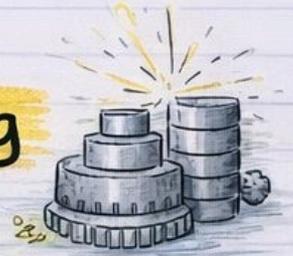




# Manufacturing Machining Module-1 Notes



→ by pyqfort.com ←

## Contents Covered: →

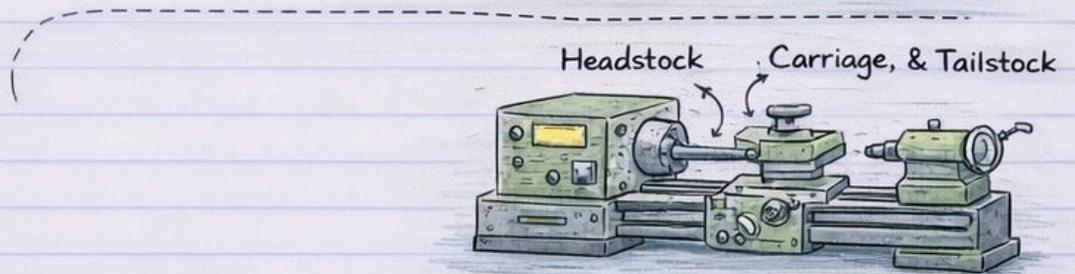
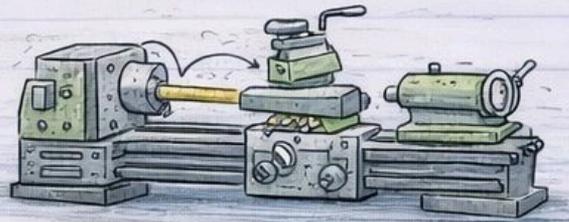
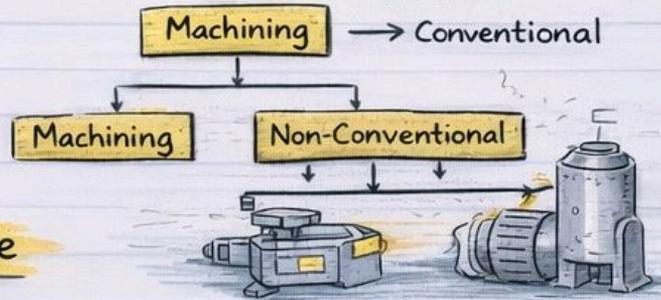
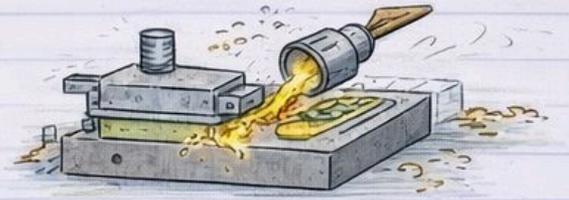
- Machining Processes: Intro

- Classification of Machining Processes

- Lathe

- Main Parts of a Centre Lathe

- Types of Lathes

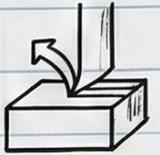


Center Lathe      Bench Lathe      Turret Lathe

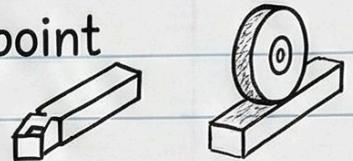
# MACHINING PROCESSES: INTRODUCTION

## 1. What is Machining?

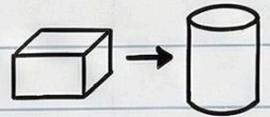
- Gradual removal of metal from a workpiece.



- Includes metal cutting (single/multi-point tools) & grinding (abrasive wheels).

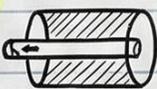


- Carried out on machine tools to achieve desired shape, size, and surface finish.



