LATHE MACHINE

OBJECTIVES

- Introduction & history of lathe.
- Working principle of lathe.
- Classification of lathe.
- Construction and parts of lathe.
- Accessories of lathe.
- Specifications of lathe.
- Lathe operations.
- Work holding devices.
- Conclusion

INTRODUCTION

- Lathe is one of the most important machine tools in the metal working industry. A lathe operates on the principle of a rotating work piece and a fixed cutting tool.

- The cutting tool is feed into the work piece, which rotates about its own axis, causing the work piece to be formed to the desired shape.

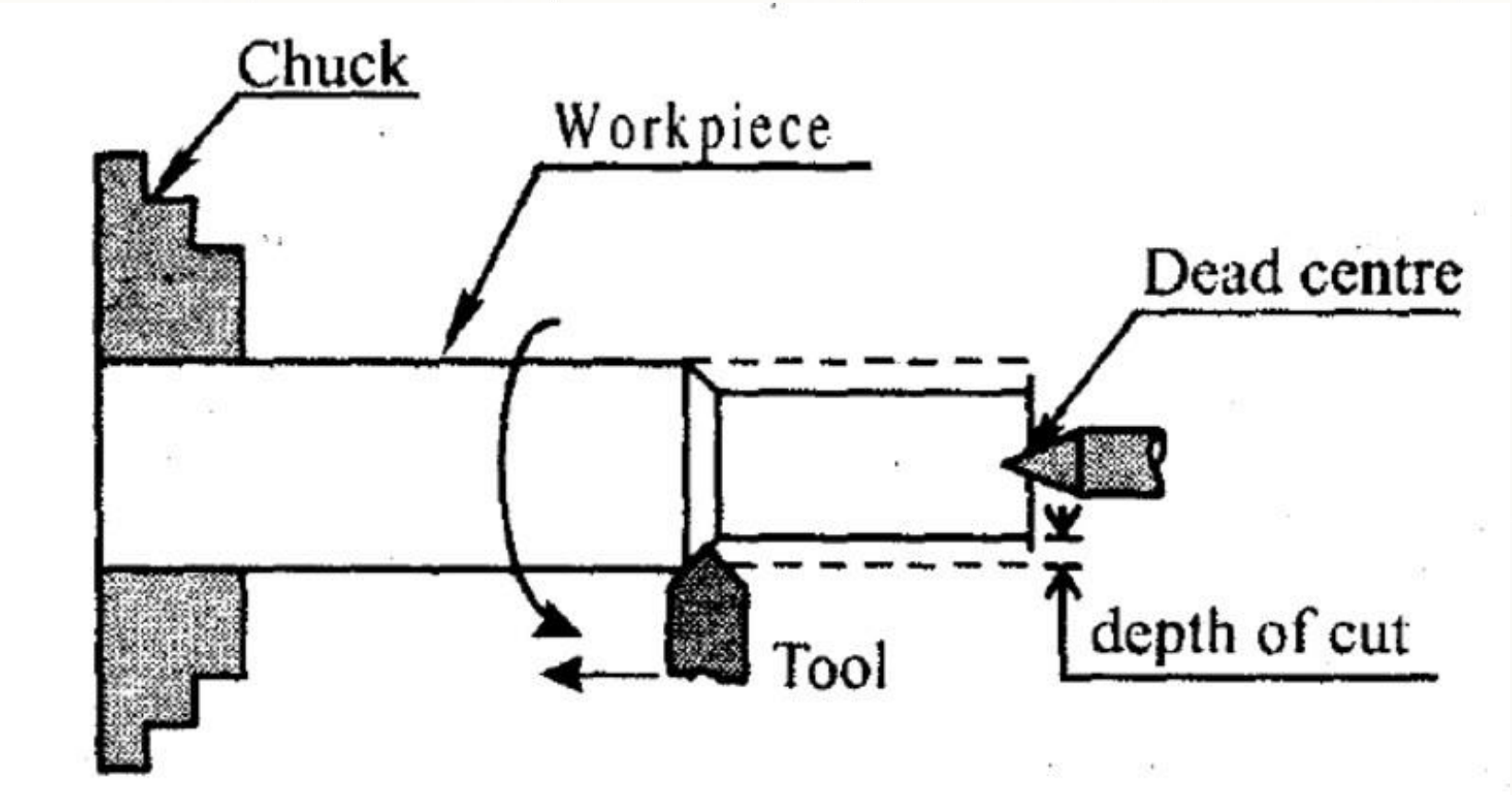
- Lathe machine is also known as “the mother/father of the entire tool family”.

HISTORY

- The lathe machine is one of the oldest and most important machine tools. As early as 1569, wood lathes were in use in France. The lathe machine was adapted to metal cutting in England during the Industrial Revolution.

- Lathe machine also called “Engine Lathe” because the first type of lathe was driven by a steam engine.

WORKING PRINCIPLE OF LATHE

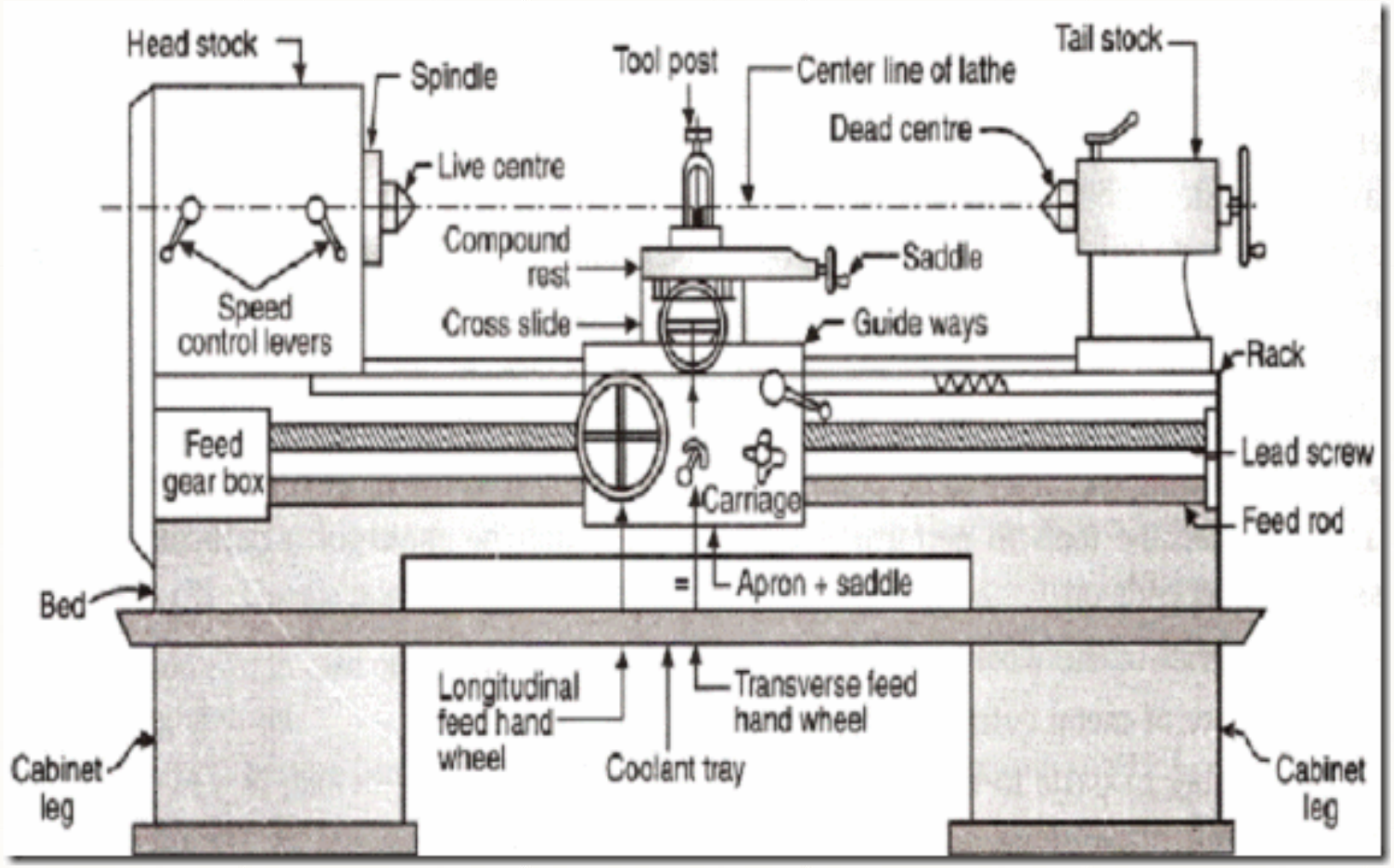


WORKING PRINCIPLE OF LATHE

- The lathe is a machine tool which holds the work piece between two rigid & strong supports called centres or in a chuck or in face plate which revolves.

- The cutting tool is held and fed against the revolving work. Cutting tool fed either parallel or at right angles to the axis of w/p. Or may also at an angle .

BLOCK DIAGRAM OF LATHE



CLASSIFICATION OF LATHE

- Speed Lathe

  a)wood cutting lathe b)centering lathe

  c)polishing lathe d)spinning lathe

- Engine Lathe

  a)belt driven lathe b)individual motor drive lathe

  c)gear head drive lathe

- Bench Lathe
- Tool room Lathe
- Capsten & Turret Lathe
- Special purpose Lathe

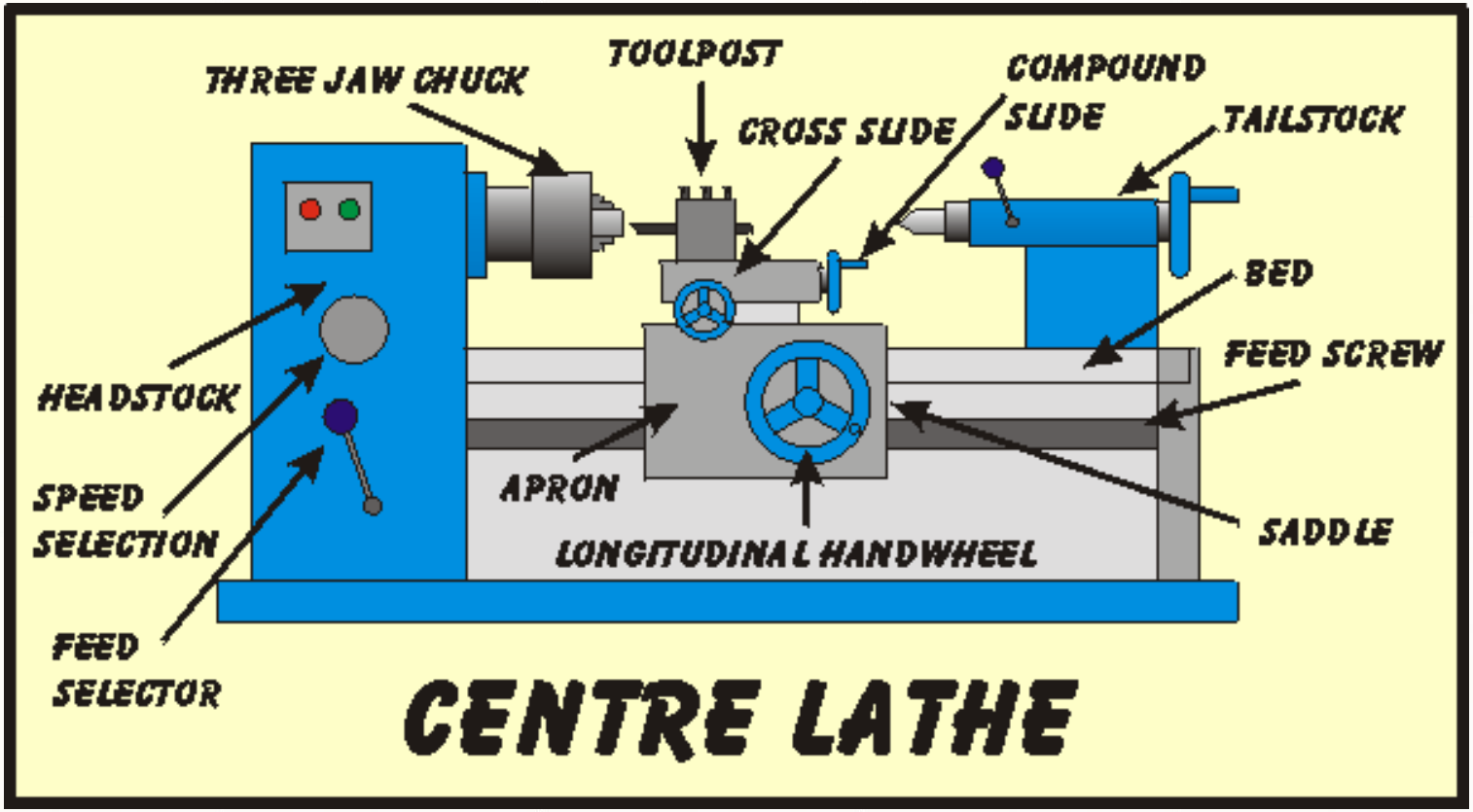
  a)wheel lathe b)gap-bed lathe c)t-lathe d)duplicating lathe

- Automatic Lathe

SPEED LATHE

- It is the simplest type lathe.
- Due to high speed of spindle it is called “Speed Lathe”.
- Speed of Spindle : 1200 to 3600 rpm.
- It is mainly used for metal spinning, polishing etc.

