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Ch-2
Metal Cutting Lathes

Subject:- MP **Code:-3141908**	**Prepared by:** **Asst.Prof.Harin Prajapati** **(Mechanical Department,ACET)**	AMIRAJ COLLEGE OF ENGINEERING & TECHNOLOGY

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What is Lathes?

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

- A rope wound round the work with its own end attached to a flexible branch of tree and other end being pulled by man caused job to rotate intermittently. With its further development a strip of wood called “lath” was used to support the rope and that is how the machine came to be known as “lathe”.

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

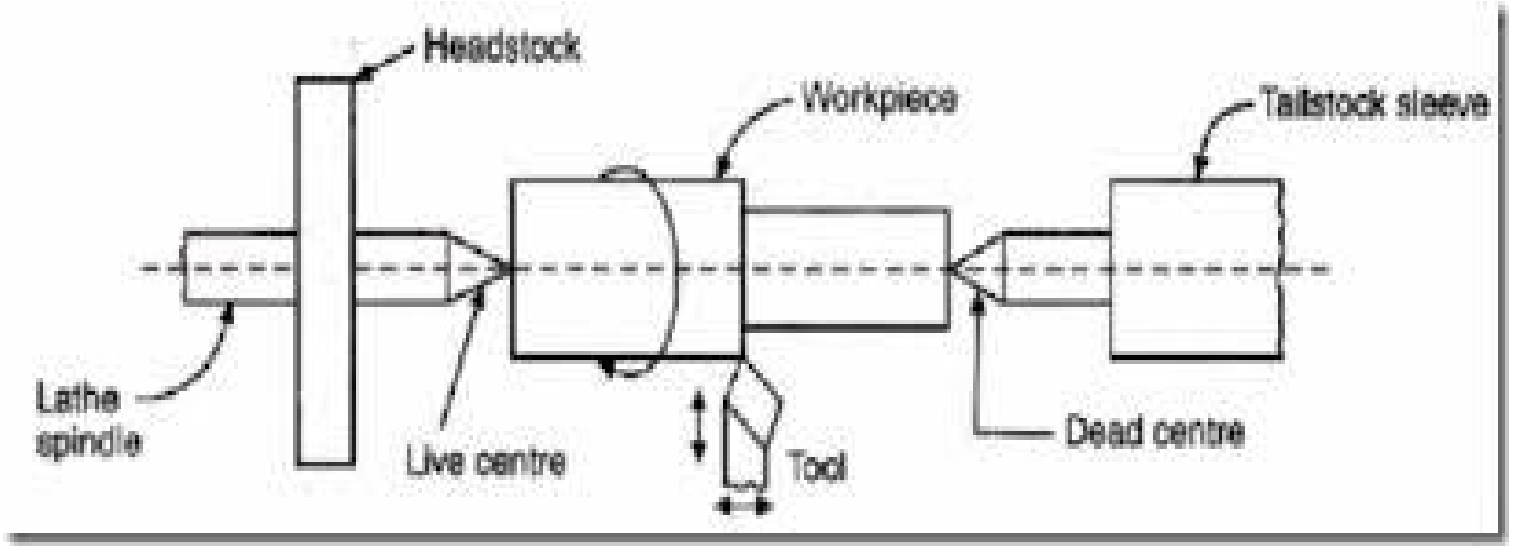
- Lathe machine is also known as “the mother/father of the entire tool family”.

INVENTOR OF CENTRE LATHE

- Henry Maudsley was born on an isolated farm near Gigghleswick in North Yorkshire and educated at University Collage London. He was an outstandingly brilliant medical student, collecting ten Gold Medals and graduating with an M.D. degree in 1857.

Henry Maudsley

LATHE PRINCIPALE



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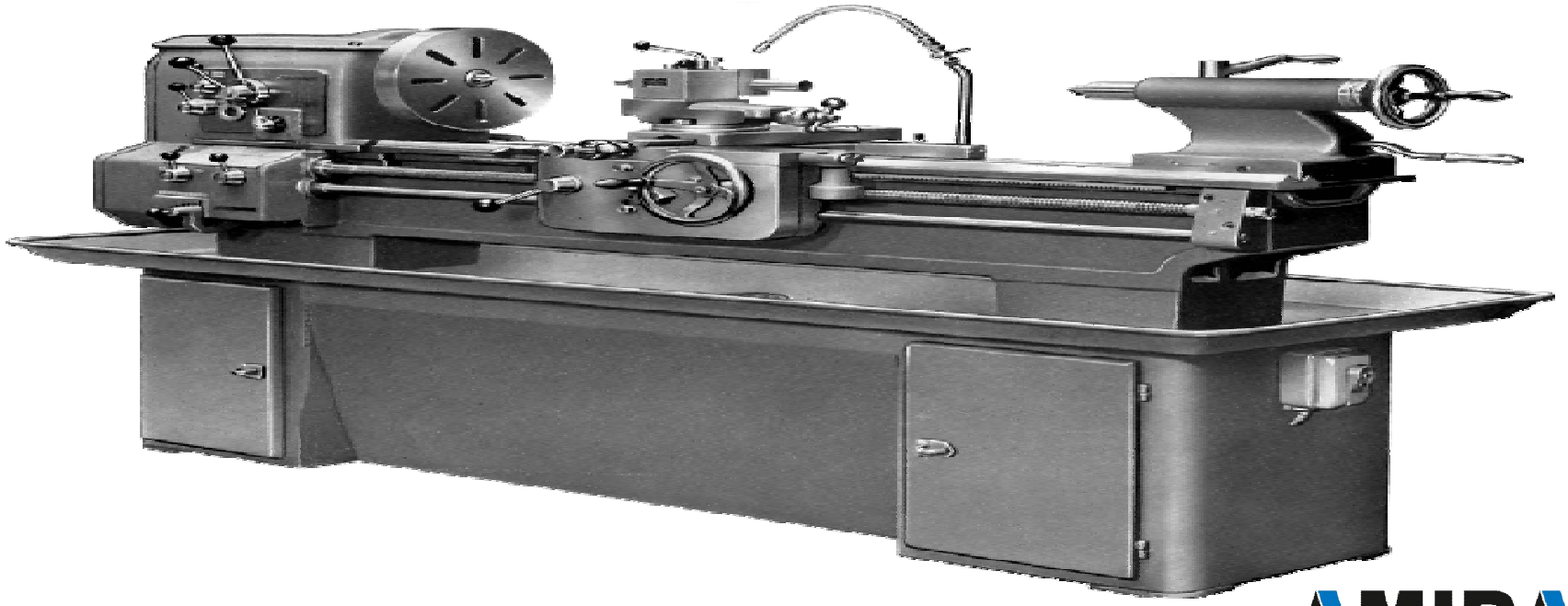
Types of Lathes?

1. ENGINE LATHE
2. BENCH LATHE
3. TRACER LATHE
4. TOOL ROOM LATHE
5. AUTOMATIC LATHE
6. TURRET LATHE
7. COMPUTER CONTROLLED LATHE

1. ENGINE LATHE

- This term ‘engine’ is associated with the lathe owing to the fact that early lathes were driven by steam engine. It is also called centre lathe. The most common form of lathe, motor driven and comes in large variety of sizes and shapes.



1. ENGINE LATHE

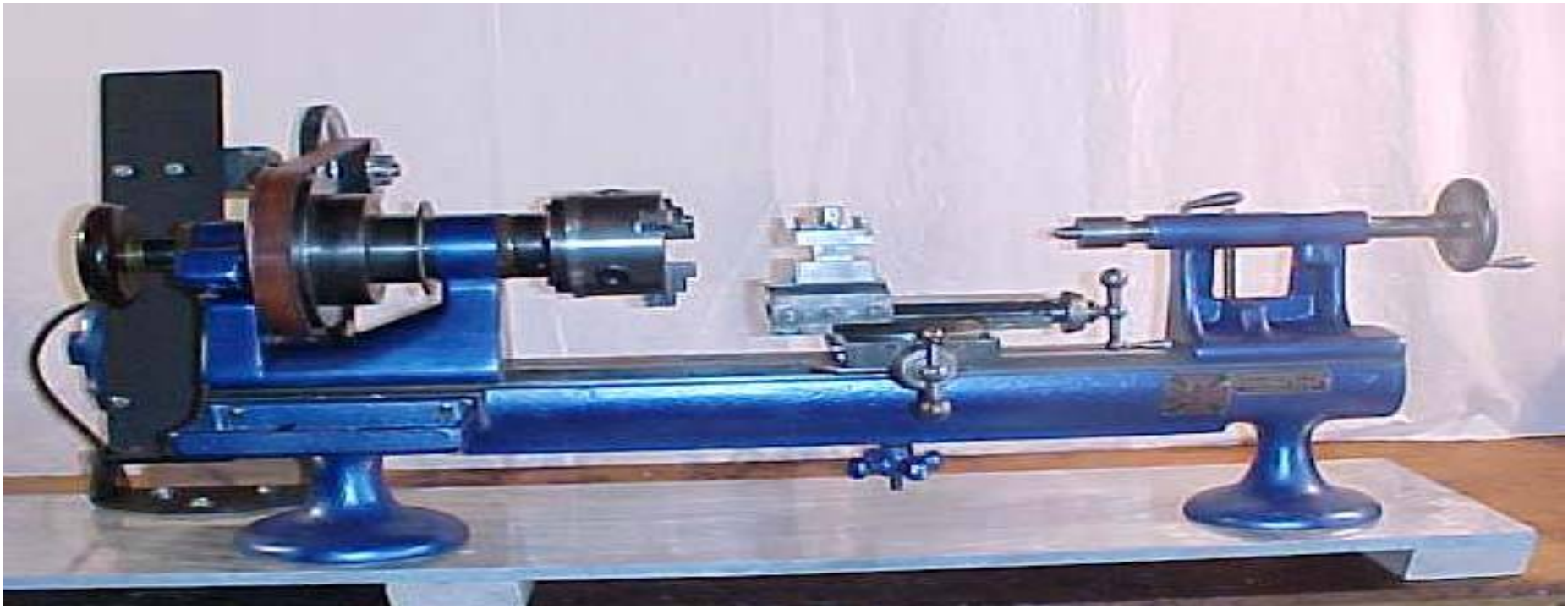
➢Engine lathes are classified according to the various designs of headstock and methods of transmitting power to the machine.

