigue to the hands of the operator.	1. Its turret to head is mounted directly on the saddle. 2. For feeding the tool to the work, the entire saddle unit is moved. 3. It is suitable for long and heavy work and severe cutting condition.\ 4. It is used to work for large size bar upto 200mm dia. 5. Turret head is hexagonal. 6. It is large in size as compared to capstan lathe. 7. The tool feeding is relatively slower and provide more fatigue to operator hands.

The capstan or ram type lathe:

The capstan or ram type turret or capstan lathe carries a hexagonal turret on ram or short slide,the ram slide longitudinally on a saddle on bed ways. the feeding movement is obtained when the ram moves from left to right and when the ram moved backward the turret indexes automatically and the toll mounted on the next face comes into operation. This type of machine is lighter in construction and is suitable for machinery bar of small diameter.

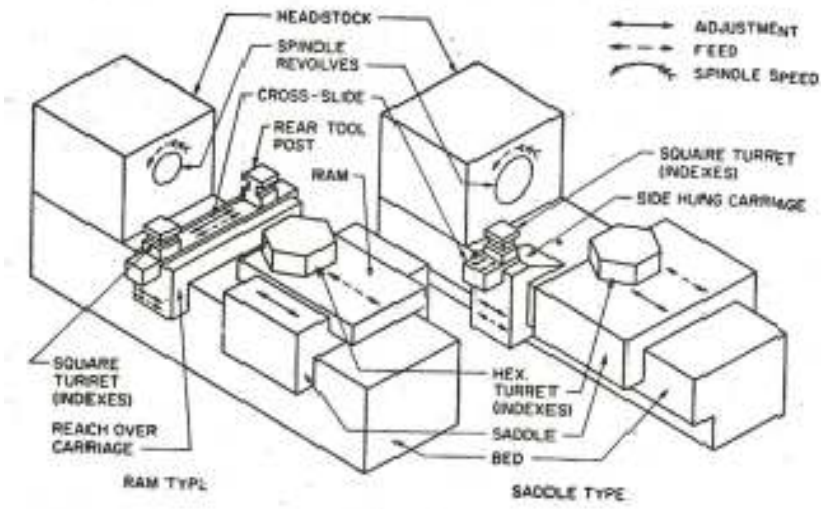


Figure **Ram type (capstan) and saddle type (turret) lathes**
(Reproduced from Doyle *et al*)

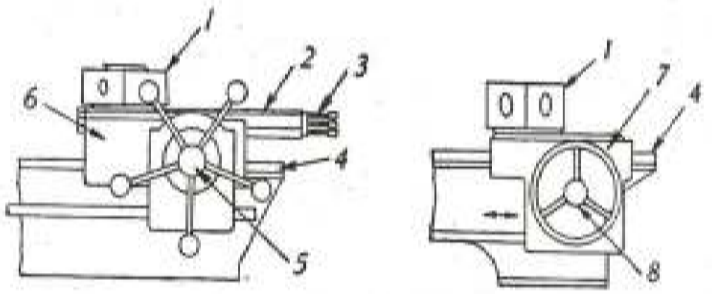
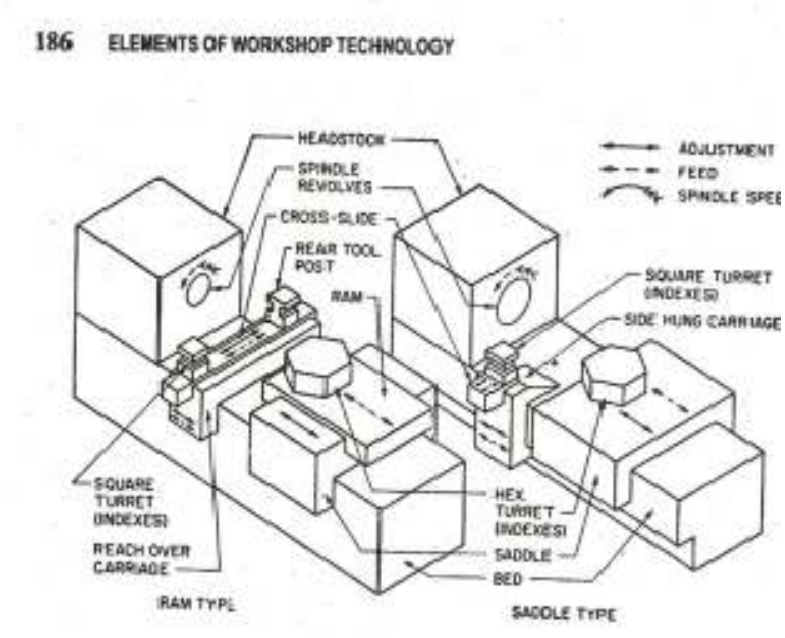