ENGINE OR CENTRE LATHE



ENGINE OR CENTRE LATHE

- In starting it was driven by steam engine, So it is called as Engine lathe.
- Not production lathe, found in school shops, tool rooms, and job shops.
- Primarily for single piece or short runs.
- Manually operated.
- Types :-
    a) Belt driven lathe
    b) Individual motor driven lathe
    c) Gear head drive lathe

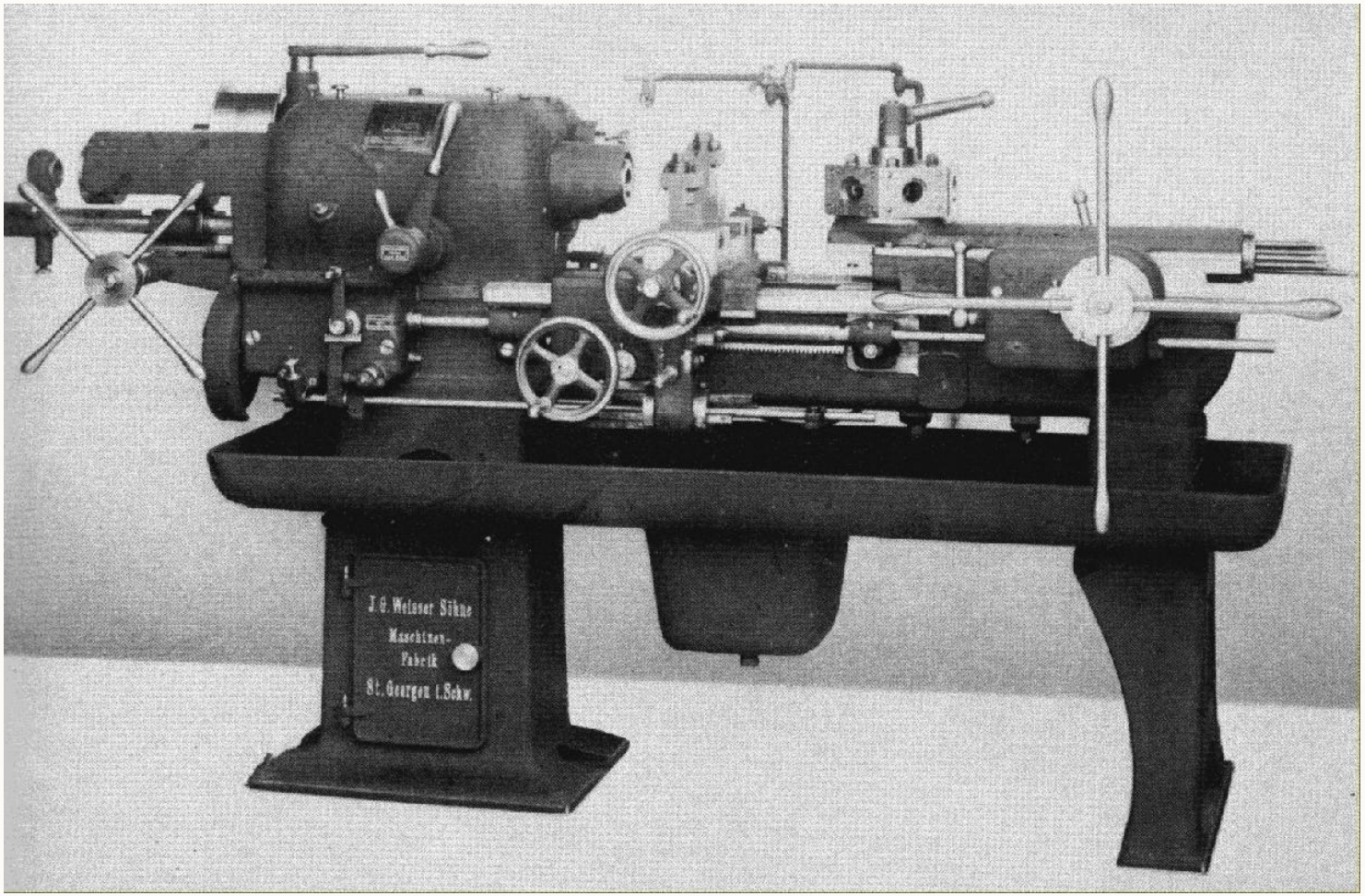
BENCH LATHE

- It is small sized engine lathe mounted on bench.
- A bench top model usually of low power used to make precision machine small & light weight work pieces.

TOOL ROOM LATHE

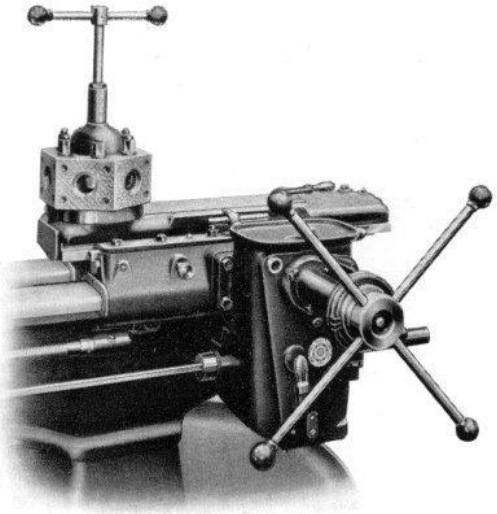
- Same as Engine lathe.
- It is used for production of small & precision works like tools, gauges, fixtures and accurate parts in tool room.
- Different speeds can achieved.
- Costly as compared to a same size Engine lathe.

CAPSTEN & TURRET LATHE



CAPSTEN & TURRET LATHE

- Modified Engine lathe.
- Capsten lathes are used in mass production used for light duty workpieces.
- Turret lathes are used in mass production and for heavy duty workpieces.
- No tailstock.
- Instead of tailstock hexagonal turret is there.
- No time waste for re-setting of tools.



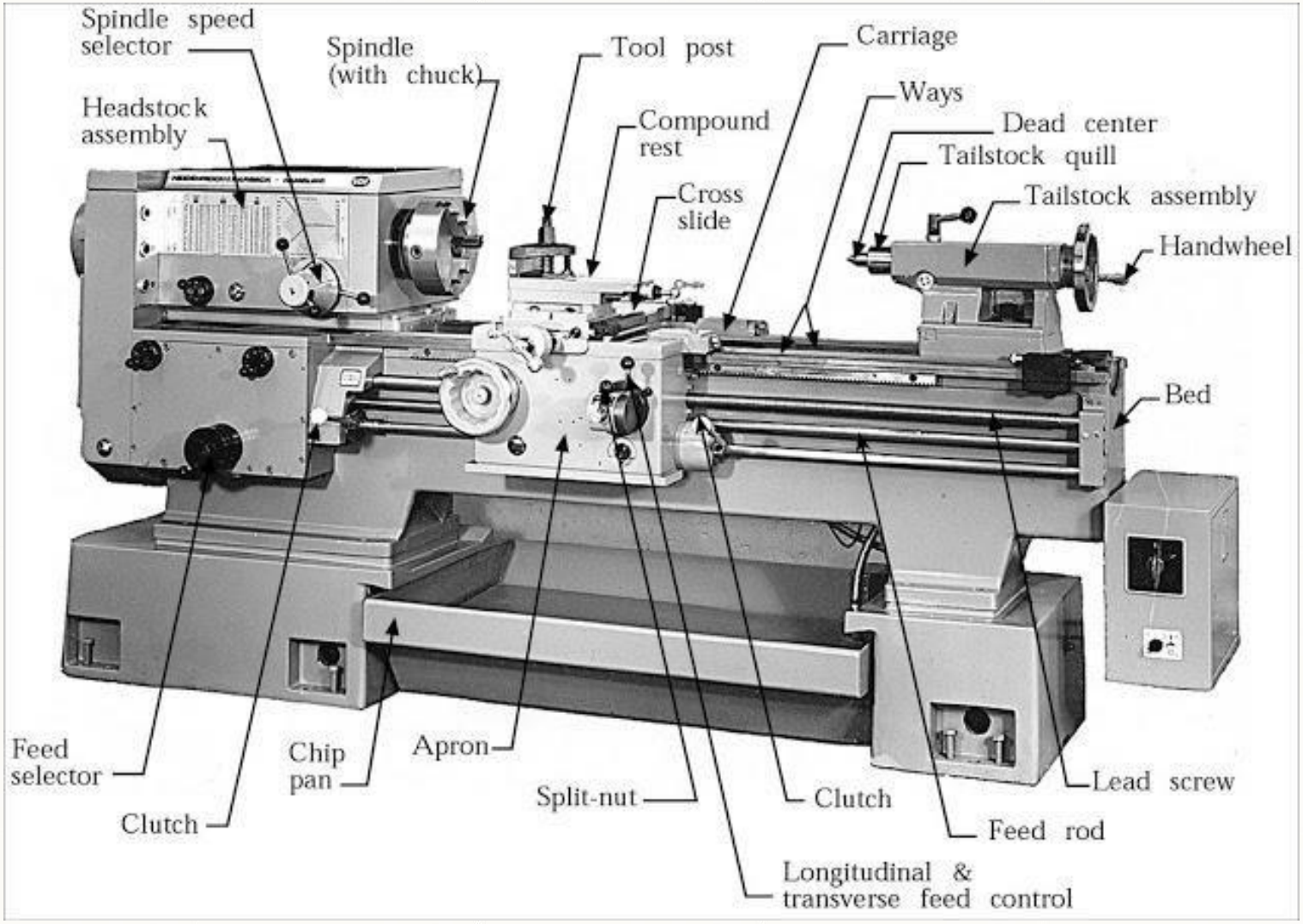
SPECIAL PURPOSE LATHE

- Conventional/programmable lathe.
  - Operated as standard lathe or programmable lathe to automatically repeat machining operations.
  - 2-axis (DRO) so can see exact location of cutting tool and workpiece in X and Z axes.
- Computerized numerically controlled lathes.
  - Cutting-tool movements controlled by computer-controlled program to perform sequence of operations automatically

AUTOMATIC LATHE

- A lathe in which the work piece is automatically fed and removed without use of an operator. It requires very less attention after the setup has been made and the machine loaded.