## 2. History & Evolution:

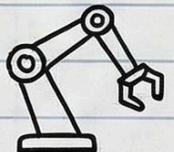
- First effective machine tool: horizontal-boring machine by John Wilkinson (for James Watt's steam engine).



- Industrial revolution speeded up development.

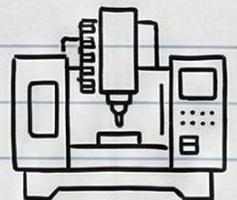


- 20<sup>th</sup> Century: Special purpose machines, NC tools, robots, FMS.

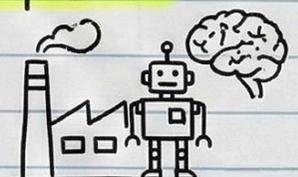


## 3. Modern Machining:

- Machining centre: performs several operations, automatic tool changing.



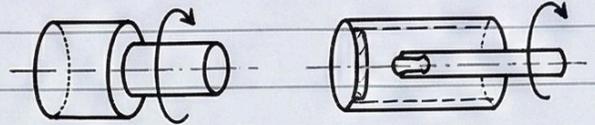
- Future: Complete automatic factory, computer-managed with robots, no workers.



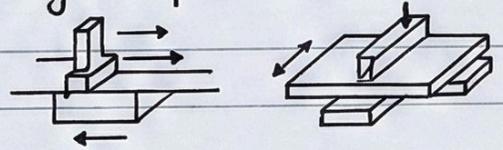
# CLASSIFICATION OF MACHINING PROCESSES

1. **Turning and Boring**: Turning generates external surfaces of revolution. Boring generates internal surfaces of revolution.

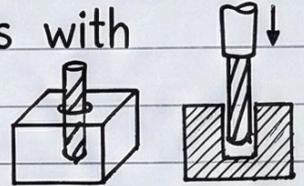
Tool or workpiece rotates.



2. **Shaping, Planing and Slotting**: Shaping generates flat surfaces with reciprocating tool. Planing reciprocates workpiece for large flat surfaces. Slotting is similar to shaping.



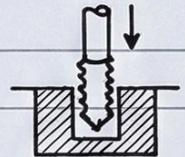
3. **Drilling and Reaming**: Drilling produces holes with rotary motion of tool. Reaming is a hole finishing process.



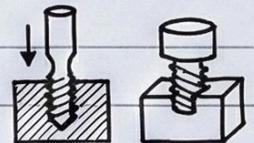
4. **Milling**: Generates flat and curved surfaces by rotating multi-edged cutting tools.



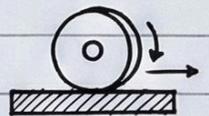
5. **Broaching**: Uses multi-teeth cutter for gears, key slots, internal bores.



6. **Thread Cutting**: Tapping and die cutting produce internal and external screw threads.



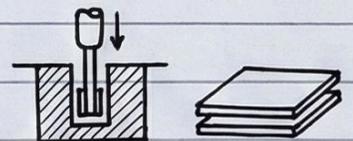
7. **Grinding**: Removes excess material using rotating abrasive wheel for flat and curved surfaces.



8. **Fine Finishing Process**:

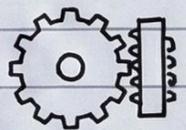
(i) **Honing** (abrasive sticks),

(ii) **Lapping** (soft material with abrasive particles).



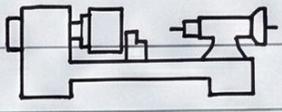
9. **Gear Cutting**: Milling, hobbing, shaping, rolling.

**Gear finishing**: Burnishing, Shaving, Grinding, Lapping.

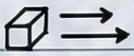
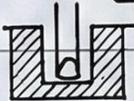


# TURNING (LATHE)

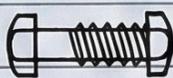
## 1. Introduction & Purpose:

- Lathe is a basic machine tool. 
- Used to machine external, internal, and face surfaces of solids of revolution. 
- Also used to cut threads. 
- Applications: Batch & mass production, repair work.