1. Belt Driven Lathe
2. Motor Driven Lathe
3. Gear Head Lathe

➢ The power to the engine lathe spindle may be given with the help of a belt drive from an overhead line shaft but most modern machines have a captive motor with either a cone pulley driven or an geared headstock arrangement.

2. BENCH LATHE

- A bench top model usually of low power used to make precision machine small work pieces.
- It is used for small w/p having a maximum swing of 250 mm at the face plate. Practically it consists of all the parts of engine lathe or speed lathe.



3.TRACER LATHE

- A lathe that has the ability to follow a template to copy a shape or contour.

4.TOOL ROOM LATHE

- A tool room lathe having features similar to an engine lathe is much more accurately built and has a wide range of spindle speeds ranging from a very low to a quite high speed up to 2500 rpm.
- This lathe is mainly used for precision work on a tools, dies, gauges, and in machining work where accuracy is needed.
- This lathe machine is costlier than an engine lathe of the same size.

5. AUTOMATIC LATHE

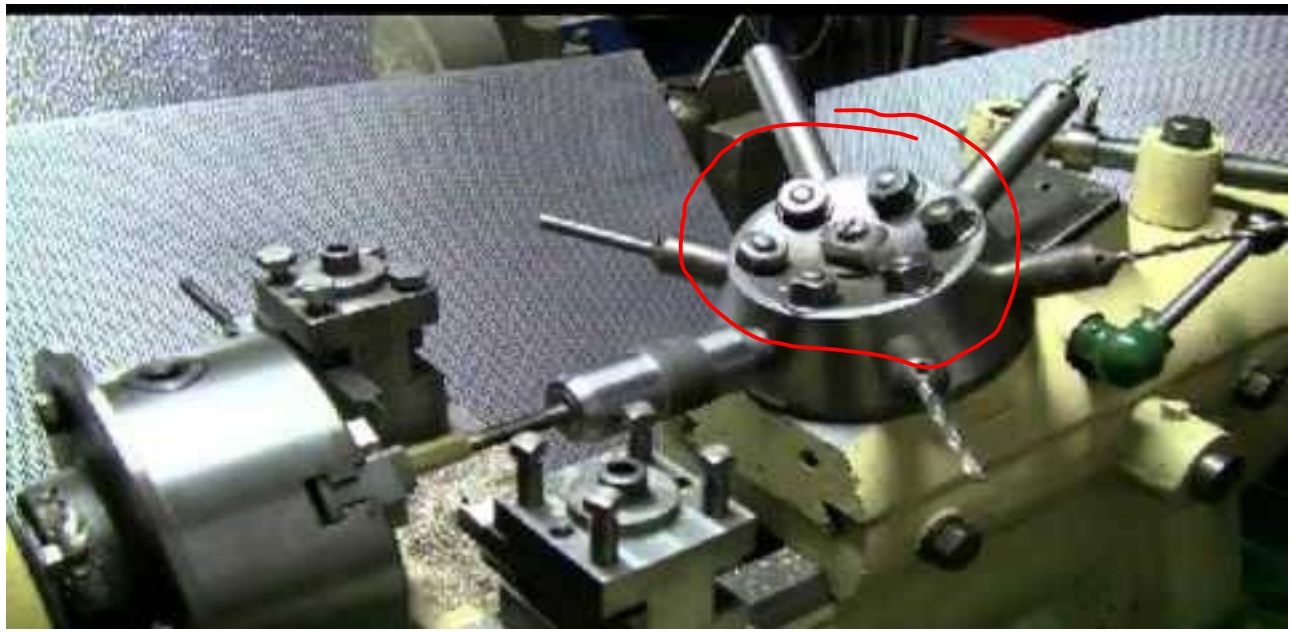
- A lathe in which the work piece is automatically fed and removed without use of an operator. It requires very less attention after the setup has been made and the machine loaded.

5. AUTOMATIC LATHE

- Once tools are set and the machine is started it performs automatically all the operations to finish the job.
- After the job is complete, the machine will continue to repeat the cycles producing identical parts.
- An operator can maintain five or six such a types of lathes at a time simply look after the general maintenance of the machine and cutting tools.

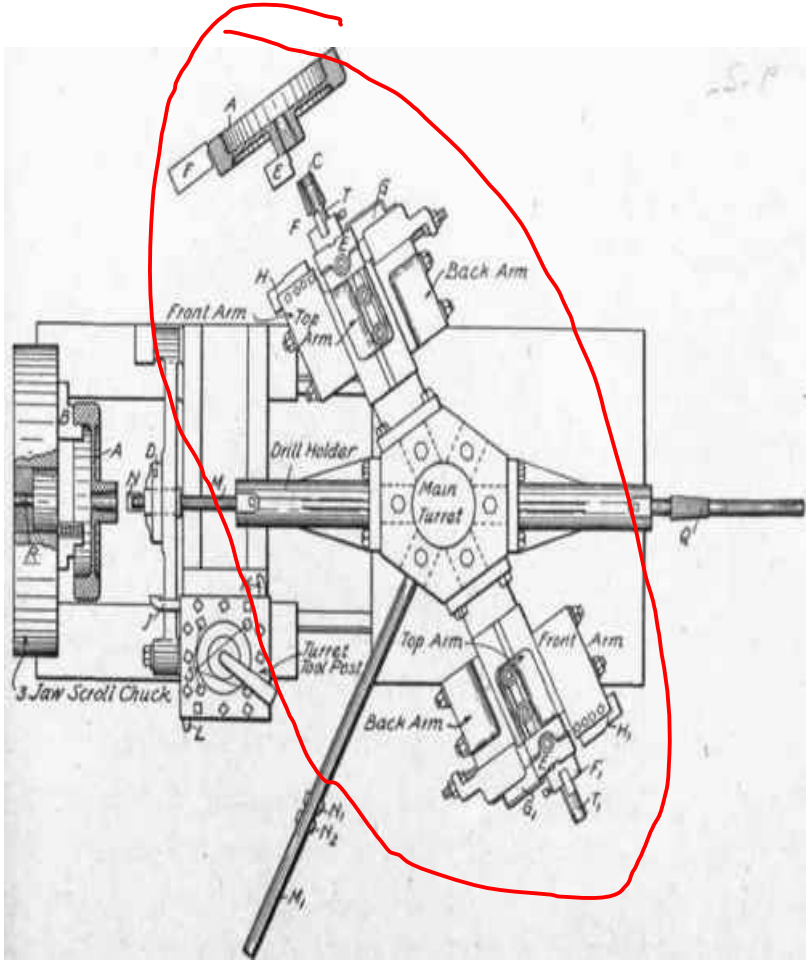
6. TURRET LATHE

- Turret lathe is the adaptation of the engine lathe where the tail stock is replaced by a turret slide(cylindrical or hexagonal). Tool post of the engine lathe is replaced by a square cross slide which can hold four tools.



6. TURRET LATHE

- It has heavier construction and provides wider range of speeds.
- The saddle carrying the turret head moves along the whole length of the bed. Much longer jobs can be machined.
- Turret head directly mounted on the saddle. The front tool post can carry 4 tools and rear tool post may have 1 or 2 tools. Turret may have4 to 6 tools.
- More than one tool may be set to operate simultaneously. There is no lead screw.