Figure **Capstan and turret lathe to show their difference**
1. Hexagonal turret, 2. Auxiliary slide, 3. Feed stop rod, 4. Lathe bed, 5. Handwheel for auxiliary slide, 6. Saddle, 7. Turret saddle, 8. Handwheel for saddle.

The turret or saddle type lathe

The hexagonal turret is mounted directly on the saddle and the whole unit moves back and forth on the bed ways to apply feed. The machine can accommodate longer work pieces than that in a capstan lathe. It is heavier in construction and for larger bar work and chucking work.



Multiple Tool holder.

Both capstan and turret lathe carry a multiple holding device called capstan head in capstan lathe and turret head in case of turret lathe. The capstan head usually circular carrying six slots. It can be mounted either its axis vertical or at an inclination. The turret head can be square, he agonal or octagonal in shape having one hole on each face. The hexagonal type is more commonly used. It is always mounted with its axis vertical except in case of vertical turret where the axis of rotation of the turret head is horizontal.T

Parts of capstan and turret lathe:

Bed:

The bed is longer box like casing provided with accurate guide ways on which the carriage and turret slid are mounted. It is designed to ensure strength, rigidity and permanency of alignment under heavy duty services.

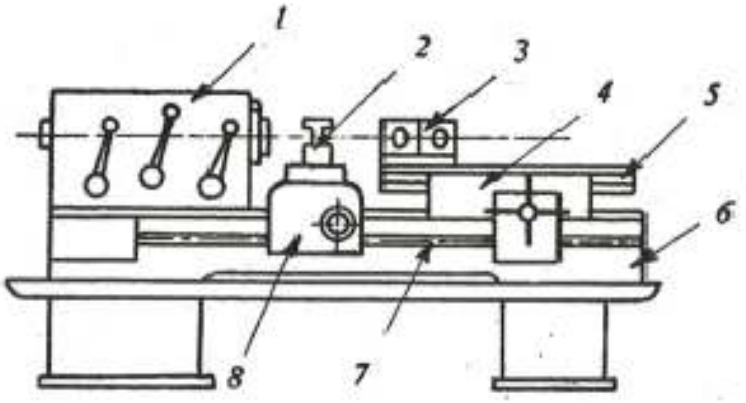


Figure 4.3 Capstan lathe parts

1. Headstock, 2. Cross-slide toolpost, 3. Hexagonal turret, 4. Saddle for auxiliary slide, 5. Auxiliary slide, 6. Lathe bed, 7. Feed rod, 8. Saddle for cross-slide.

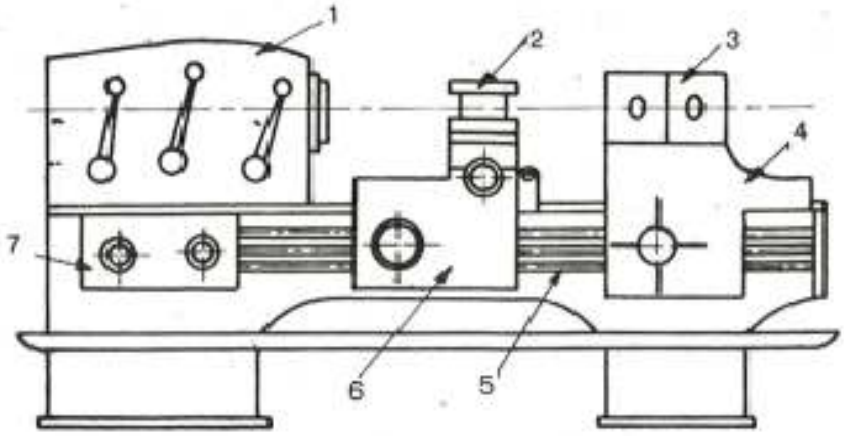


Figure 4.4 Turret lathe parts

1. Headstock, 2. Cross-slide toolpost, 3. Hexagonal turret, 4. Turret saddle, 5. Feed rod, 6. Saddle for cross-slide.

Headstock:

It is similar to engine lathe in construction. It is larger & heavier in construction and wider range of speeds speed may rang form 30 to 2000rpm two types of headstocks.

a) Electric head - variable speed motor is mounted.
b) All geared heads - wider range of speeds

The spindle is hollow and bar stock can be fed thorough a collar chuck .

Gross slide & saddle:

There are two types of slides used in turret lathe

- ➢ Conventional type
- ➢ Slide hunk type

The conventional type of Carriage Bridge the gap between the front and rear bed wage

The slide hunk type carriage is generally fitted with heavy duty turret lathe. Large diameter of work pieces can be swing over bed. The longitudinal movement of each tool may be regulated by using stop bars or shafts set against the stop fitted on the bed and carriage. The stops are set so the each tool will feed into the work to desired length the stop bars are indexed by hand

The turret saddle and auxiliary slide :-

The turret saddle bridges the gap between two bed ways. The hexagonal turret is mounted o9n the auxiliary slide. In turret lathe, the turret is directly mounted on the top of the saddle.

The turret is a hexagonal shaped tool harder intended for six or more tools. The centre line of each hole is coincides with the axis of the lathe. Six stop bars are mounted on the saddle which restricts the movement of each tool mounted on each face of turret to be fed predetermined amount. After one operation the turret is brought backward from the spindle nose the turret indexes automatically.

Capstan and turret lathe mechanism:-

Turret head indexing mechanism:-

This is an inverted plan of turret assembly. The turret is mounted on the spindle. The index plate, the, bevel gear and an indexing ratchet are keyed to the spindle. The plunger fitted within the housing and mounted on the saddle locks the index plate by spring pressure and prevents any rotary movement of the turret as the tool feeds into the work.

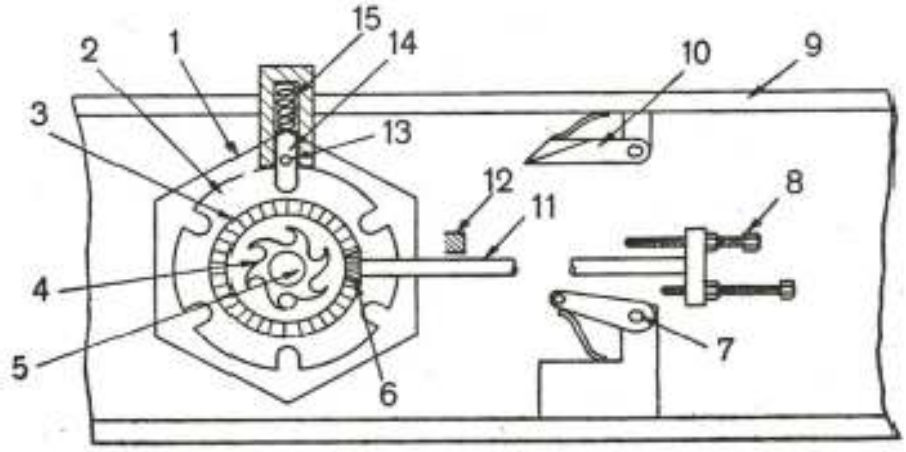


Figure 4.5 Turret indexing mechanism

1. Hexagonal turret, 2. Index plate, 3. Beveled gear, 4. Indexing ratchet, 5. Turret spindle, 6. Beveled pinion, 7. Indexing pawl, 8. Screw stop rods, 9. Lathe bed, 10. Plunger actuating cam, 11. Pinion shaft, 12. Stop, 13. Plunger pin, 14. Plunger, 15. Plunger spring.

A pin is fitted on the plunger projects out of the housing. An actuating cam and the indexing pawl are attached to the lathe bed at desired positions. Both the cam and the pawl are spring loaded. As the turret reaches the backward position, the attaching cam lifts the plunger out of the groove in the index plate due to the riding of the pin on the bevelled surface of the cam and thus unlocks the index plate.