## 2. Principle of Turning:

- Workpiece is rotated about its axis (primary motion). 
- Cutting tool is given a feed motion normal to the cutting operation. 
- Turning generates external surfaces. 
- Boring generates internal surfaces. 

## 3. Key Operations:

1. Cylindrical turning 
2. Facing 
3. Boring 
4. External threading 
5. Cut-off 

## 4. Working Mechanism:

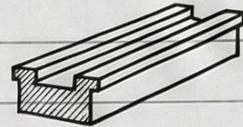
- Workpiece rotates (primary motion).
- Tool is set to desired depth of cut and moves forward (feed motion).
- Causes continuous removal of chip. 
- Resultant motion is vector sum of primary & feed motion.



# MAIN PARTS OF A CENTRE LATHE

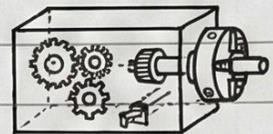
## 1. Bed :

- Supports the main parts of the lathe.
- Made of cast iron, consists of heavy metal slides running lengthwise with ways.



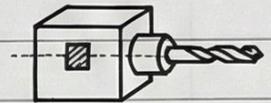
## 2. Head Stock :

- Houses the transmission system with speed changing levers.
- Holds devices like three jaw chuck, face plate, etc.
- Contains hollow main spindle through which cylindrical jobs can pass.



## 3. Tailstock :

- Movable part opposite to head stock on bed rails.
- Supports free end of the job.
- Holds tools for drilling, reaming, tapping.



## 4. Carriage :

- Located between headstock and tailstock, can be locked at any position.
- Consists of Apron (gears, clutches, lead screw), Saddle (H-shaped), Compound Rest (supports tool post), Cross Slide (transverse motion), and Tool Post (holds cutting tool).

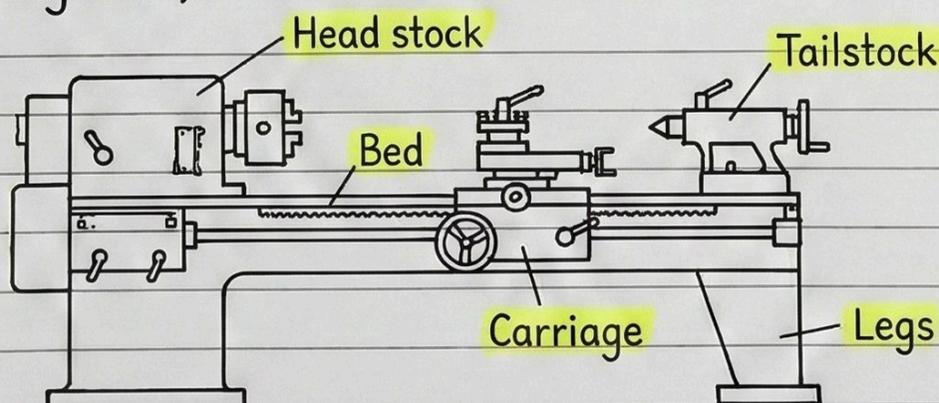
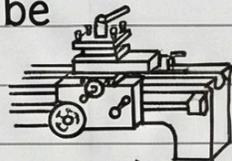


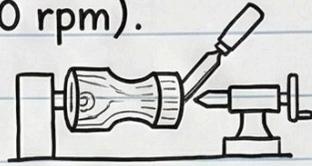
Fig. 4.2. Centre lathe

# TYPES OF LATHES

Various designs and constructions to suit different machining conditions and functions. All work on same principle.

1. **Speed Lathe**: Very high spindle speed (1200-3600 rpm).  
Simple construction (no feed box/carriage).

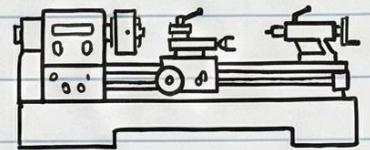
For wood working, centering, polishing, spinning.



2. **Engine (Centre) Lathe**: Most versatile and widely used.