6.COMPUTER CONTROLLED LATHE

- A highly automated lathe, where both cutting, loading, tool changing, and part unloading are automatically controlled by computer coding.
- E.g. CNC Lathe M/C.(Computer Numerical Control Machine)

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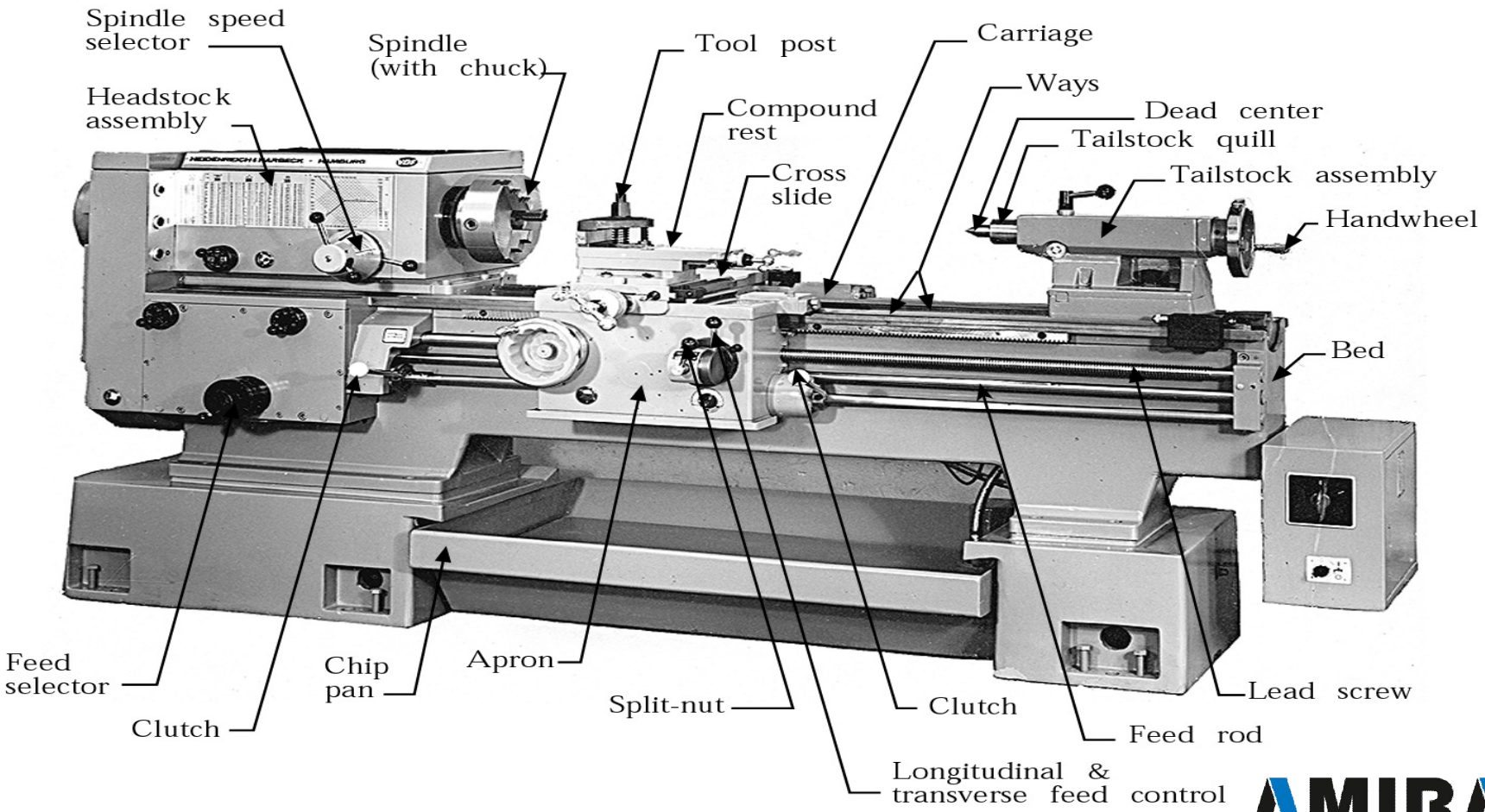
Lathe Machine



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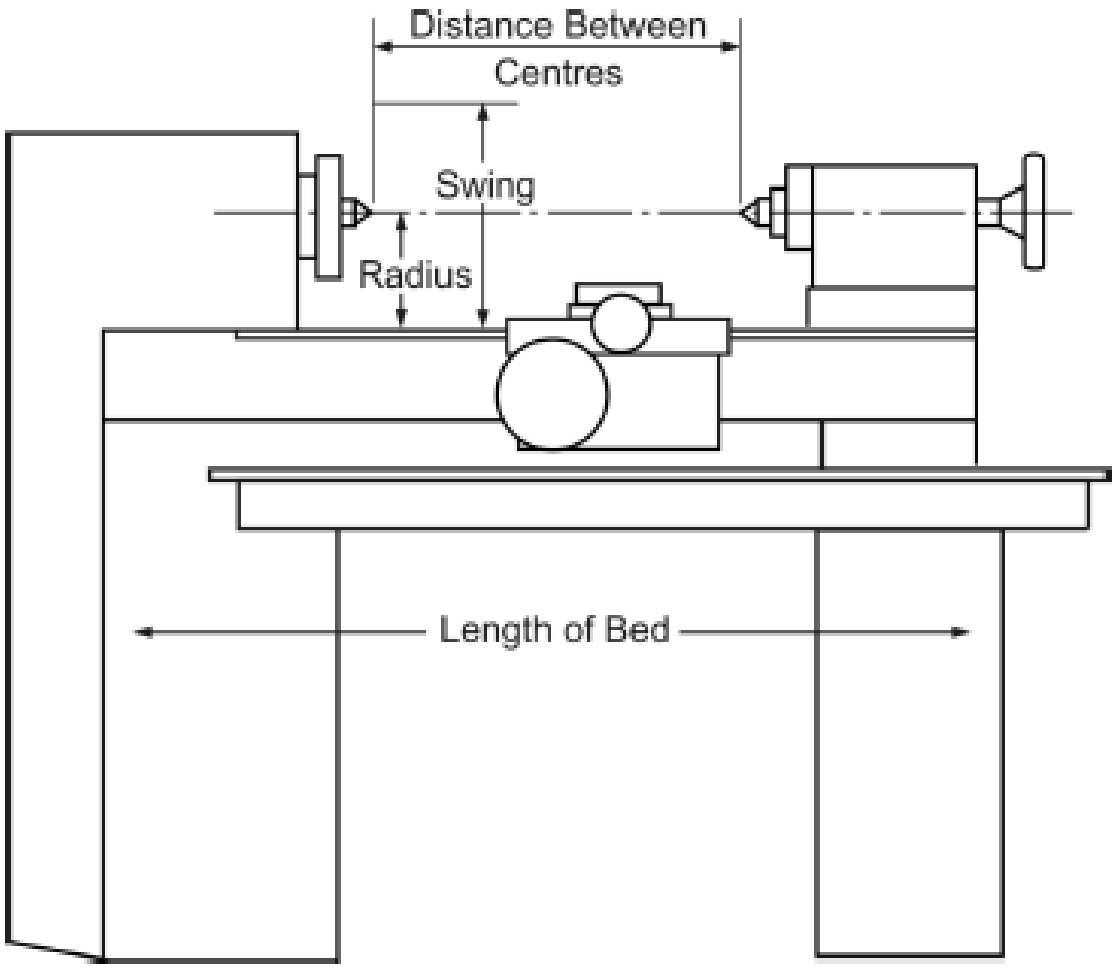
Sizing a Lathe?



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Parts of a Lathe

- The main parts of an engine lathe, that are also common to all lathes are:

- bed,
- ways,
- headstock,
- back gears,
- quick-change gearbox,
- lead screw, feed rod and rack,
- carriage and
- tailstock.