CONSTRUCTION OF LATHE



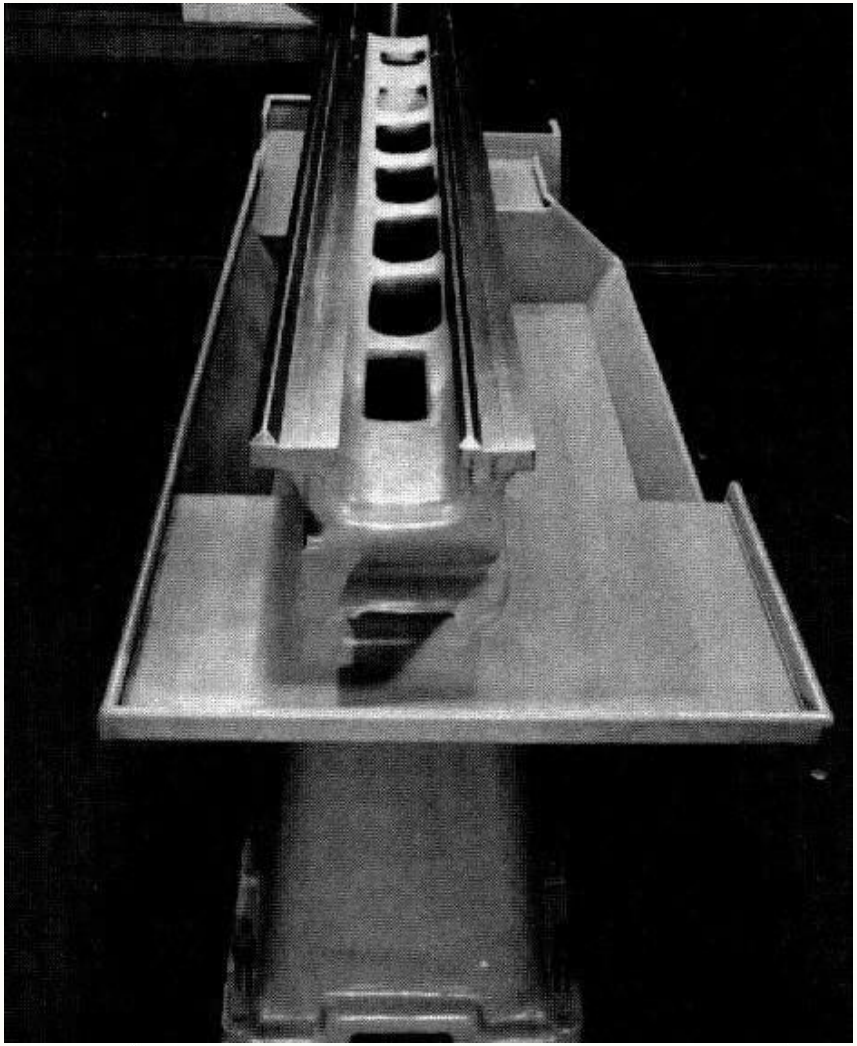
CONSTRUCTION & PARTS OF LATHE

Main parts of lathe are :-

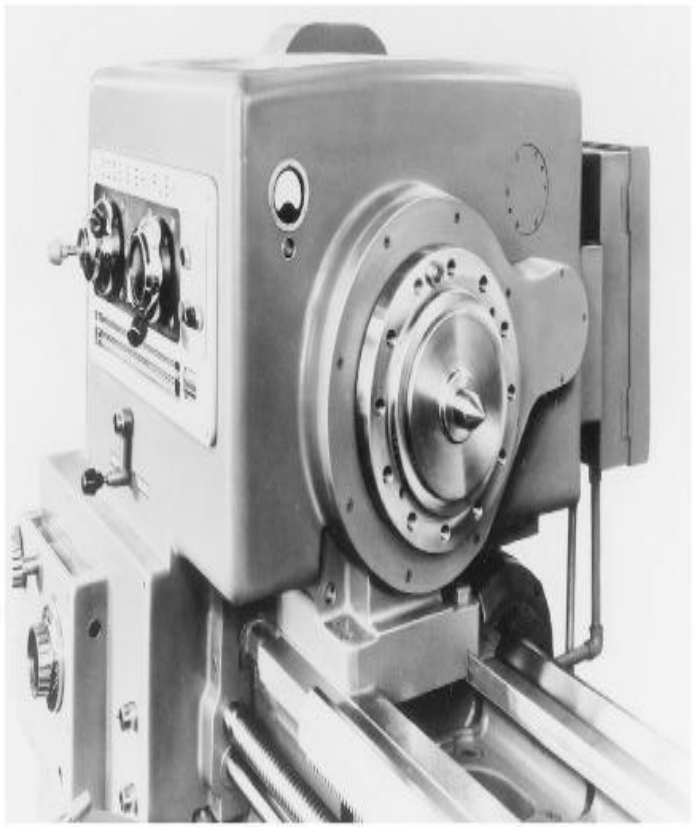
- Bed
- Head stock
- Tail stock
- Carriage
- Feed mechanism
- Screw cutting mechanism

BED

- Made from cast iron or nickel cast iron alloy.
- It supports head stock, tail stock & carriage.
- Machining and scraping of lathe bed is done withhigh precision.
- On top section are machined ways
- Guide and align major parts of lathe

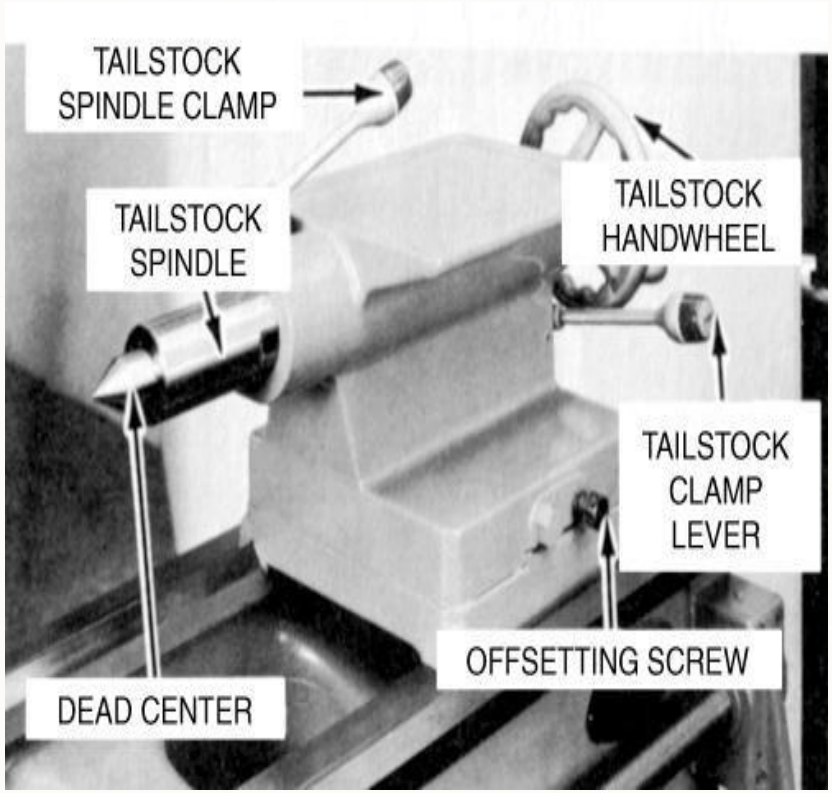


HEAD STOCK



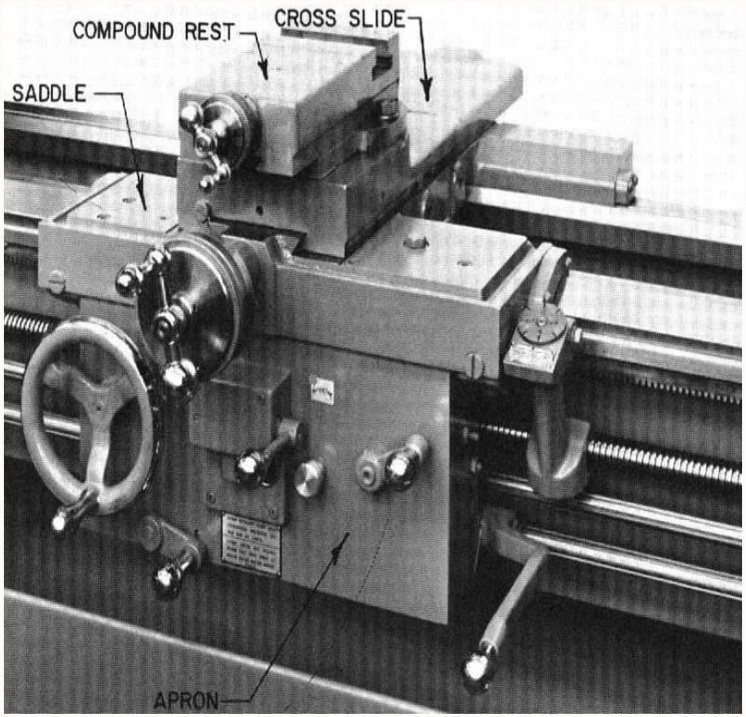
- Clamped on left-hand end of bed
- Headstock spindle
- Hollow cylindrical shaft supported by bearings
- Provides drive through gears to work-holding devices

TAIL STOCK



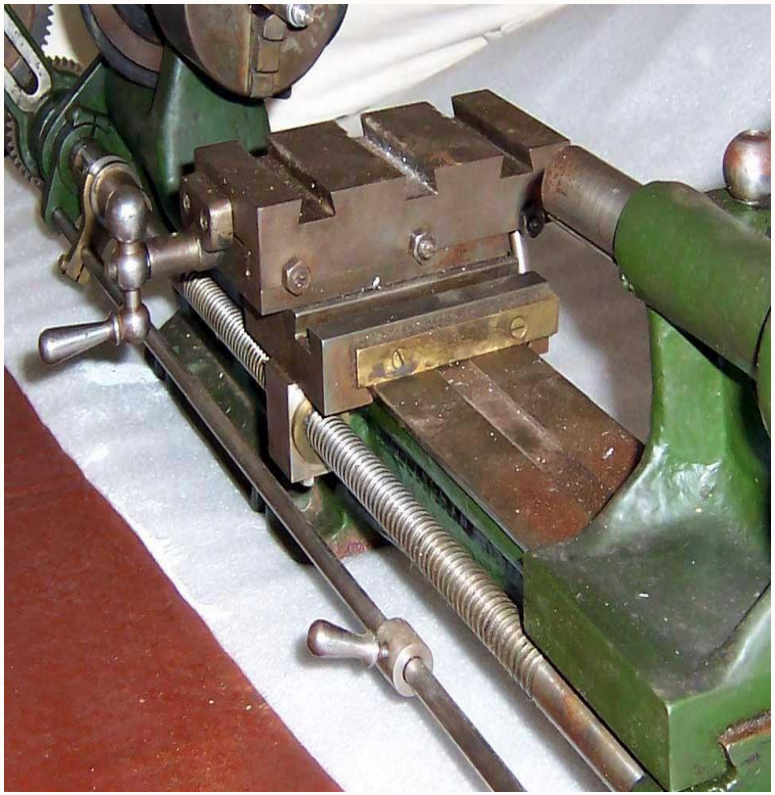
- Placed at right side of lathe.
- To support long workpiece.
- Operations like drilling, tapping, reaming can done using sleeve of tailstock.