The spring loaded pawl which by this time engages with a groove of ratchet plate, causes the ratchet to rotate as the turret head moves backward.

When the index plate or turret rotates through one sixth of revolution, the pin and the plunger drops out of the cam and the plunger locks the index plate at the next groove.

The turret is thus indexed by one sixth of revolutions and again backed into the next position automatically. The turret holds the next tool is now fed forward and the pawl is released from the ratchet plate by the spring pressure.

The bevel opinion meshes with the bevel gear mounted on the turret spindle. The extension of the pinion shaft carries a plate holding six adjustable stop rods. As the turret rotates through one sixth of the revolution , the bevel gear causes the plate to rotate.

The ratio of the teeth between the pinion and the gear are so chosen that when the tool mounted on the face of the turret is indexed to bring it to the cutting position, the particular stop rod for controlling the longitudinal travelling of the tool is aligned with the stop.

The setting of the stop rods for limiting the feed of each operation may be adjusted by unscrewing the lock nuts and rotating the stop rods on the plate. Thus, six stop rods may be adjusted for controlling the longitudinal travel of tools mounted on six faces of the turret.

Bar feeding mechanism:-

On the capstan and turret lathes, some arrangements is need to be feed the bar stock through the collet or chuck after each finished work piece is parted off. Bar may be fed by hand also but has a safety measure one has to stop the machines first for every feeding of bar. It also wastes lot of time.

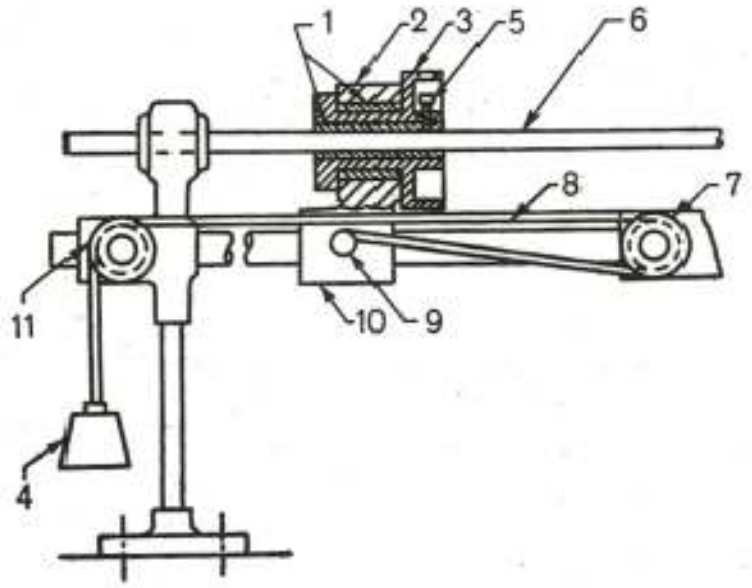


Figure 4.6 Bar feeding mechanism

1. Chuck bush, 2. Sliding bracket body, 3. Bar chuck, 4. Weight, 5. Bar chuck set screw, 6. Bar, 7, 11, Pylley, 8. Chain, 9. Pin on the sliding bracket, 10. Sliding bracket

In this method the bar is push forward as soon as it release from the collect without stopping the lathe.

A bar feeding mechanism is fitted with a capstan lathe is the back side of lathe. Bar is fed against the rotating sleeve and the collet chuck. The bar stock passes through the spindle of the collet chuck. One end of the rope is connected with a sleeve and the other end is attached with a weight.