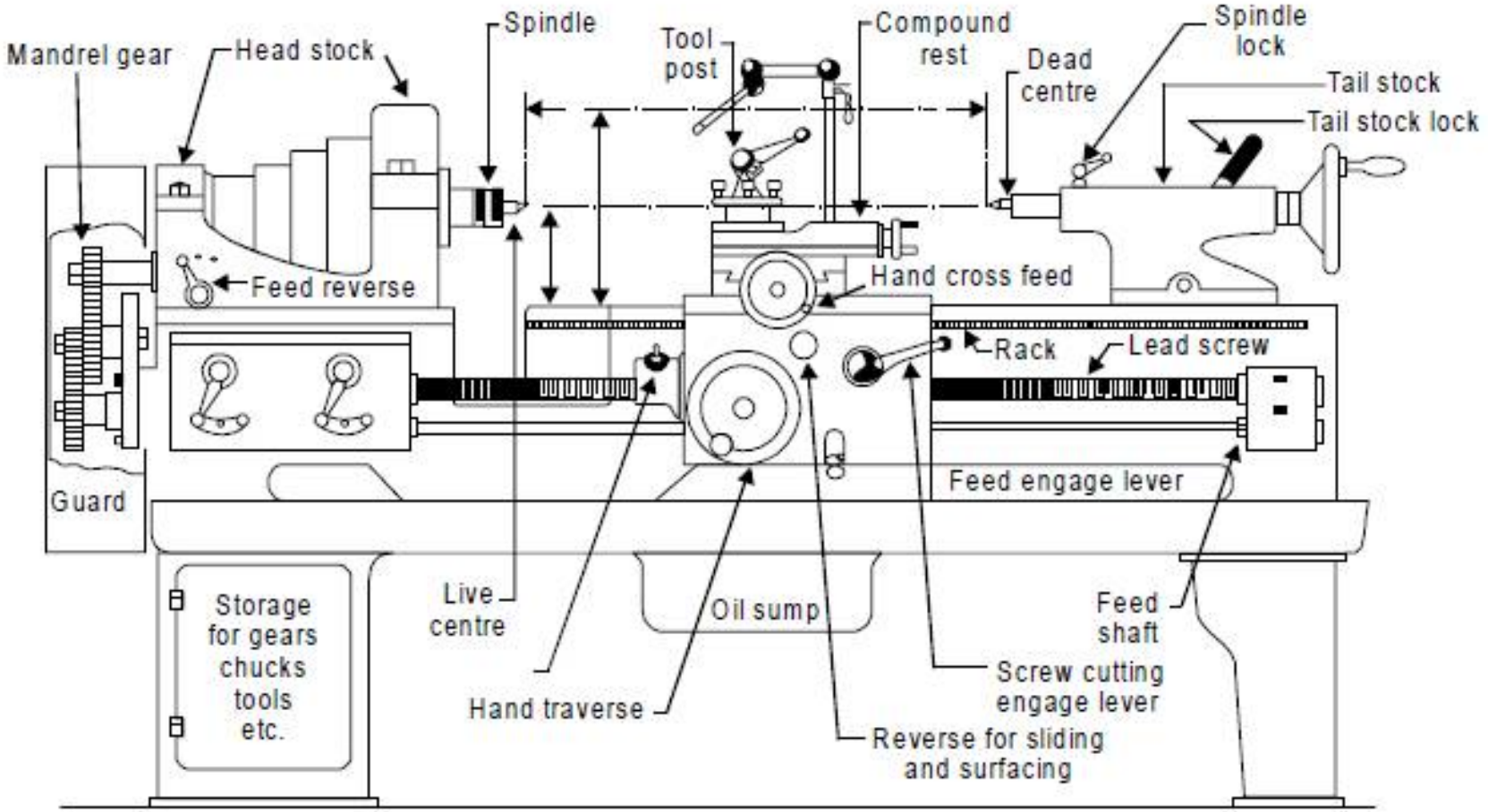
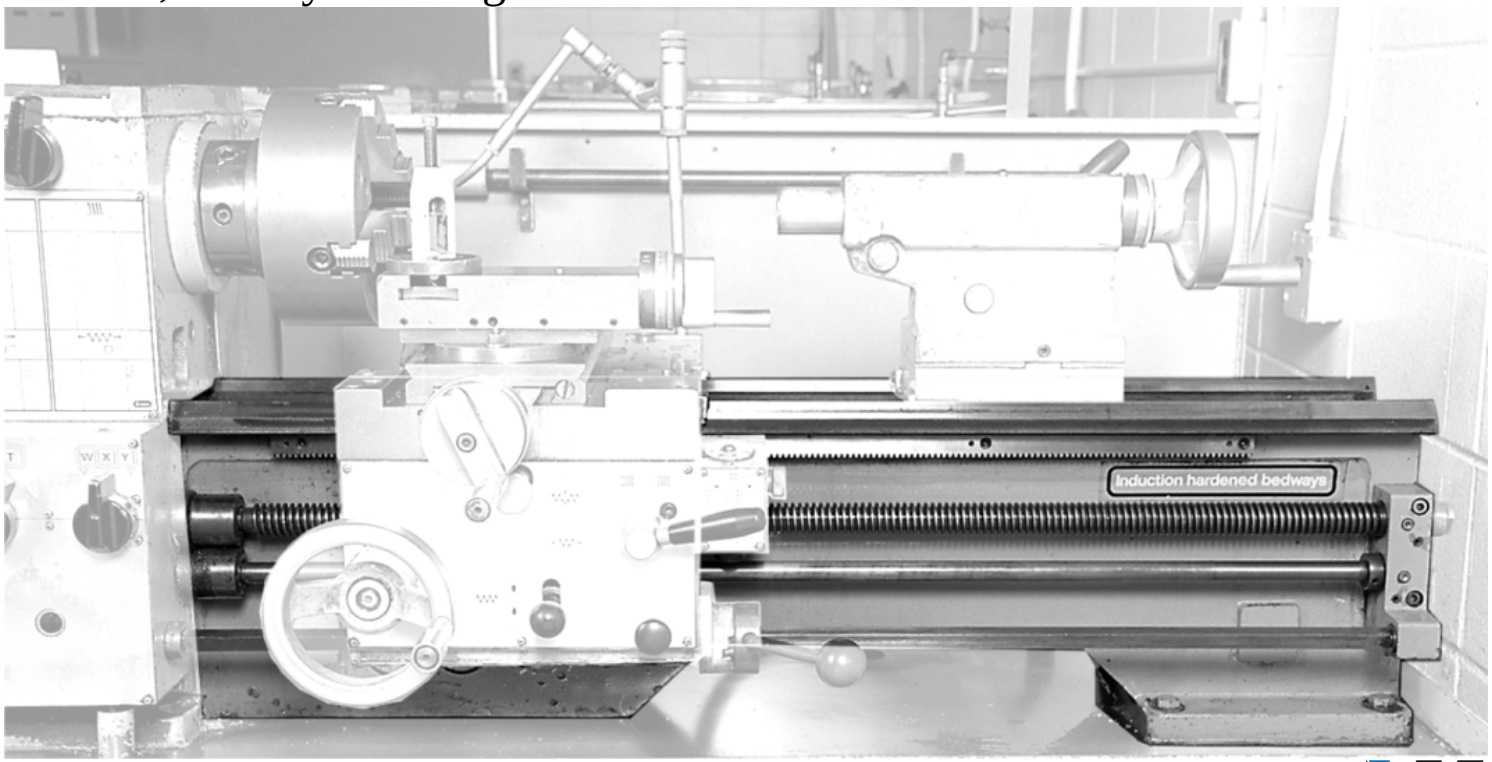


Fig. 21.3 Different parts of engine lathe or central lathe

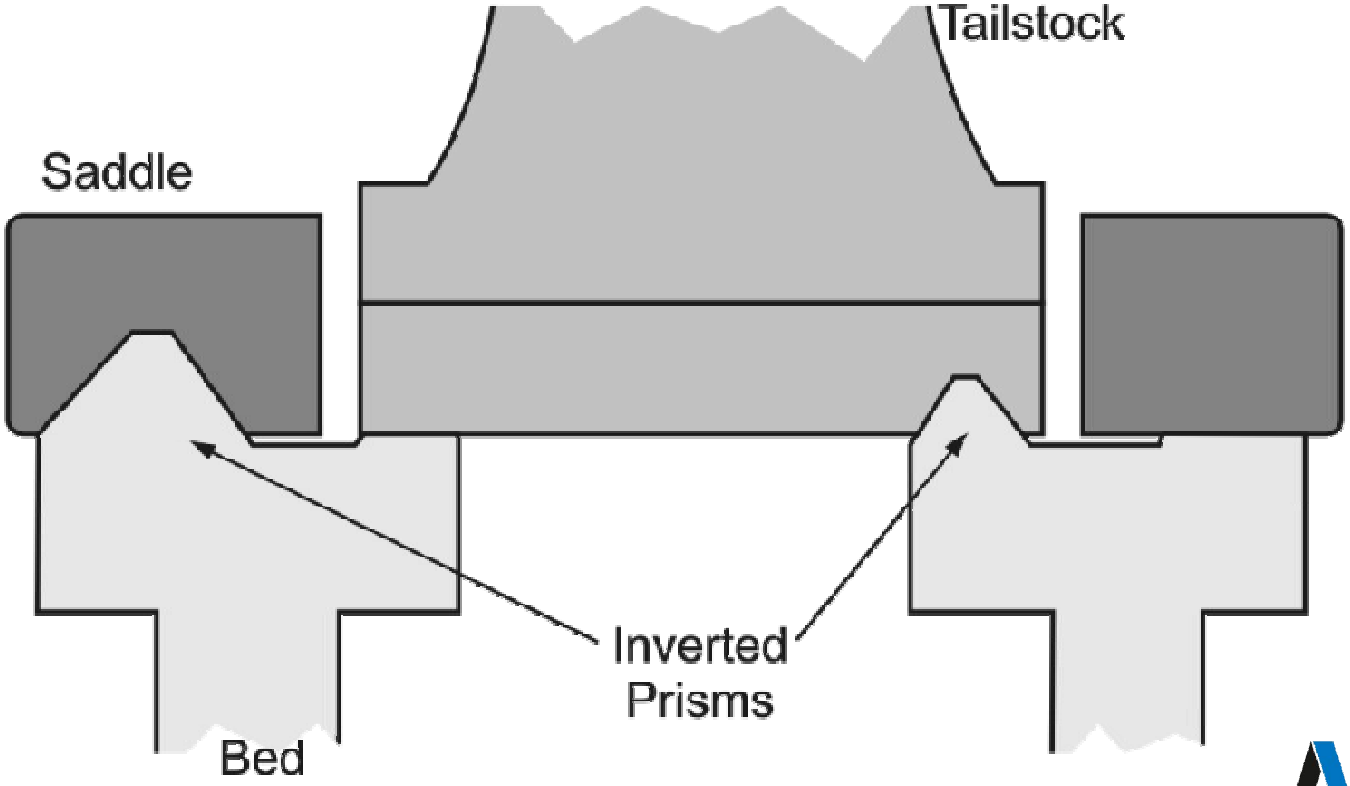
1.BED

- The bed of a lathe is a heavy iron casting (Figure). It must be strong enough to support large workpieces and rigid enough not to distort under the stress of machining. Iron is the most widely used material for beds because it dampens vibration, thereby reducing chatter.



2.WAYS

- Ways are machined on the top of the bed and are hardened to resist wear. All modern machines use an inverted prism design (Figure). There is one set of ways for the carriage and an other smaller set for the tailstock.