CARRIAGE



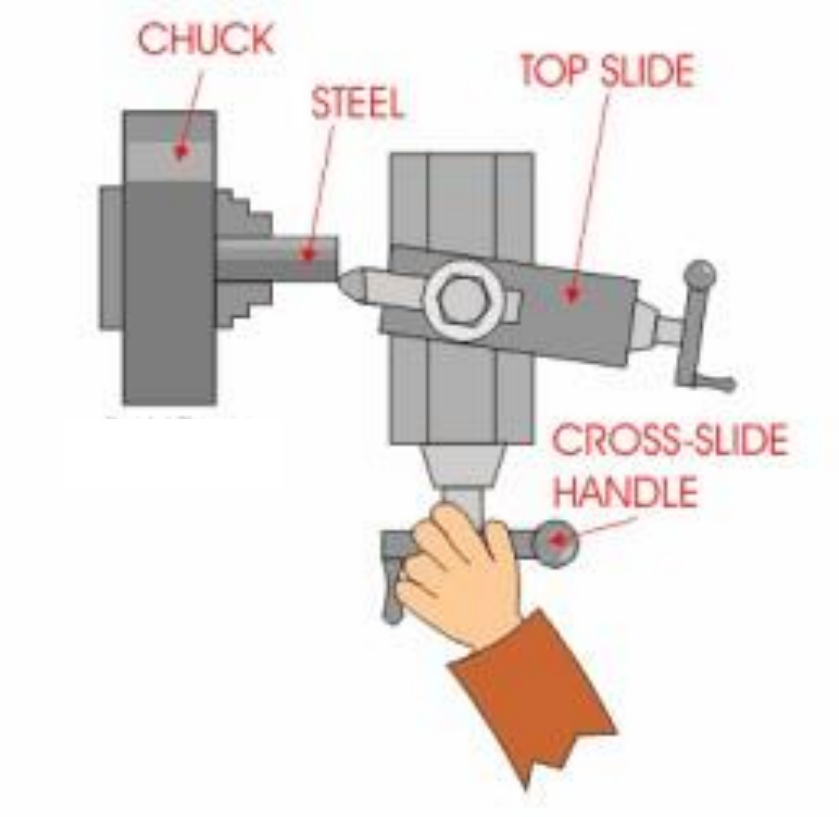
- Used to move cutting tool along lathe bed
- Consists of four main parts
  - Saddle
  - Cross-slide
  - Apron
  - Compound rest

FEED MECHANISM



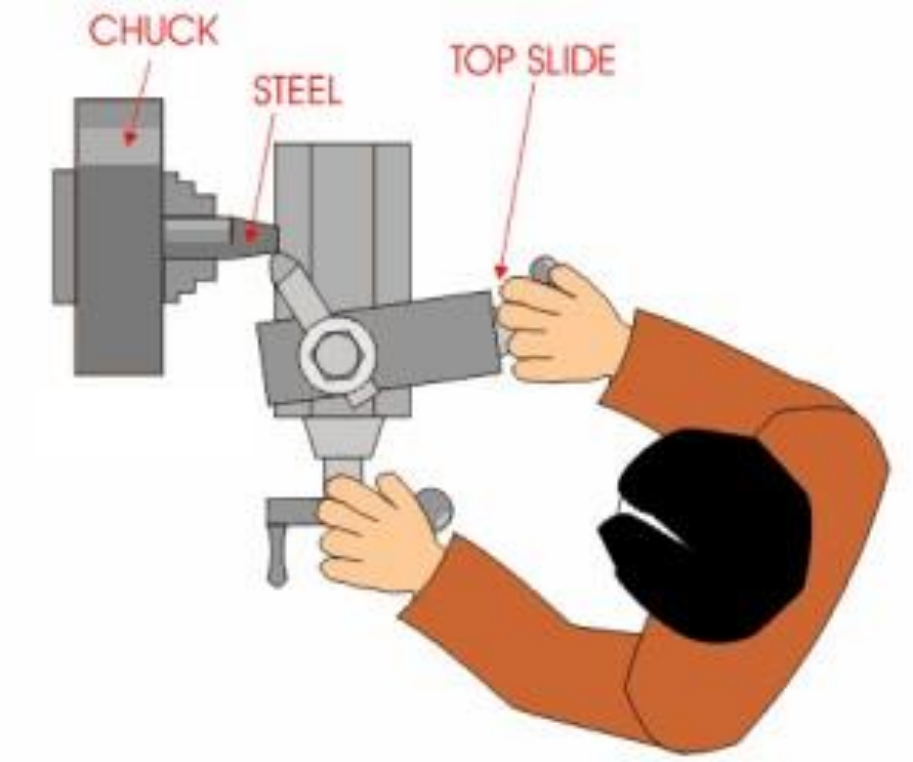
- Three types of feed
  - Longitudinal
  - Cross
  - Angular

CROSS SLIDE



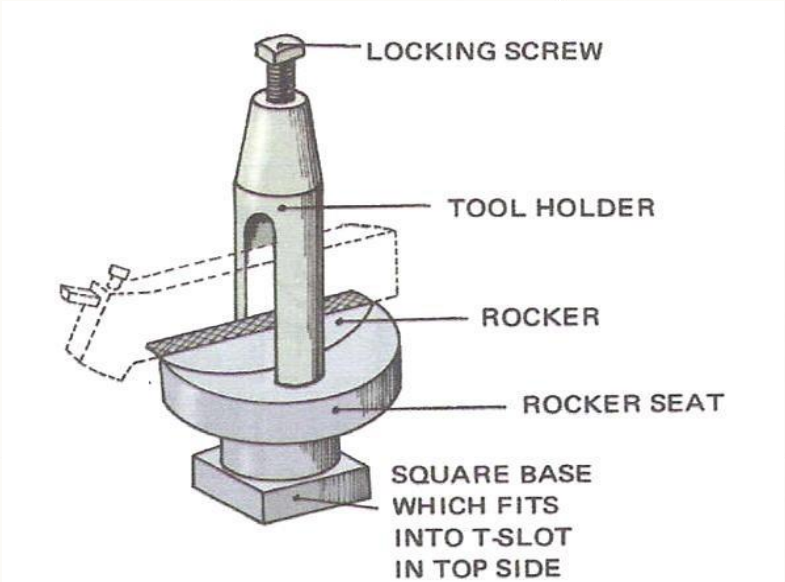
- Fitted on the Saddle
- Moves cutting tool at right angles to lathe bed

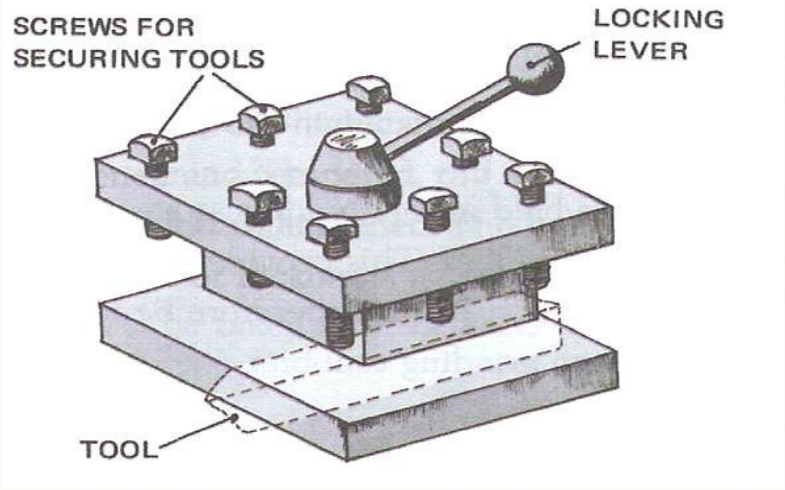
TOP SLIDE



- Fitted to top of Cross slide
- Carries tool post and cutting tool
- Can rotate to any angle
- Is used to turn tapers

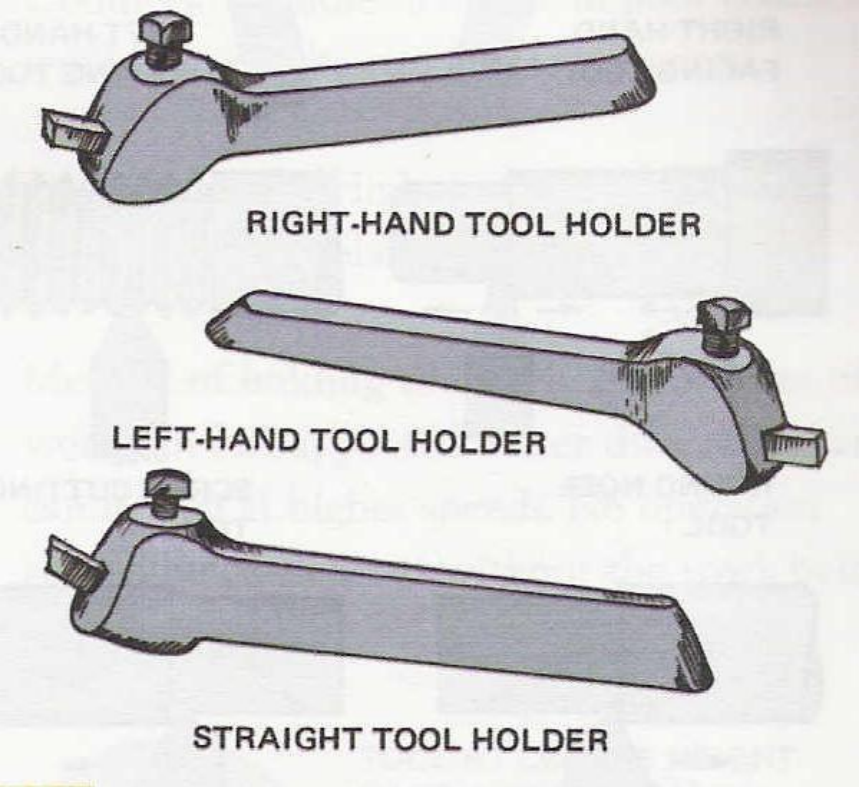
TOOL POST





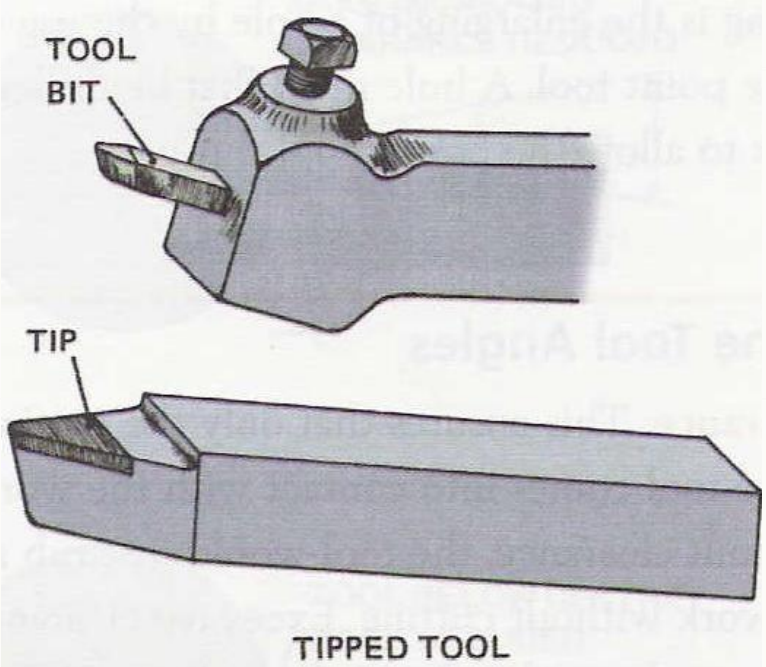
- Fitted on top slide and carries the cutting tool or the cutting tool holder
- Can adjust the height on some types
- Can carry 4 different tool holders

TOOL HOLDERS

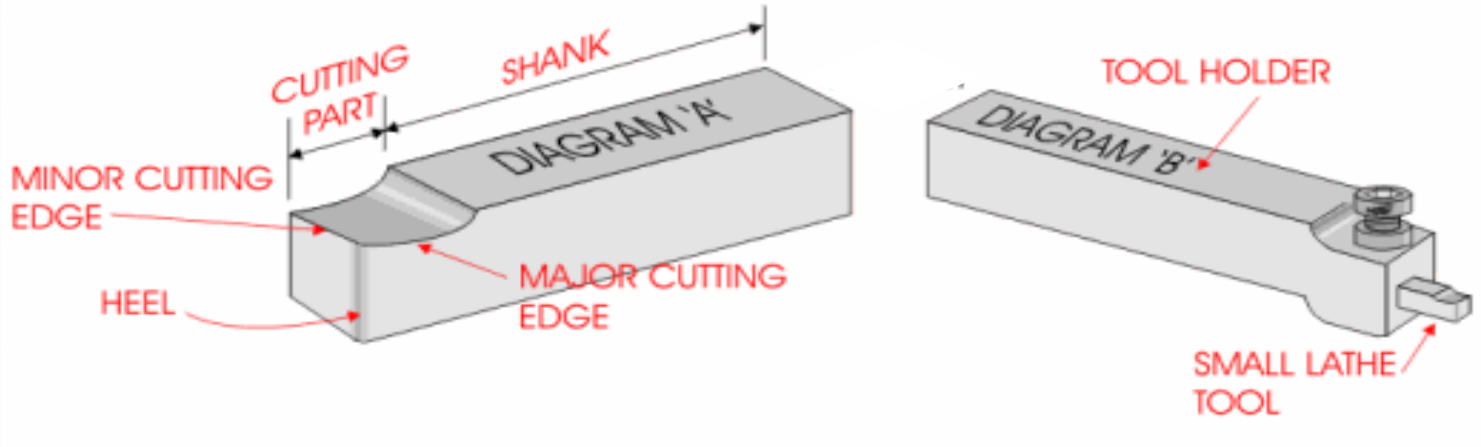


- Used for holding cutting tool bits
- Available in Right hand, left hand and straight