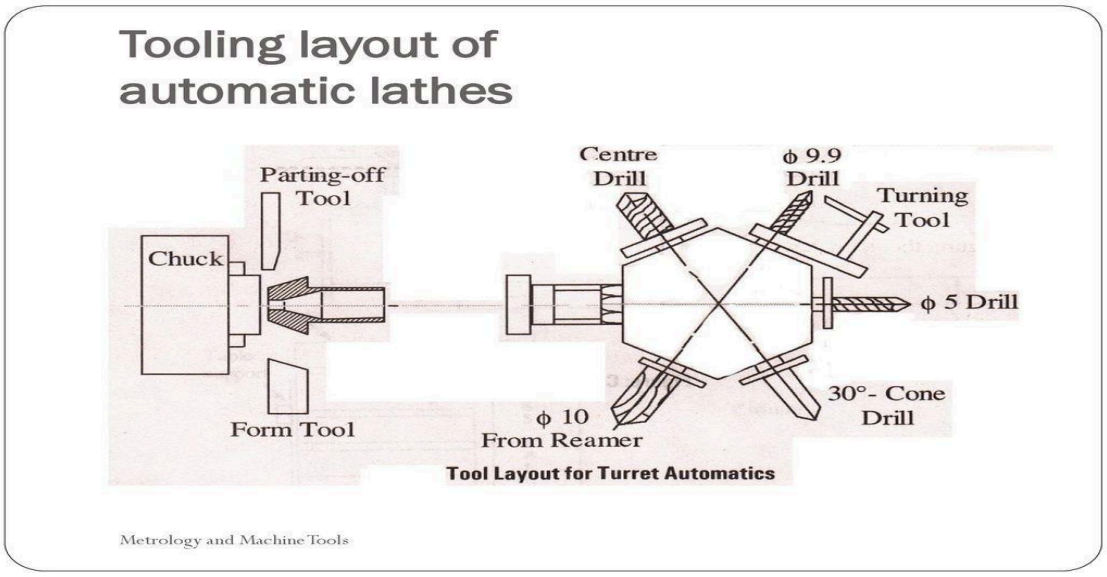
Under the action of the weight, the bar moves towards the head stock. At the end of the parting off operation on the job. It is needed to feed the new length of the bar. As soon as the collet is opened by operating the Colet control lever, the bar is release and is automatically rushes out of the collet and strike with the bar stop.

The bar stop mounted on the capstan head for the purpose of getting the required bar length projecting out of the colet. The colet lever is again operated to close the collet and hold the bar tightly.

Tooling layout:

The tool layout for a job constitute the predetermined plan for the order and method of machining operation necessary to produce it. For preparation of the layout, it is necessary to have a finished drawing of the part to be produce. The tool layout consists of two steps: preparation of operation sheet.

Sketching the plan showing various tolls fitted into the turrent faces and the cross slides, in proper sequence.



Production of hexagonal bolts:-

Operation no.	description of operation	tool position	tools
1	Hold in collet	1st turret Position	Bar stop
2	Turn to 16 mm dia	2nd turret Position	Roller steady bar turning tool
3	Form end of the bolt	3rd turret Position	Roller steady bar ending tool
4	Screw 16 mm	4th turret Position	Self opening die head with chasers for 16 mm

5	Chamfer	Front cross slide tool past	Chamfering tool
6	Parting off	Rear tool post	Parting off tool

For bush:-

Sl no	Sequence of operation	Machine shop	Tools / gauges
1	Fixed 2mm end deep	Turret lathe position1 (rear slide)	Bar ending tool
2	Feed out bar stop	Position 2	Bar stop
3	Stop for drilling	Position 3	Centre drill
4	Drill hole 10 mm	Position 4	Drill 10 mm dia,

	dia, and rough turn 16.5dia×36 mm		rough turning tool
5	Finish turn to 16.10 mm dia, bore 11.5 dia × 36 mm and chamfer 0.3×45°	Position 5	Finish turn tool, chamfering tool and boring tool
³	Rough ream 11.8 mm dia×36 mm	Position 6	Reaming toll rough
7	Finish ream 11.8mm dia × 36 mm	Position 7	Reaming tool finish
8	Cut off to 31 mm length	Position 8	Parting off tool
9	Chamfer other end 0.3×45°	Upright drill	Chamfering tool
10	Drill oil hole	Upright drill	Drill 2mm
11	Cut oil grooves	Special machine	Groove cutter
12	Grind to 16 mm dia	Cylindrical Grinder	Finish grading wheel
13	inspect	Inspection department	Limit gauges