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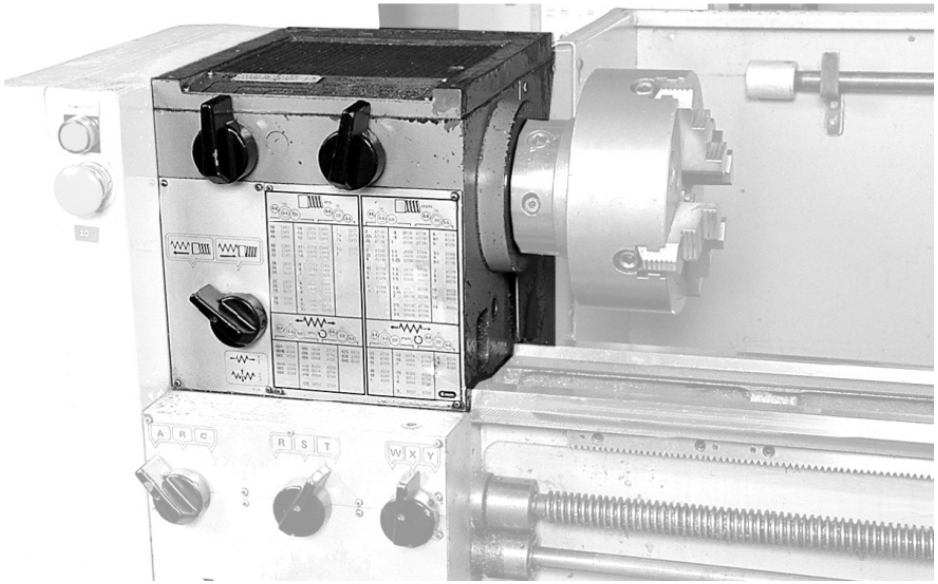
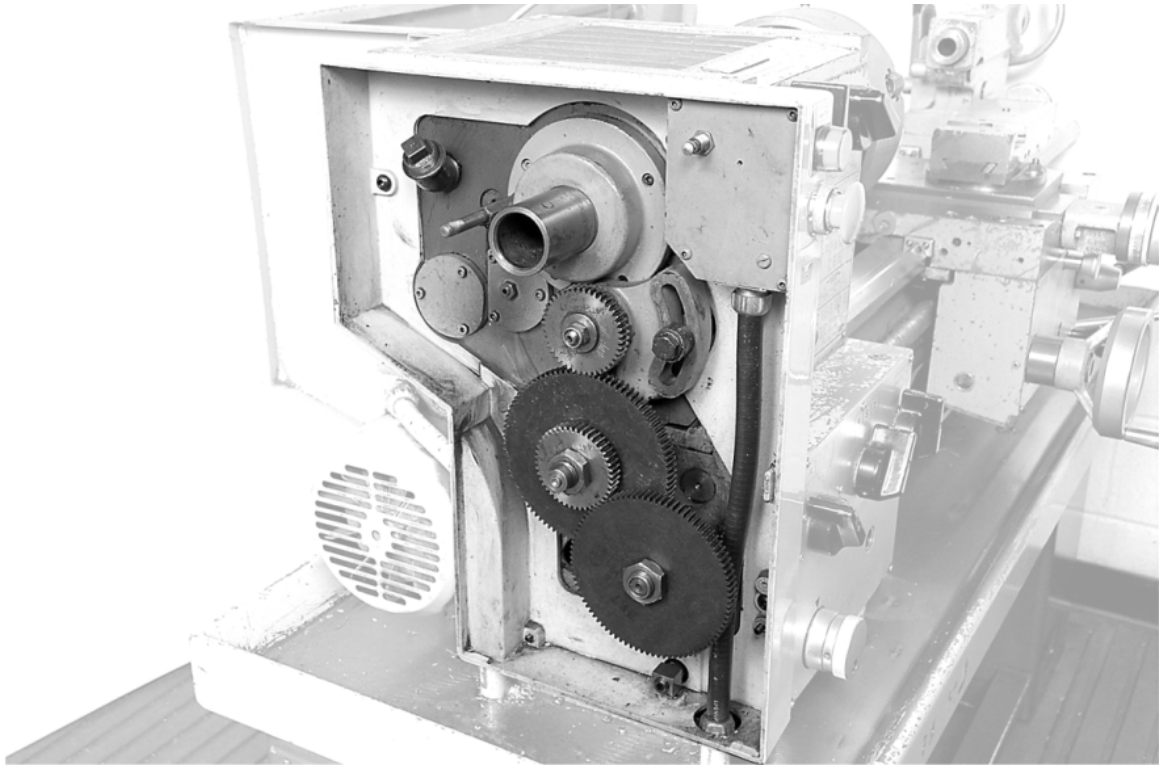
3.Headstock

- The headstock spindle is a hollow shaft supported in bearings. The work end holds a live centre, chuck or faceplate. The spindle on a small hobby lathe might be driven by a belt and pulleys, but industrial lathes use gears and are called geared head lathes.



4.Back Gears

- The back gears link the spindle to the input shaft of the quick-change gearbox (Figure). It is often necessary to remove one set of gears and replace it with another in order to achieve a particular feed rate or pitch listed on the quick-change gearbox.



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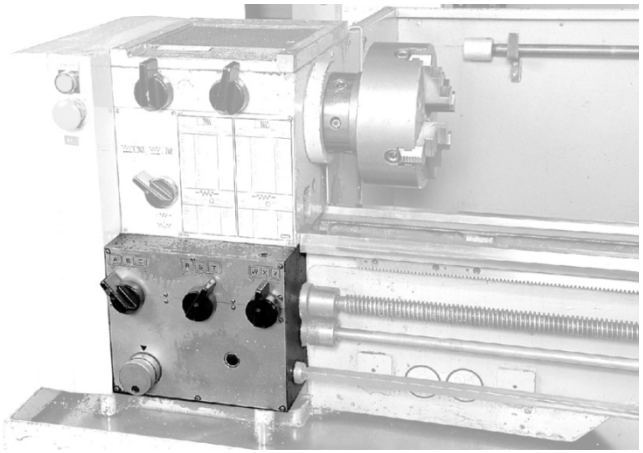
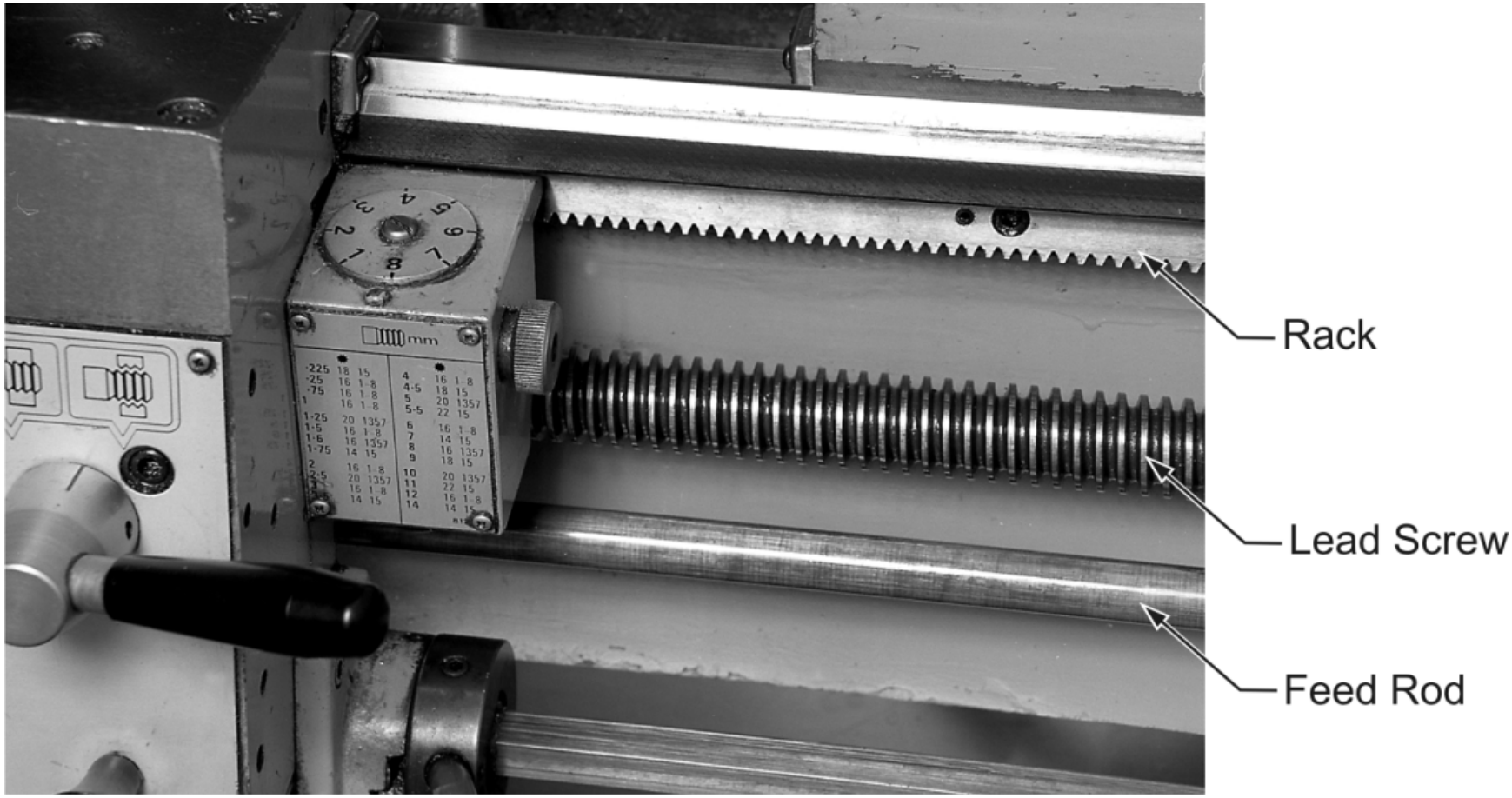
Quick-Change Gearbox