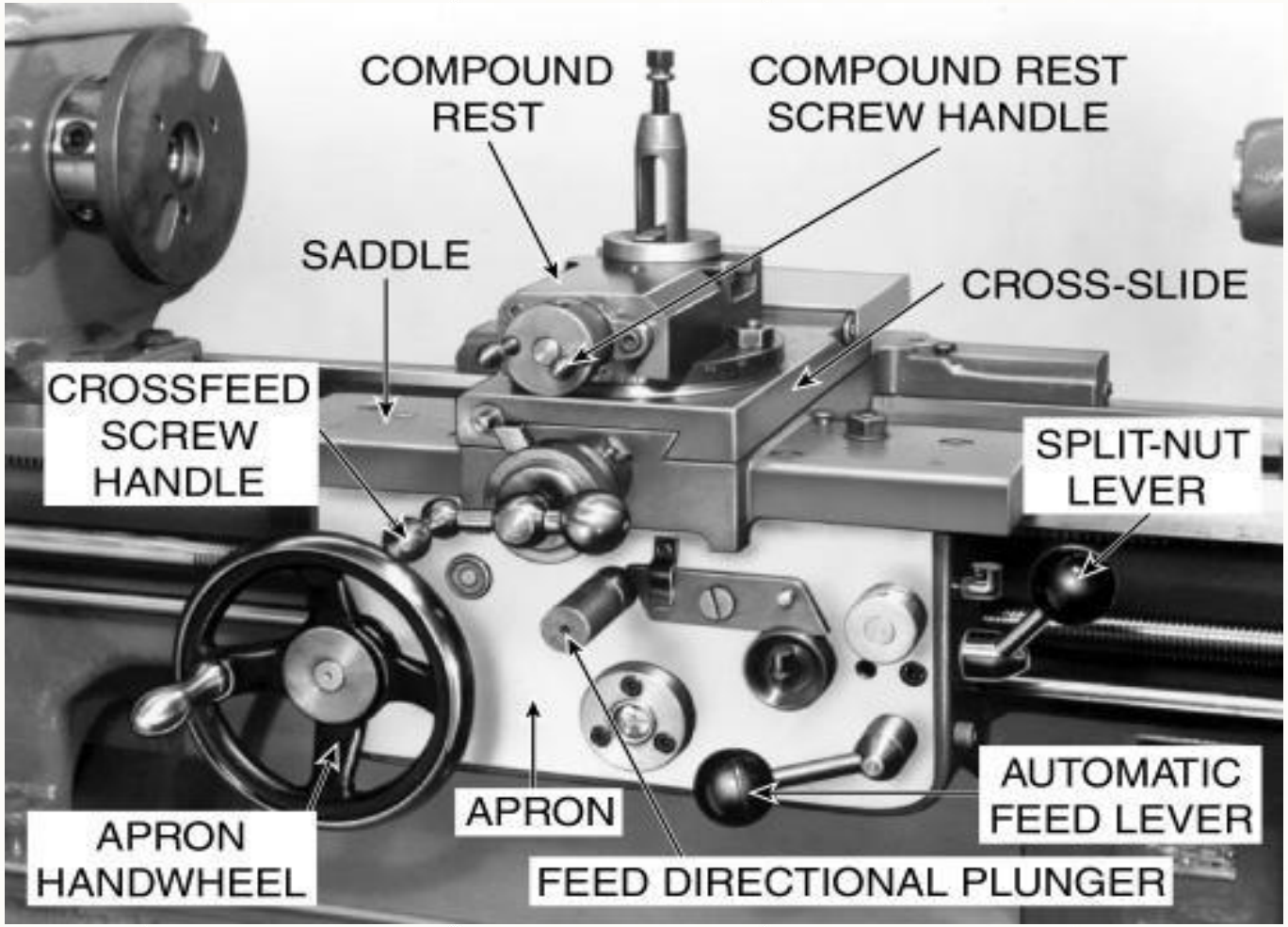
CUTTING TOOLS



- Can be High Speed Steel held in tool holders
- Can be also Ceramic (Tungsten carbide) bits held directly in toolpost



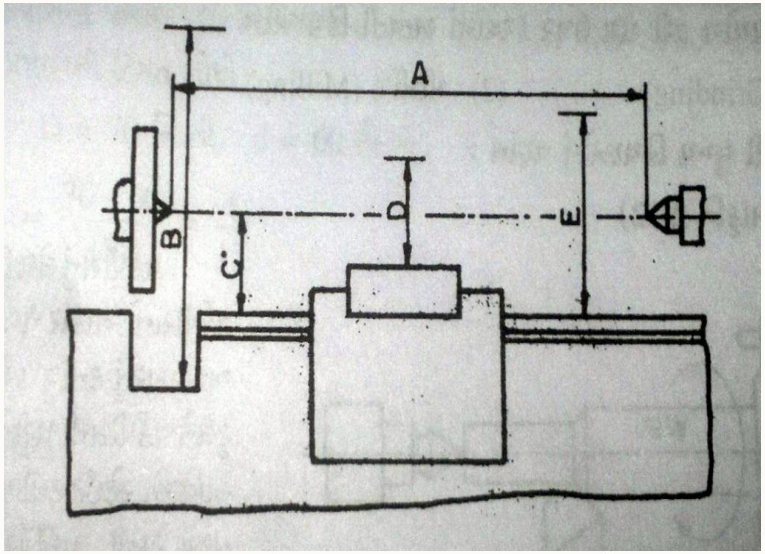
APRON MECHANISM



ACCESSORIES OF LAHTE

- Chucks :
  - Three jaw chuck
  - Four jaw chuck
  - Collet chuck
- Centres:
  - Live centre
  - Dead centre
  - Tipped centre
  - Ball centre
- Mandrels :
  - Plain mandrel
  - Stepped mandrel
  - Collared mandrel
  - Screwed mandrel

SPECIFICATION OF LATHE



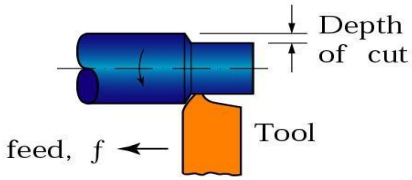
- Height of the centre : “C”
  - Vertical distance between the lathe bed &the centre line of the lathe spindle.
- Swing diameter over bed :
  - Largest diameter of the work that can be revolved without touching bed.
  - Equal to 2C.
- Length between centre : “A”
  - Max. length of work piece that can be set between centers.
- Swing dia. Over carriage : “D”
  - Largest dia. of work piece that can be revolved over the lathe saddle.
- Max. bar dia. :
  - Max. dia. Of bar stock that pass through the hole of head stock
- Length of bed :
  - Total length of guide ways provided on the bed.

LATHE OPERATIONS

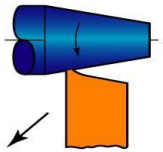
- Straight turning
- Taper turning
- Facing
- Chamfering
- Thread cutting
- Grooving
- knurling
- Under cutting
- Filing
- Spinning
- Forming
- Polishing
- Solder turning
- Spring winding
- Boring
- drilling

LATHE OPERATIONS

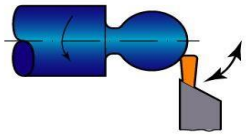
(a) Straight turning



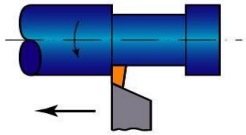
(b) Taper turning



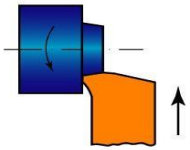
(c) Profiling



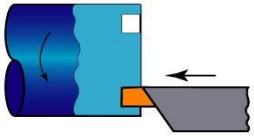
(d) Turning and external grooving



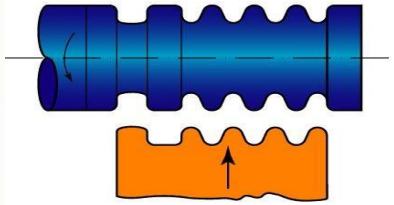
(e) Facing



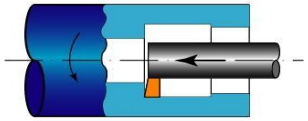
(f) Face grooving



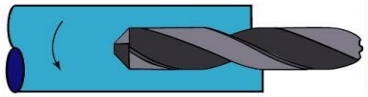
(g) Cutting with a form tool



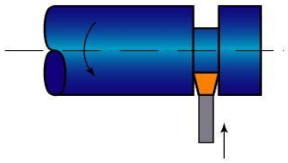
(h) Boring and internal grooving



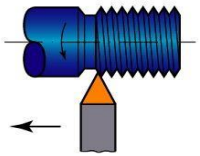
(i) Drilling



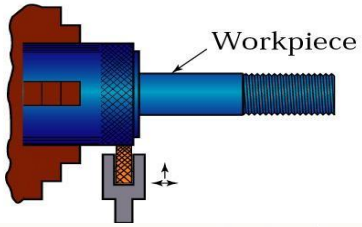
(j) Cutting off



(k) Threading



(l) Knurling



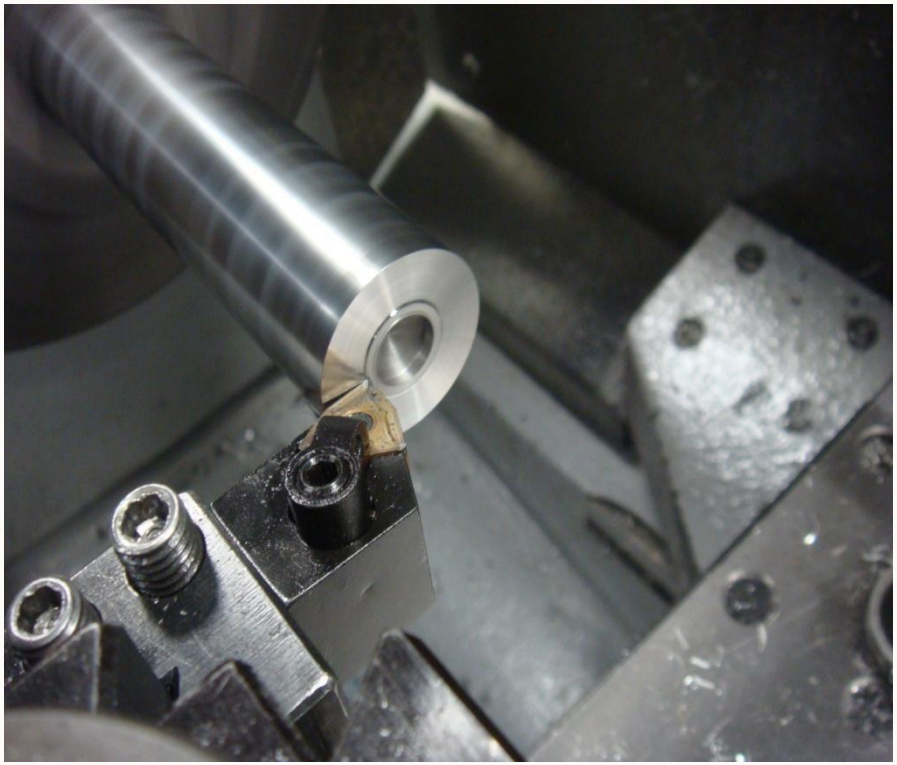
LATHE OPERATIONS

- Turning: to remove material from the outside diameter of a workpiece to obtain a finished surface.
- Facing: to produce a flat surface at the end of the workpiece or for making face grooves.
- Boring: to enlarge a hole or cylindrical cavity made by a previous process or to produce circular internal grooves.
- Drilling: to produce a hole on the workpiece.
- Reaming: to finishing the drilled hole.
- Threading: to produce external or internal threads on the workpiece.
- Knurling: to produce a regularly shaped roughness on the workpiece.