1. Feed the bar stock to stop
2. Turn 14 mm dia with box tool
3. Turn 14.28 mm dia with box tool
4. Round end with roller steady ending tool
5. Centre with centre drill
6. Cut threads with die head
7. Form 17 mm dia and chamfer with tool from front square slide
8. Part off with cut of tool in rear tool

CNC LATHE(COMPUTER NUMERICAL CONTROL LATHE)

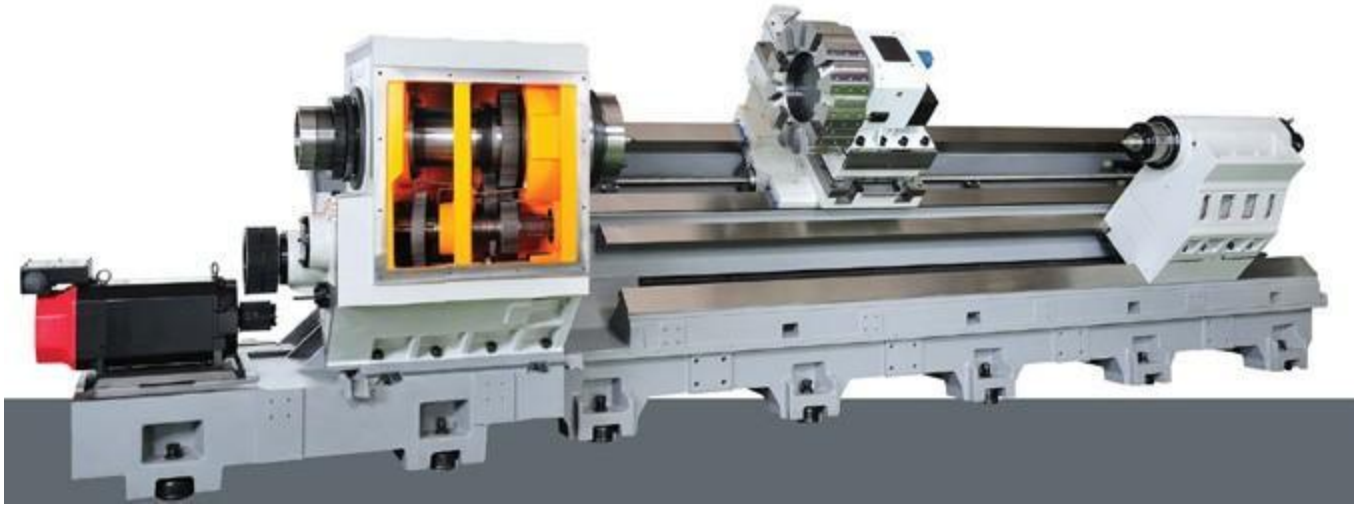
Physically CNC lathe machine is a simple lathe machine with CNC controls panel equipped with it. Internally all the functionality of cnc lathe machine it controlled through cnc control.

- CNC Lathe Main Parts
  - 1 – Headstock
  - 2 – CNC Lathe Bed
  - 3 – Chuck
  - 4 – Tailstock
  - 5 – Tailstock Quill
  - 6 – Foot Switch or Foot Pedals
  - 7 – CNC Control Panel
  - 8 – Tool Turret

CNC Lathe Main Parts

1 – Headstock

Headstock of a cnc lathe machine have the main motor of cnc lathe machine which drives the main spindle. Chuck is mounted on this main spindle.