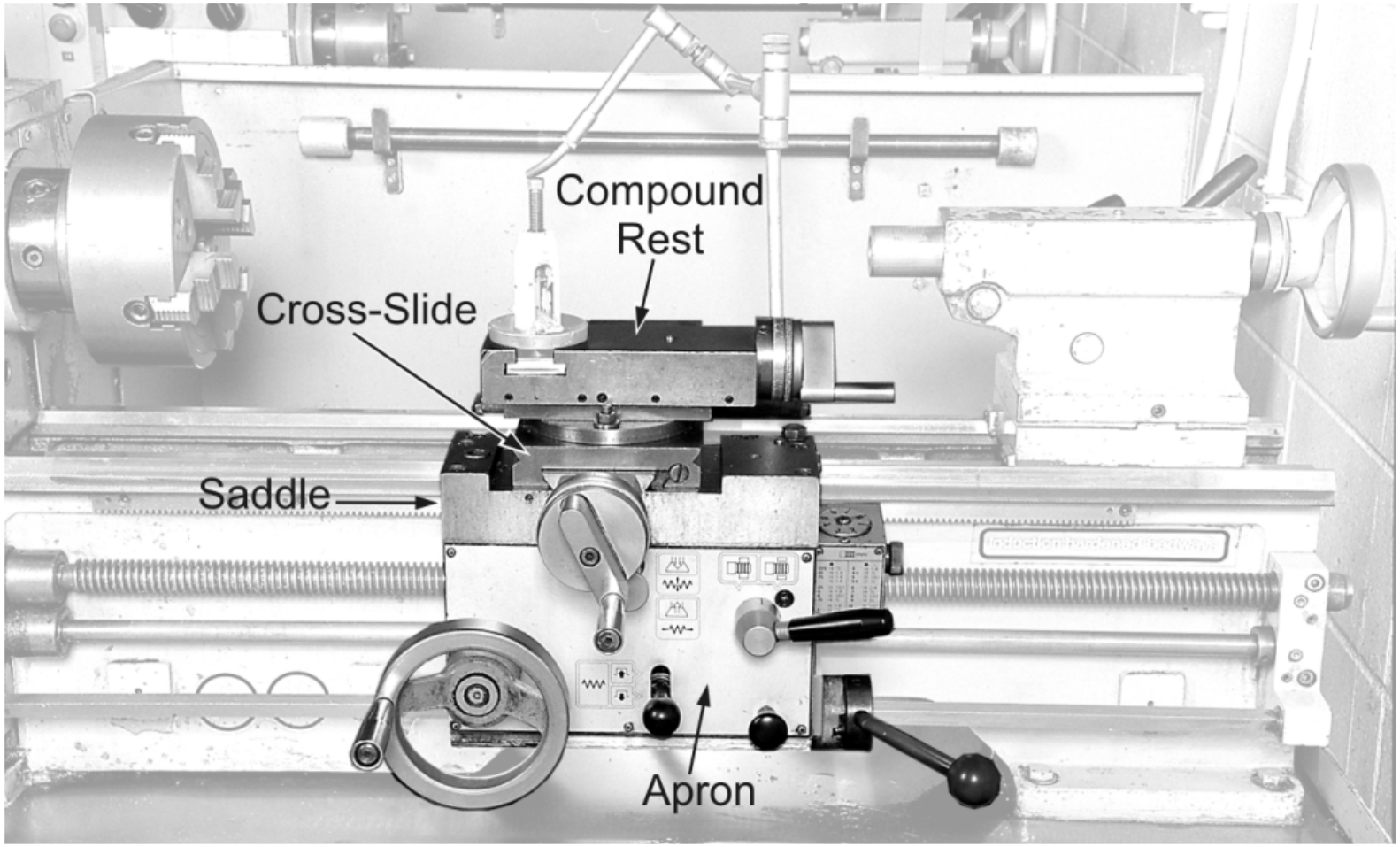
- The movement of the carriage is timed with the rotation of the spindle, causing the carriage to move a specific distance every time the spindle completes a revolution.
- This feature is fundamental to a lathe because it allows the lathe to cut threads. The timing is accomplished with gears and the gears must be changed every time a new ratio is desired.
- The quick-change gearbox allows you to change gears quickly and easily by shifting levers (Figure).



5.Lead Screw, Feed Rod and Rack



6.Carriage



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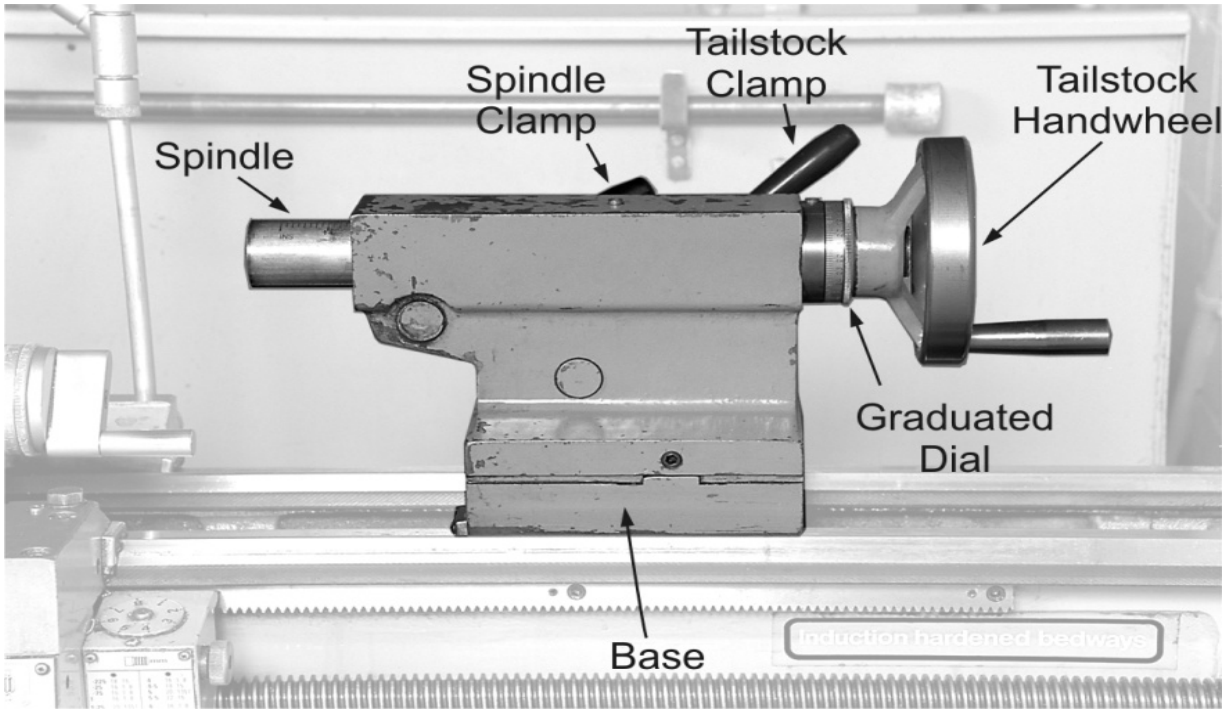
7.Tailstock

- The tailstock consists of a heavy two-part casting that sits on the ways and is clamped in place with the tailstock clamp.
- The top part of the casting may be adjusted from side to side as needed for parallel or taper turning (Figure).



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Lathe Accessories

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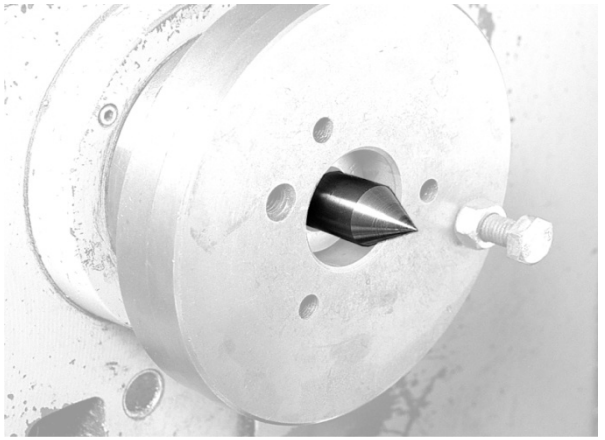
Lathe Accessories

- Divided into two categories
  - Work-holding, -supporting, and –driving devices
    - Lathe centers, chucks, faceplates
    - Mandrels, steady and follower rests
    - Lathe dogs, drive plates
  - Cutting-tool-holding devices
    - Straight and offset toolholders
    - Threading toolholders, boring bars
    - Turret-type toolposts

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 60º centers, steel with carbide tips
- Care to adjust and lubricate occasionally



Chucks

- Used extensively for holding work for machining operations
  - Work large or unusual shape
- Most commonly used lathe chucks
  - Three-jaw universal
  - Four-jaw independent
  - Collet chuck

Three-jaw Universal Chuck

- Holds round and hexagonal work
- Grasps work quickly and accurate within few thousandths/inch
- Three jaws move simultaneously when adjusted by chuck wrench
  - Caused by scroll plate into which all three jaws fit