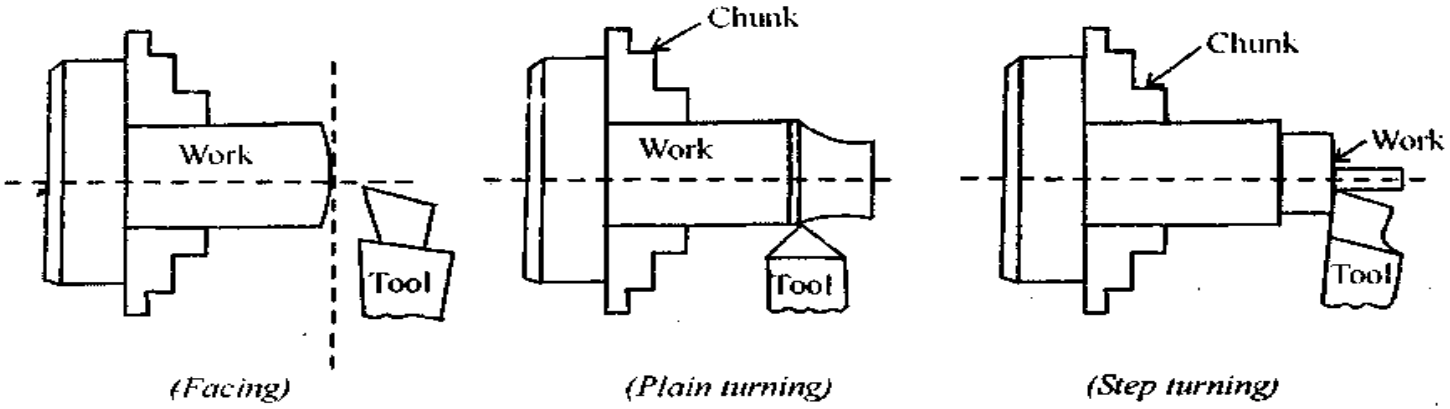
STRAIGHT TURNING

- Work piece become cylindrical.
- Motion of tool is parallel to the work piece surface.

FACING



- To make side surface perpendicular via cutting tool
- Motion of tool is perpendicular to the work piece surface.

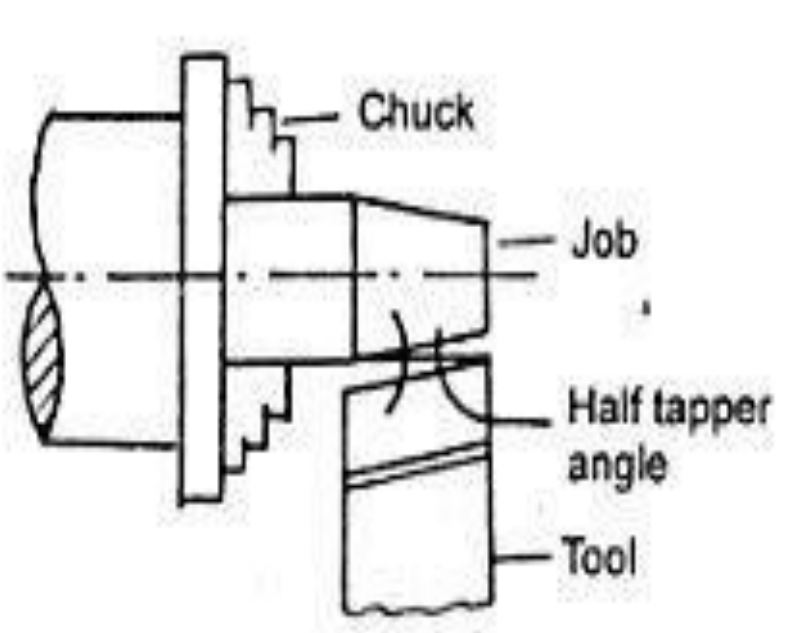


TAPER TURNING

- Dia. of cylindrical work piece decreasing or increasing gradually is called as taper turning.

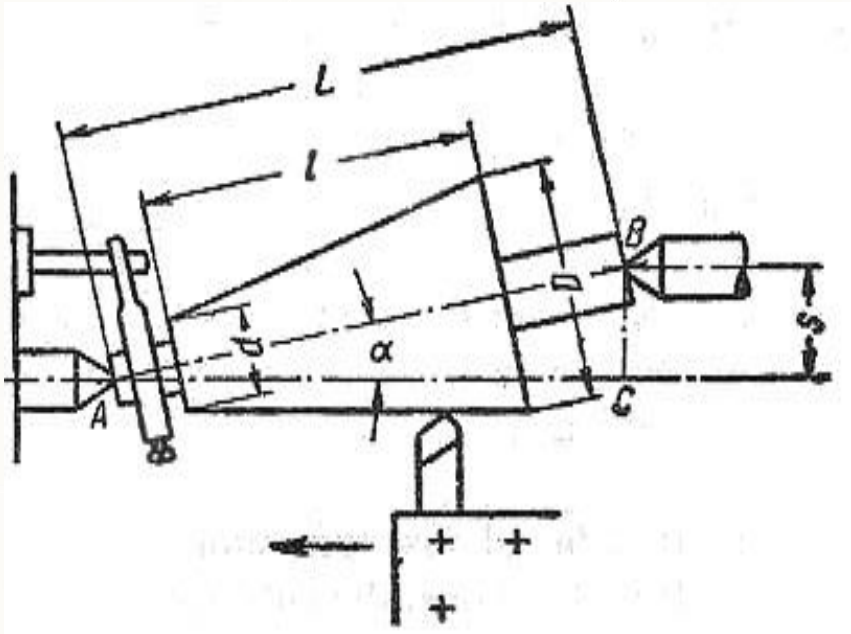
- Types of taper turning:
  - By using form tool.
  - By setting over tailstock center.
  - By swiveling the compound rest.
  - By using taper turning attachment.

TAPER TURNING BY USING FORM TOOL



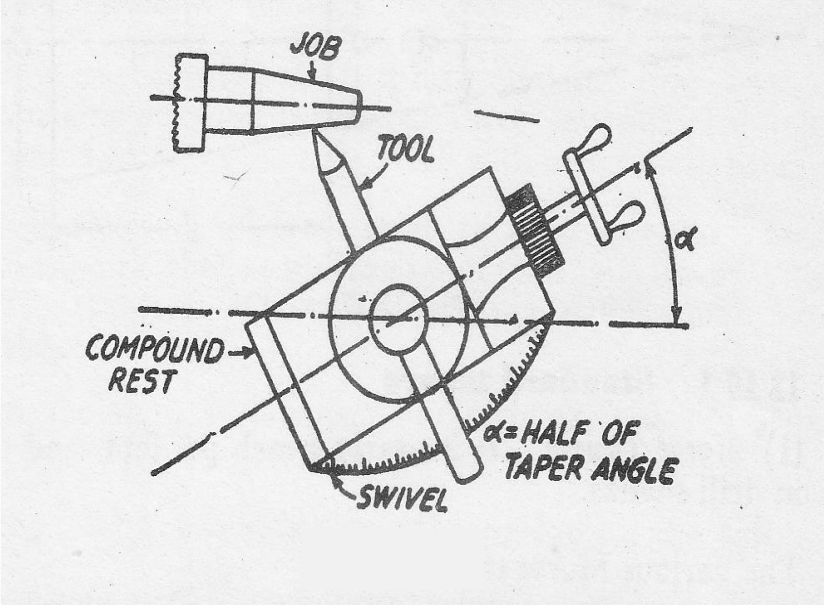
- A broad nose form tool having straight cutting edge makes half taper angle with the axis of work.
- The toll is fed right angle to the work axis.
- Work is held in chuck or face plate.
- Use to turn short length of taper only.

TAPER TURNING BY SETTING OVER TAIL STOCK CENTRE.



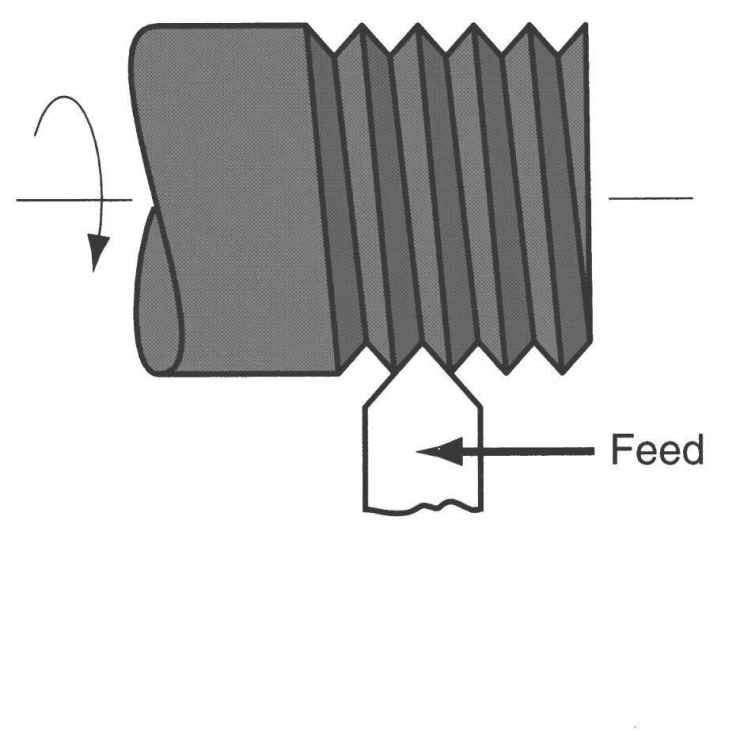
- The method is suitable when the work is held betn the centers.
- The work pieces is rotated at an angle to the lathe axis and tool fed parallel to the lathe axis.
- Desired conical surface obtained.
- Use to turn small external taper in long work piece.

TAPER TURNING BY SWIVELING THE COMPOUND REST



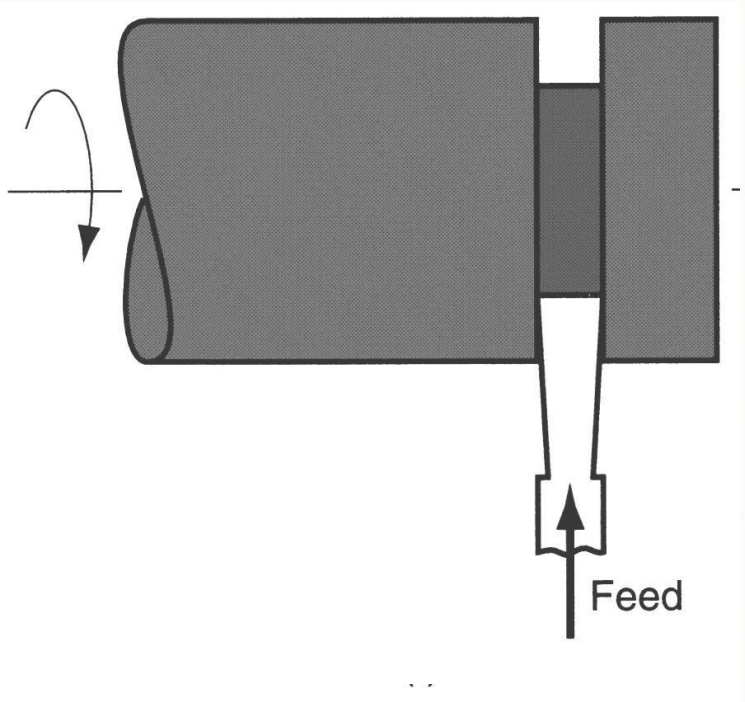
- The work pieces is rotated at lathe axis and tool is fed at an angle to the axis of rotation of work piece.
- Tool is mounted on compound rest.
- The tool can be fed at angle of compound slide as compound rest is mount at half taper angle.