cnc lathe headstock

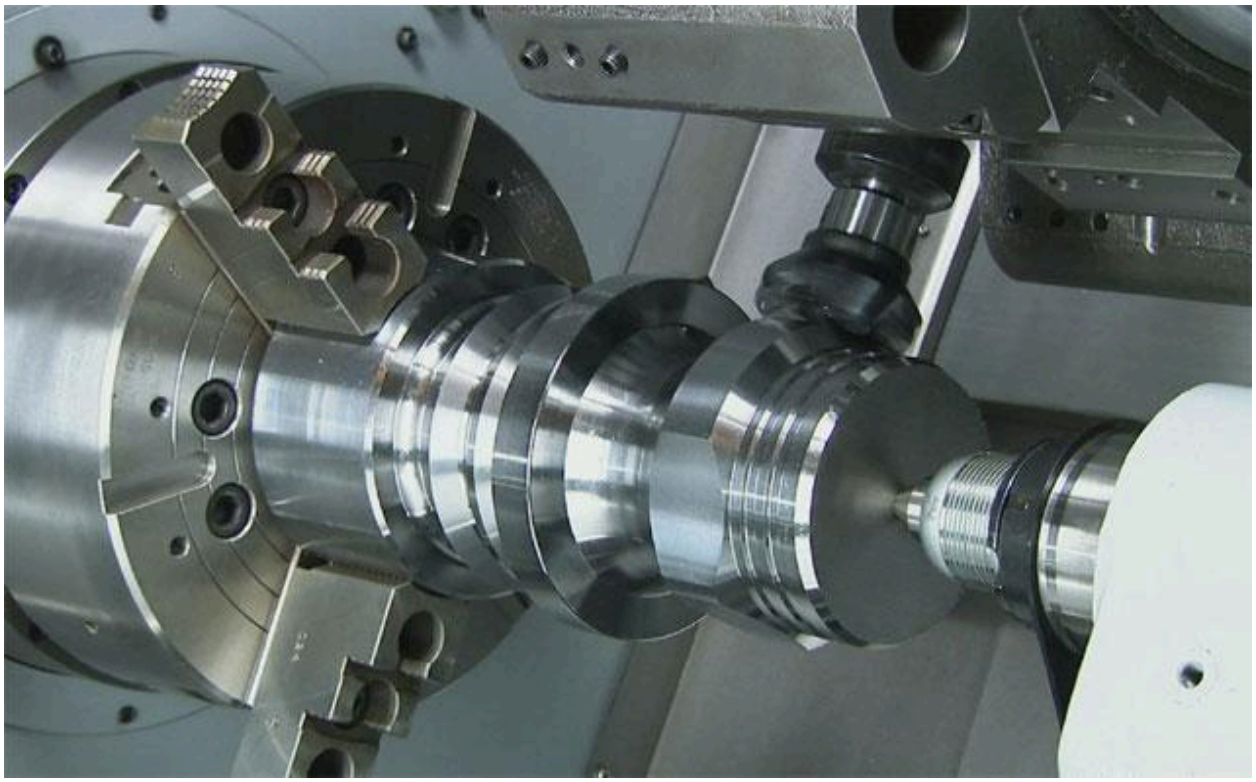
Here is another cnc lathe machine, the headstock covers are removed, so you can see the Main drive (Main Motor), Gears. Gears can be selected with the cnc programming instructions (M41,M42,M43)

2 – CNC Lathe Bed

The tool turret travel over the cnc lathe bed, which is specially hardened so any kind of machining can't affect them.

3 – Chuck

CNC lathe machine chuck grips the component which are to be machined. Chuck itself has many parts. Jaws are mounted on the chuck to grip the part, you might read more about jaws here CNC Machine Jaws an Introduction for CNC Lathe Machinist.



4 – Tailstock

Tailstock are mostly used to give an extra gripping force for component machining. For long components machining they provide extra force on the other end so machining process can complete smoothly. You can see in the above picture at the one end chuck is gripping the component and on the other end tailstock is providing the extra force.

5 – Tailstock Quill

Actually you move the whole tailstock forward or reverse, but in that way it is not used to grip the part, but tailstock is travelled to a point near the component and then it is set there, after that you actuate the tailstock quill which travel either with hydraulic pressure or pneumatic pressure to grip the component.

6 – Foot Switch or Foot Pedals

Foot switches are used to actual the chuck and tailstock quill. Through these pedals cnc machinist's open and close the chuck to grip the component, the same way tailstock quill is taken to forward position or reversed through theses pedals.

cnc lathe foot switches or Pedals

7 – CNC Control Panel

The brain of the cnc machine, all the cnc program are stored inside this panel, cnc machinists control the whole machine through the keys on this panel. CNC machinists stat/stop the machine move axis by pressing different keys on this panel.

Learn G Code Programming

They can enter new program by using this panel, programs can be transferred by using usb port on this panel as well. So this is the main part which controls the whole cnc machine.

8 – Tool Turret

The tool are mounted on the tool turret which are used for component machining. Tool turrets vary in shapes and number of tools that can be mounted on them.