- Two sets of jaw: outside chucking and inside chucking

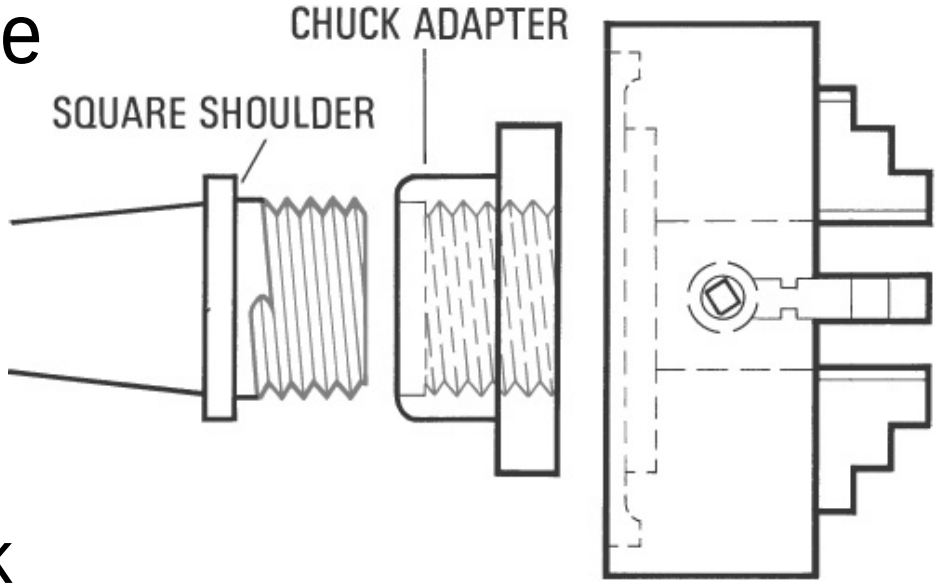
Four –Jaw Independent Chuck

- Used to hold round, square, hexagonal, and irregularly shaped workpieces
- Has four jaws
  - Each can be adjusted independently by chuck wrench
- Jaws can be reversed to hold work by inside diameter

Headstock Spindles

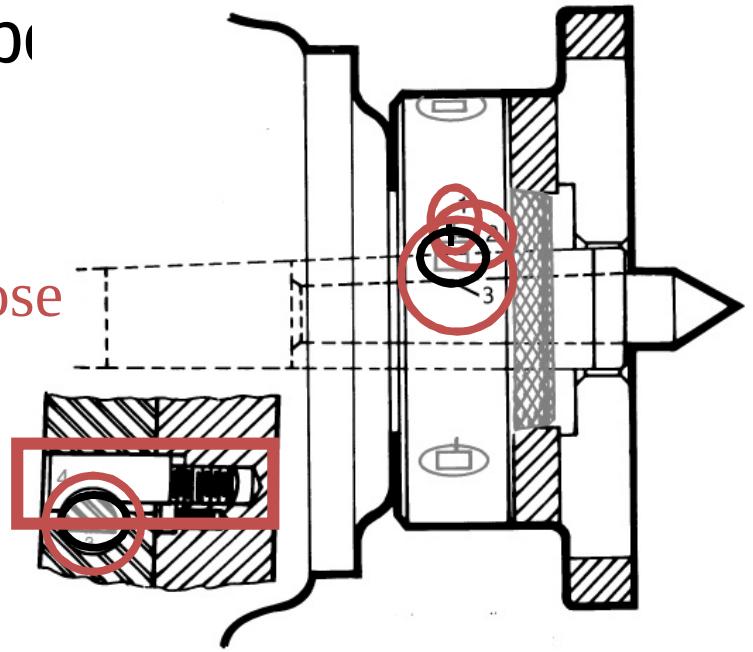
Universal and independent chuck fitted to three types of headstock spindles

1. Threaded spindle nose
   - Screws on in a clockwise direction
2. Tapered spindle nose
   - Held by lock nut that tightens on chuck



Headstock Spindles

3. Cam-lock spindle nose
   - Held by tightening cam-locks using T-wrench
   - Chuck aligned by tap
     on spindle nose



Registration lines on spindle nose

Registration lines on cam-lock

Cam-locks

Cam-lock mating stud on chuck or faceplate

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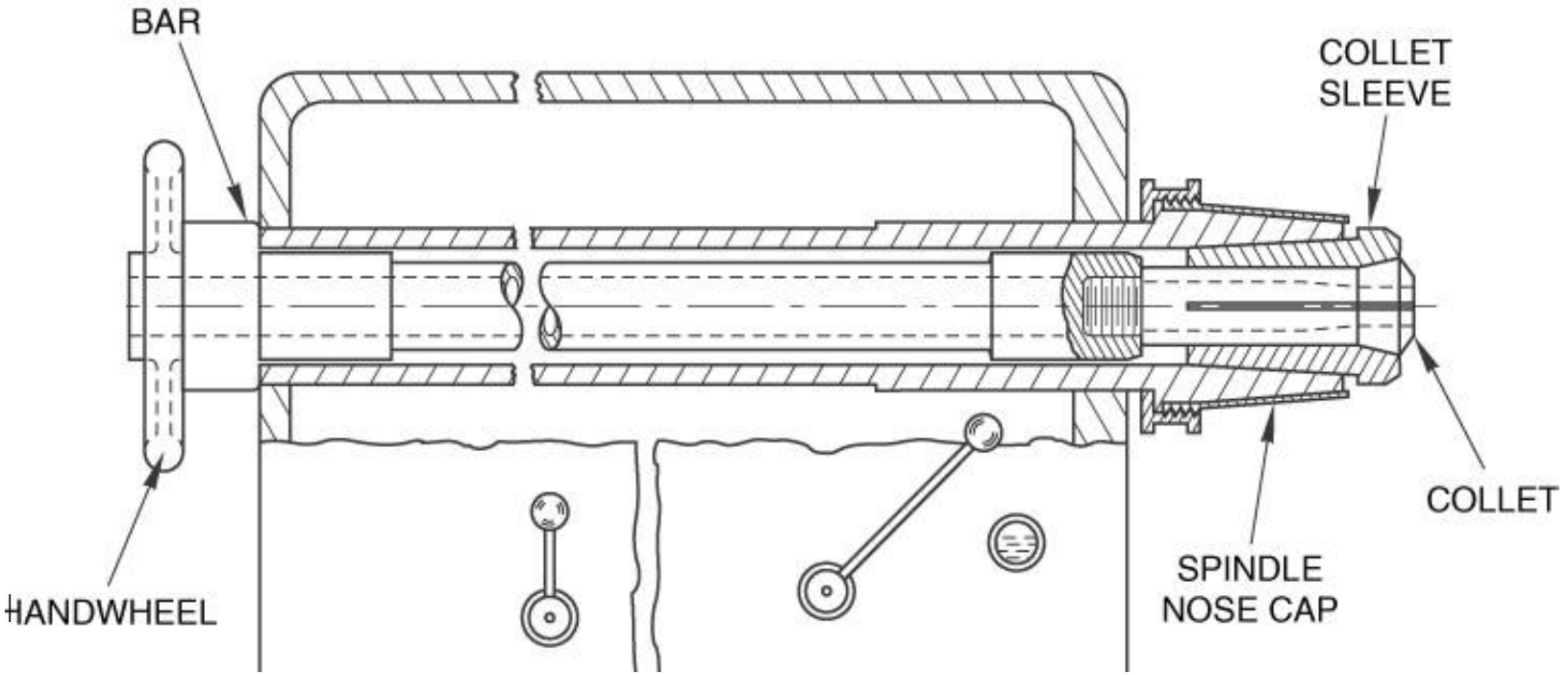
Collet Chuck

- Most accurate chuck
- Used for high-precision work
- Spring collets available to hold round, square, or hexagon-shaped workpieces
- Each collet has range of only few thousandths of an inch over or under size stamped on collet

Collet Chuck



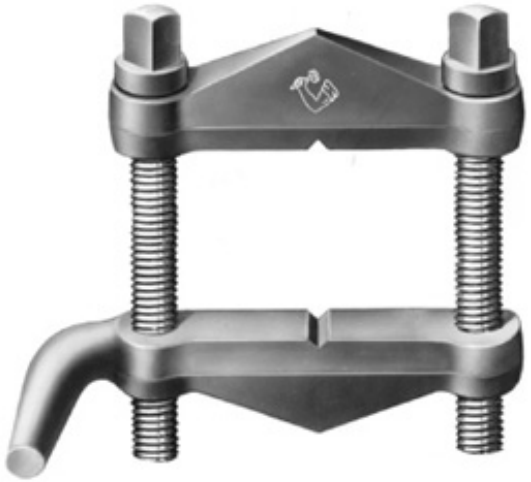
Special adapter fitted into taper of headstock spindle, and hollow draw bar having internal thread inserted in opposite end of headstock spindle. It draws collet into tapered adapter causing collet to tighten on workpiece.