THREADING



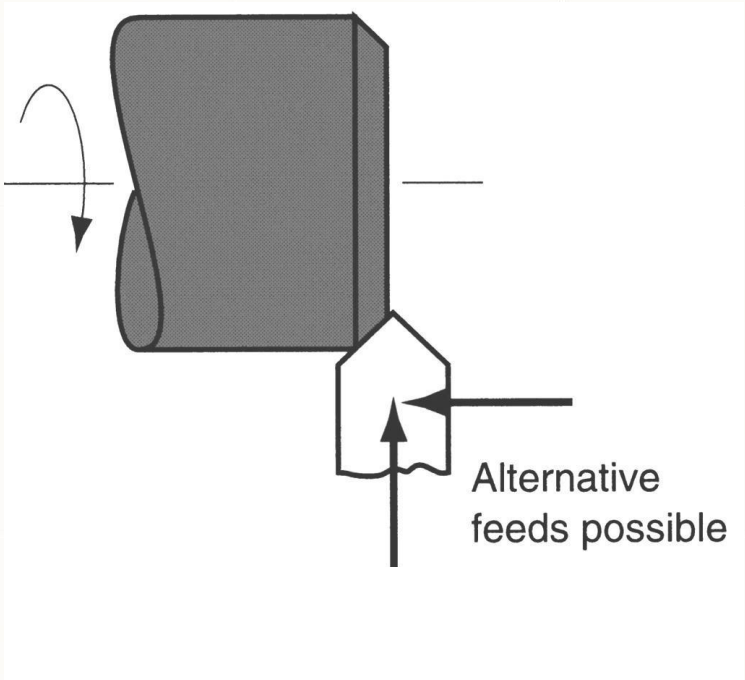
- Pointed form tool is fed linearly across surface of rotating work part parallel to axis of rotation at a large feed rate, thus creating threads.

GROOVING



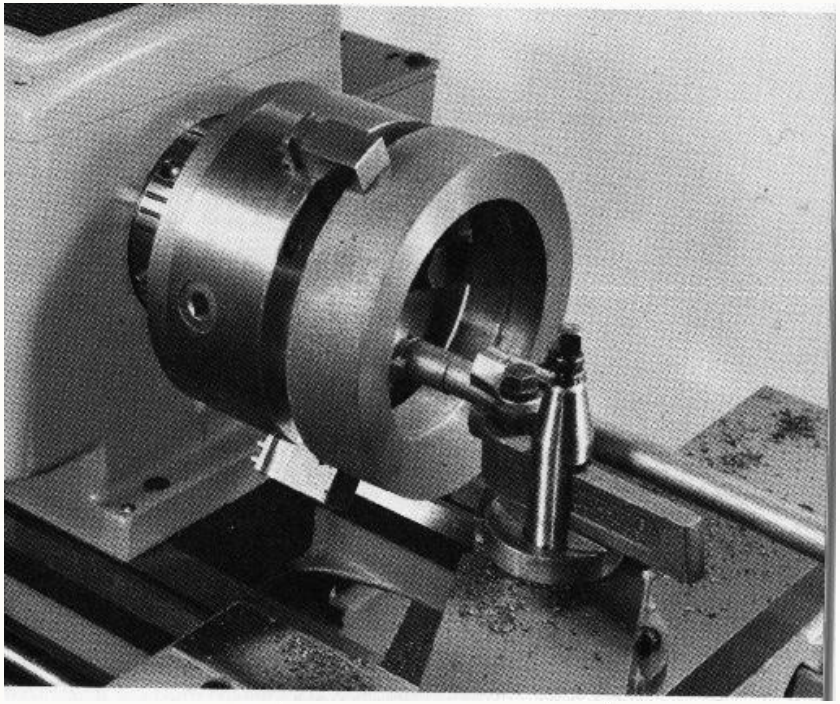
- Tool is fed radially into rotating work at some location to cut off end of part, or provide a groove.

CHAMFERING



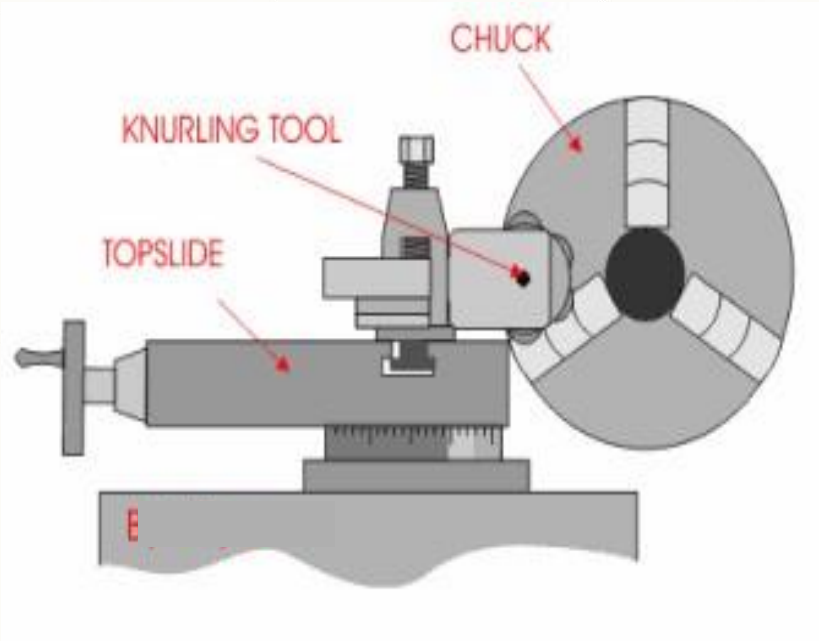
- Cutting edge cuts an angle on the corner of the cylinder, forming a "chamfer"

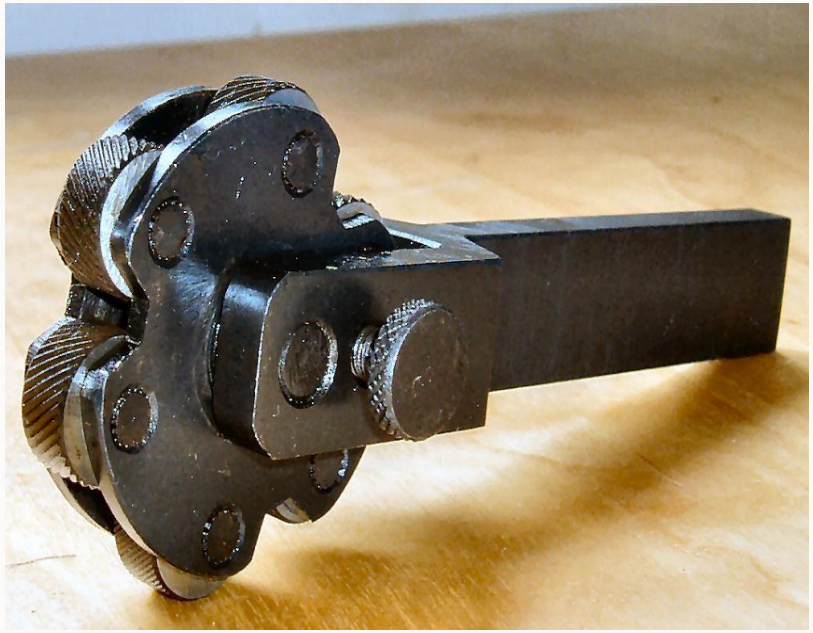
BORING

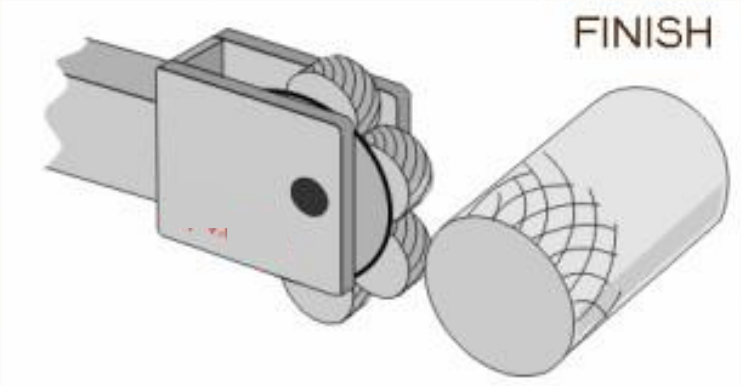


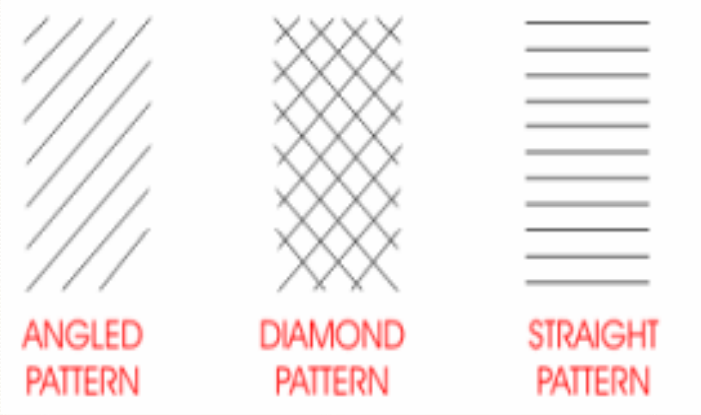
- Boring produces circular internal profiles in hollow work pieces
- Boring mills are used for large work pieces
- Holes can be bored up to 20M if needed
- Machines are available with a variety of features
  - Horizontal boring machines
  - Jig borers

KNURLING


CHUCK
KNURLING TOOL
TOPSLIDE




FINISH

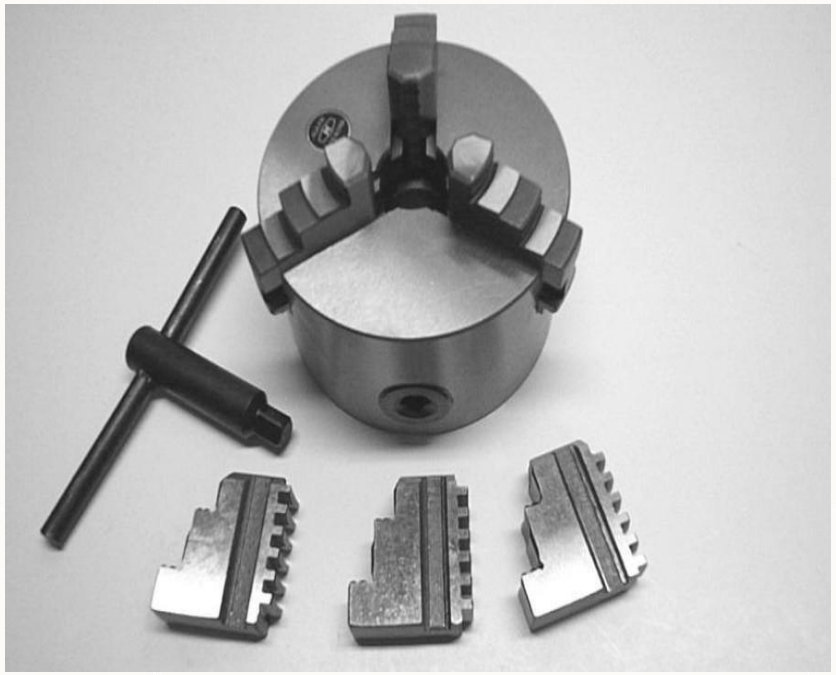

ANGLED PATTERN
DIAMOND PATTERN
STRAIGHT PATTERN

WORK HOLDING DEVICES

- Four jaw independent chuck :
  - Used to hold square, rectangular regular & irregular shapes of work pieces.
  - Initially to set the work piece it takes more time.
  - This chuck includes four independent jaws
- Four square holes on circumference of the body
  - By using key jaw can be taken in or out independently.