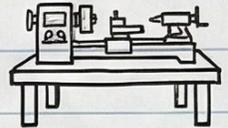
Robust headstock, feed mechanism.

Classified by power transmission: Belt-Motor-driven  
Geared-head.



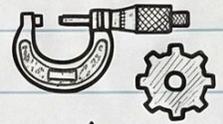
3. **Bench Lathe**: Small machine mounted on a bench.

For small and precision work.



4. **Tool Room Lathe**: For precision work on tools, dies, gauges.

Wide speed range (up to 2500 rpm), additional accessories.



5. **Capstan and Turret Lathe**: For mass production.

Tailstock replaced by hexagonal turret holding multiple tools for sequential operations.



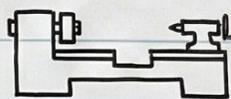
6. **Special Purpose Lathe**: For specific jobs.



(a) **Wheel lathe**: For railroad car/locomotive wheels.



(b) **Gap bed lathe**: Removable bed section for large diameter parts.



(c) **T-lathe**: For jet engine rotors, T-shape.

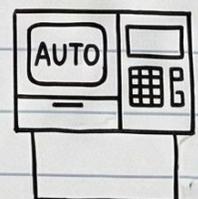


(d) **Duplicating lathe**: Duplicates shape of a template.



7. **Automatic Lathe**: High speed, heavy duty, mass production.

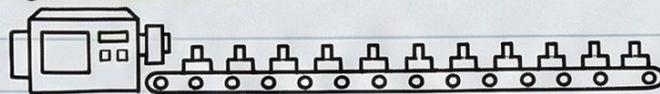
All operations automatic (start to finish, speed/feed changes, cycle repeat).



# Capstan and Turret Lathe

## Introduction & Purpose:

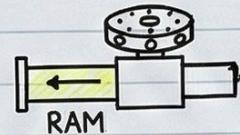
- These are heavy duty, high mass production machines used for turning out large quantities of similar articles.



## Key Differences (Capstan vs. Turret):

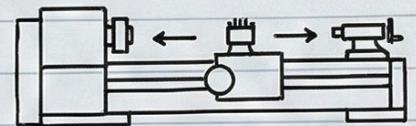
### • Capstan Lathe:

- Known as 'ram type' turret lathe.
- Used for small and medium pieces.
- The turret is mounted on a separate ram and its travel is restricted.



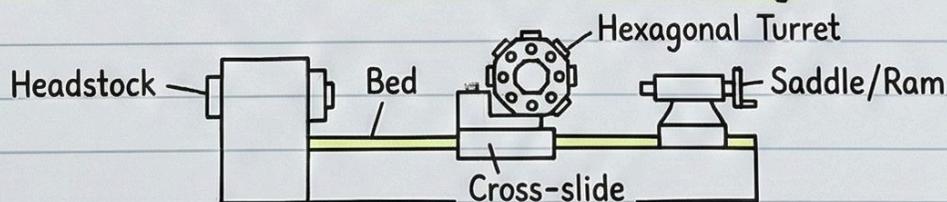
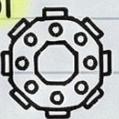
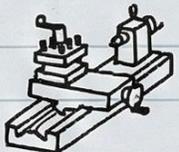
### • Turret Lathe:

- Known as 'saddle type' turret lathe.
- These are large machines.
- The turret is mounted on a slide which can operate over full length of lathe.



## Principle Parts:

1. **Bed:** Robust box type casting with accurate guideways.
2. **Headstock:** All geared (for large lathes) or step pulley drive housing mechanisms.
3. **Cross-slide and saddle:** Equipped with a four station tool post (front) and a rear tool post.
4. **Turret saddle and auxiliary slide:** Mounts the hexagonal tool holder (turret) which indexes automatically.



## Advantages:

- Tools permanently set up in proper sequence.
- Combined cuts (cross-slide & turret) save machining time.
- Multiple cuts from one tool station.
- Rigid and heavy duty for work holding.
- Many identical components machined in one setting.
- More efficient for bar work, drilling, reaming than centre lathe.