Type of Lathe Dogs

- Standard bent-tail lathe dog
  - Most commonly used for round workpieces
  - Available with square-head setscrews of headless setscrews
- Straight-tail lathe dog
  - Driven by stud in driveplate
  - Used in precision turning

Type of Lathe Dogs

- Safety clamp lathe dog
  - Used to hold variety of work
  - Wide range of adjustment



- Clamp lathe dog
  - Wider range than others
  - Used on all shapes

Left-Hand Offset Toolholder

- Offset to the right
- Designed for machining work close to chuck or faceplate and cutting right to left
- Designated by letter L

Right-Hand Offset Toolholder

- Offset to the left
- Designed for machining work close to the tailstock and cutting left to right
  - Also for facing operations
- Designated by letter R

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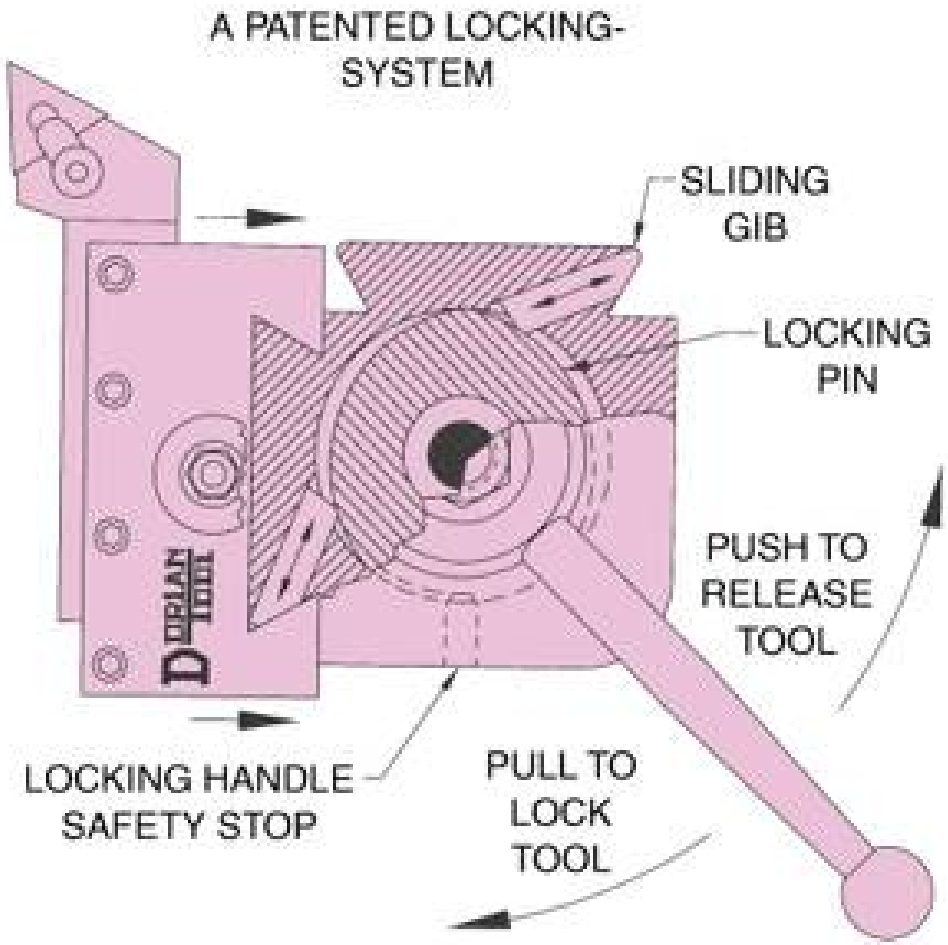
Straight Toolholder

- General-purpose type
- Used for taking cuts in either direction and for general machining operations
- Designated by letter S

Quick-Change Toolpost



Knurling, Grooving, and Form Turning

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Knurling

- Process if impressing a diamond-shaped or straight-line patter into the surface of the workpiece
  - Improve its appearance
  - Provide better gripping surface
  - Increase workpiece diameter when press fit required

Knurling

- Diamond- and straight-pattern rolls available in three styles
  - Fine
  - Medium
  - Course

Knurling Tool

- Toolpost-type toolholder on which pair of hardened-steel rolls mounted

Knurling tool with one set of rolls in self-centering head

Knurling tool with three sets of rolls in revolving head

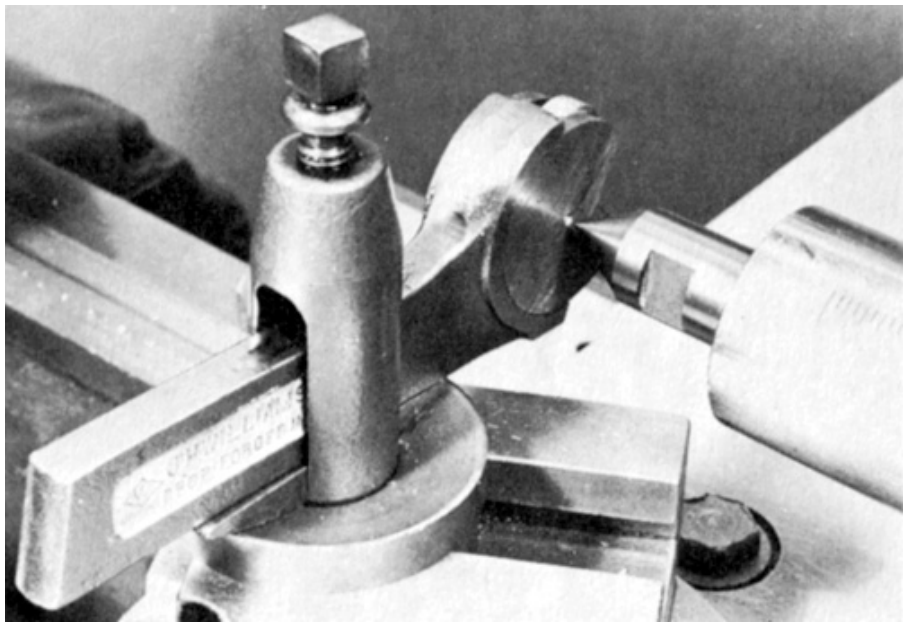
Universal Knurling Tool

- Dovetailed shank and as many as seven interchangeable knurling heads that can produce wide range of knurling patterns
- Combines in one tool
  - Versatility
  - Rigidity
  - Ease of handling
  - Simplicity

Procedure to Knurl in lathe

1. Mount work between centers and mark required length to be knurled
   - If work held in chuck for knurling, right end of work should be supported with revolving tailstock center
2. Set lathe to run at one-quarter speed required for turning
3. Set carriage feed to .015 to .030 in.

4. Set center of floating head of knurling tool even with dead-center point



5. Set knurling tool at right angles to workpiece and tighten it securely

6. Start machine and lightly touch rolls against work to check tracking
7. Move knurling tool to end of work so only half the roll face bears against work
8. Force knurling tool into work approximately .025 in. and start lathe

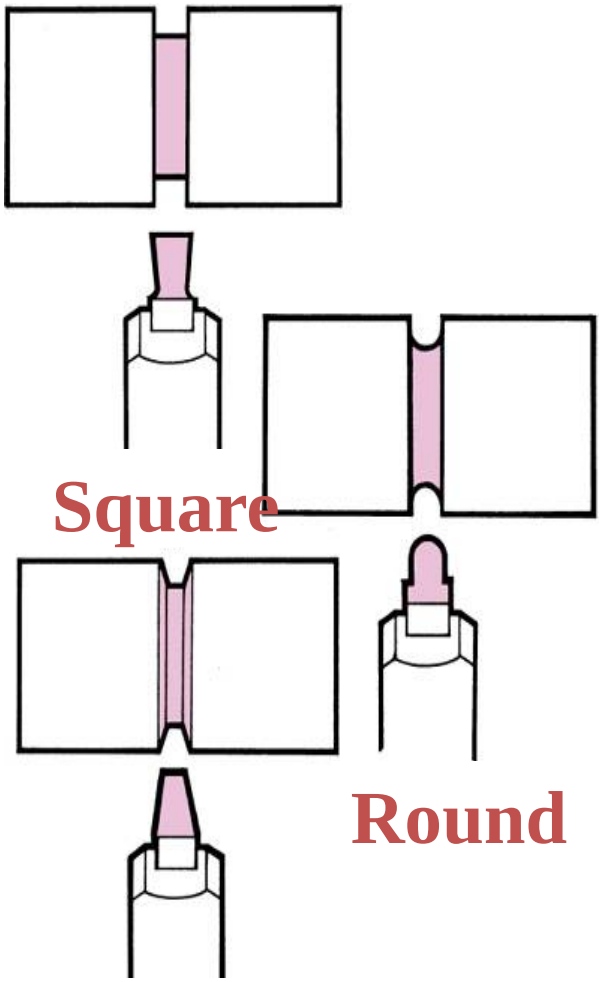
   OR

   Start lathe and then force knurling tool into work until diamond pattern come to point

9. Stop lathe and examine pattern
10. Once pattern correct, engage automatic carriage feed and apply cutting fluid to knurling rolls
11. Knurl to proper length and depth
    - Do not disengage feed until full length has been knurled; otherwise, rings will be formed on knurled pattern
12. If knurling pattern not to point after length has been knurled, reverse lathe feed and take another pass across work

Grooving

- Done at end of thread to permit full travel of nut up to a shoulder or at edge of shoulder for proper fit
- Also called recessing, undercutting, or necking
- Rounded grooves used where there is strain on part



Procedure to Cut a Groove

1. Grind toolbit to desired size and shape of groove required
2. Lay out location of groove
3. Set lathe to half the speed for turning
4. Mount workpiece in lathe
5. Set toolbit to center height

6. Locate toolbit on work at position where groove is to be cut
7. Start lathe and feed cutting tool toward work using crossfeed handle until toolbit marks work lightly
8. Hold crossfeed handle in position and set graduated collar to zero
9. Calculate how far crossfeed screw must be turned to cut groove to proper depth
10. Feed toolbit into work slowly using crossfeed handle

11. Apply cutting fluid to point of cutting tool
    - To ensure cutting tool will not bind in groove, move carriage slightly to left and to right while grooving
    - Should chatter develop, reduce spindle speed
12. Stop lathe and check depth of groove with outside calipers or knife-edge verniers

Safety note: Always wear safety goggles when grooving on a lathe

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