WORK HOLDING DEVICES

- Three jaw universal or self centering chuck :
  - Three jaws and three square slots or holes are provided on the circumference of the body.
  - By inserting the key in any one slot, all jaws can be moved simultaneously.
  - Speedy centering of the workpiece.
  - Cannot hold large size of workpiece.



WORK HOLDING DEVICES

- Combination chuck :
  - Jaws can be moved in and out simultaneously or independently.
  - Advantages of both the varieties in this chuck, so it is called combination.
  - Scroll plate is used to move the jaws simultaneously.
  - A screw is used for independent movement.

WORK HOLDING DEVICES

- Magnetic chuck :
  - Used to hold thin work pieces which can’t hold by chuck.
  - An electro magnet or permanent magnet provides the holding power.
  - In all position flux passes through the workpiece and holds.

WORK HOLDING DEVICES

- Collet chuck :
  - In production shop speedy and accurate centering of workpiece is necessary.
  - Hence to hold the bar stock collet chuck is used.
  - Outer portion of collet is tapered.

WORK HOLDING DEVICES

- Drill chuck :
  - Used for drilling, reaming, tapping operations.
  - It is held in the sleeve of the tail stock or spindle of the headstock.
  - It contains key operated centering jaws for holding the tool.

WORK HOLDING DEVICES

- Lathe centers :
- Work to be turned between centers must have center hole drilled in each end.
  - Provides bearing surface
- Support during cutting.
- Most common have. solid Morse taper shank 60° centers, steel with carbide tips.
- Care to adjust and lubricate occasionally.

WORK HOLDING DEVICES

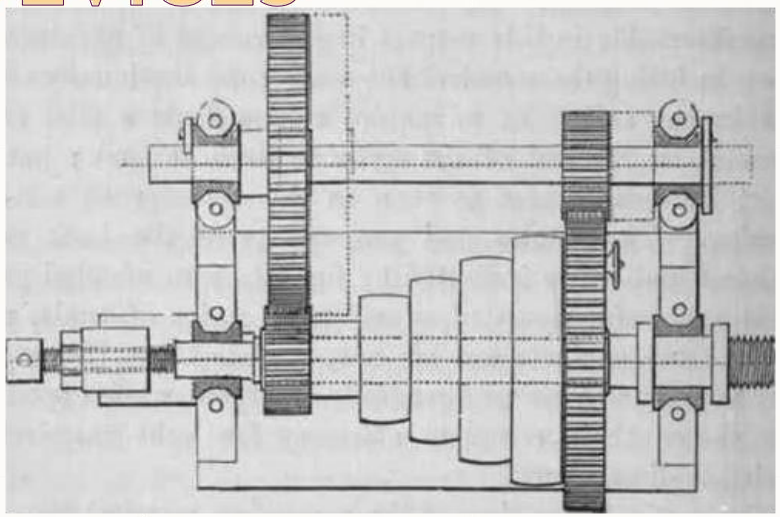
- Steady rest :
  - The base is made up of cast iron.
  - It is clamp on the lathe bed where the workpiece is to be supported.
  - Three jaws are provided.
  - All jaws can be radially moved with independent screw.

WORK HOLDING DEVICES

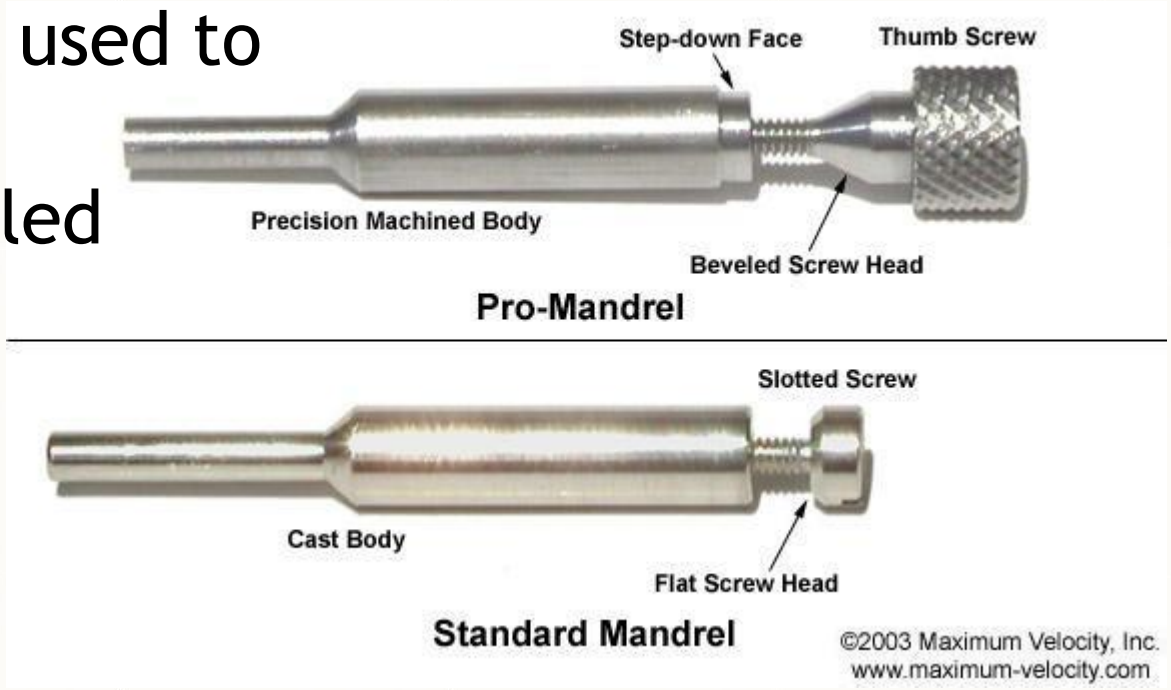
- follower rest :
  - It is “c” type in shape.
  - Two adjustment jaws to support the workpiece.
  - It is fitted on the rear portion of the carriage by bolt, hence it moves along with the carriage.
  - Used during the finishing operations or for carrying out turning along the entire length of the jaw.

WORK HOLDING DEVICES

- Mandrels :
  - Plain Mandrel
  - Collared Mandrel
  - Screwed Mandrel
  - Stepped Mandrel

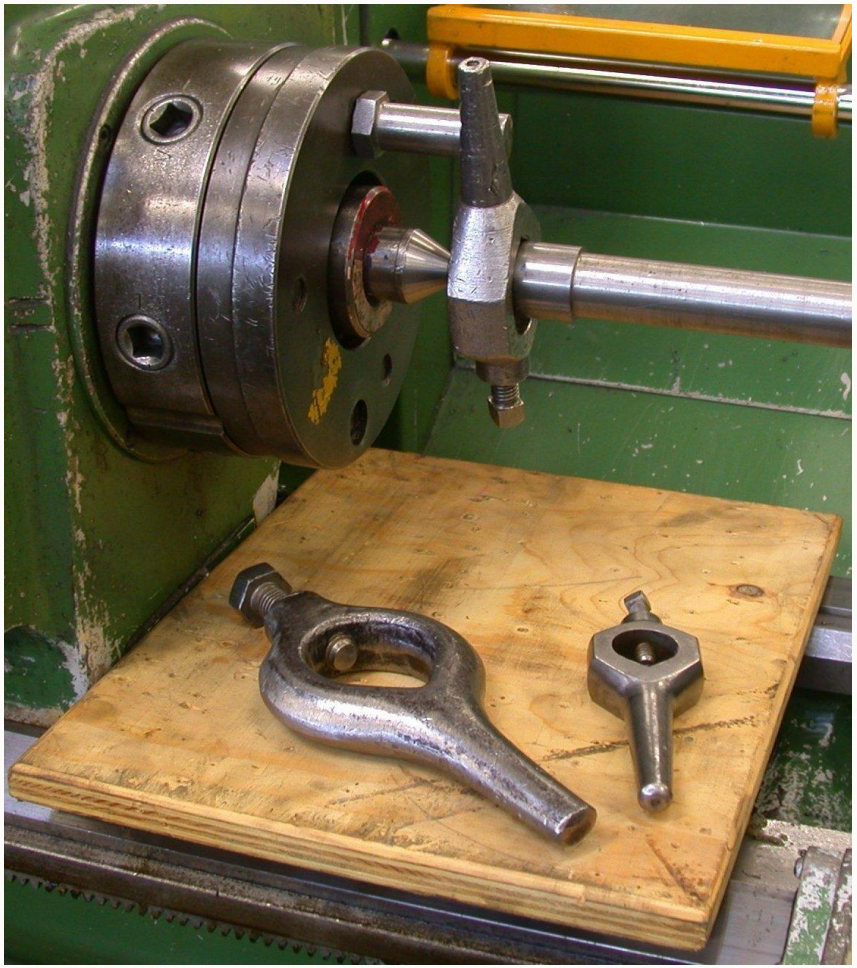


- Mandrels is used to held the hollow/drilled w/p.



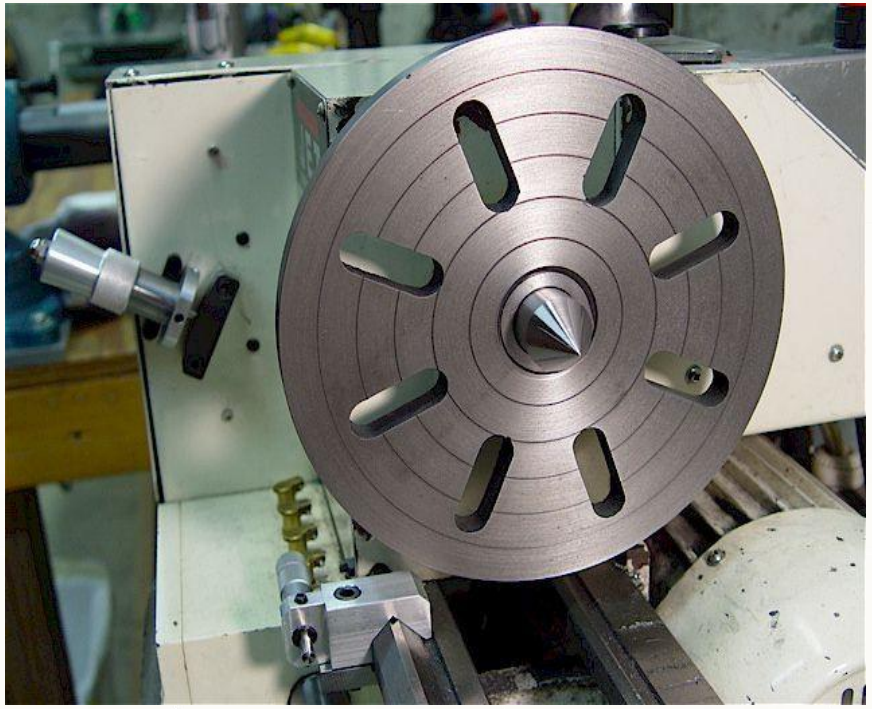
WORK HOLDING DEVICES

- Lathe dogs :
  - Lathe dogs are cast metal devices used to provide a firm connection between the headstock spindle and the w/p mounted between centres.



WORK HOLDING DEVICES

- Lathe face plate :
  - A lathe face plate is a flat round plate that threads to the headstock spindle to the lathe.
  - The faceplate is used for irregularly shaped w/p that cannot successfully held by chucks.



CONCLUSION

- Lathes are normally robust in construction and they will, with good care, last for many years. It is not unusual for instance to see good lathes still in uses that are 50 years old. To ensure good, accurate, trouble free use it is necessary that the correct maintenance routines are regularly carried out and that important surfaces such as slide-ways are kept well protected so as to reduce wear and thus maintain good accuracy, and the lubricants used, are all factors that require your attention.


Thank You!