

# Manufacturing Machining

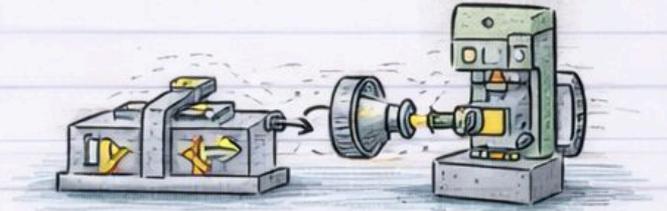
## Module-2 Notes

by [pyqfort.com](http://pyqfort.com)



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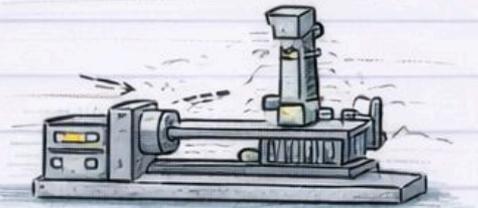


- Drilling Operations

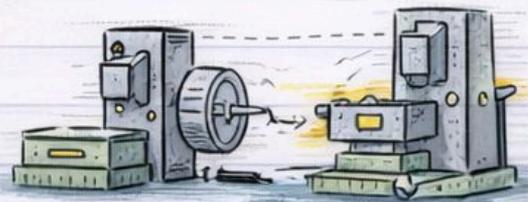


- Boring

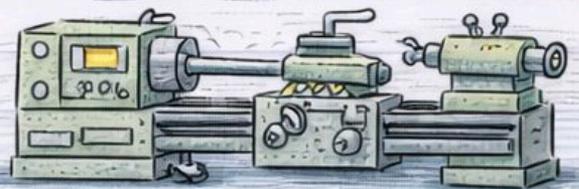
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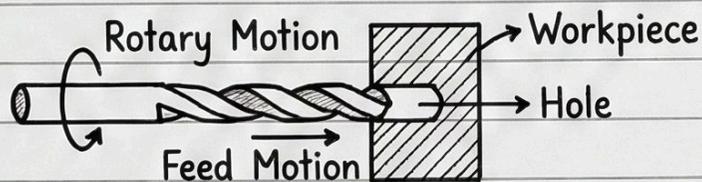


Center Lathe    Bench Lathe    Turret Lathe

# Drilling

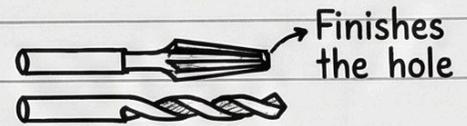
## 1. What is Drilling?

- A machining process in which a hole is produced or enlarged by a multi-point cutting tool called the drill.
- The primary cutting motion is a rotary motion usually imparted to the drill.
- Feed motion is translation and imparted to the drill.
- The cutting action is done by the cutting edge of the end face of the drill.



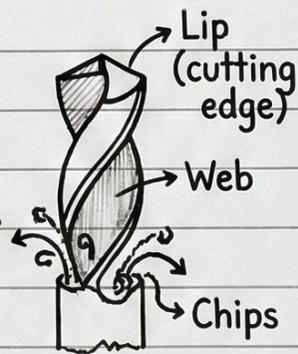
## 2. Reaming:

- Reaming is a hole finishing process.
- Tool motions are similar to drilling, but cutting edges are on the periphery of the reamer.



## 3. Working Principle:

- The drill, rotating about its axis, is fed in a straight line towards the fixed workpiece.
- A twist drill has two cutting edges at its bottom.
- Simultaneous rotation and feed cut off chips.
- Action under the web is a combination of chisel action and metal being forced away by extrusion.



## 4. Types of Drilling Machines:

There are many types designed for specific jobs. Main types are:

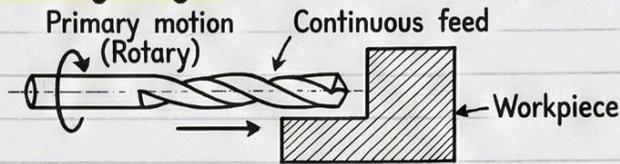
1. Portable drilling machine
2. Sensitive drilling machines (Bench mounted, Floor mounted)
3. Upright drilling machines (Round column, Box column)
4. Radial drilling machines (Plain, Semi-universal, Universal)
5. Gang drilling machine
6. Multiple spindle drilling machines
7. Automatic drilling machine
8. Deep hole drilling machine (Vertical, Horizontal)



# Drilling Operations

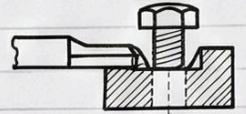
## 1. Drilling:

- Simple process of producing a cylindrical hole.
- The workpiece remains stationary and a twist drill generates an internal cylindrical surface.
- The tool has two cutting edges, each removes part of work material.



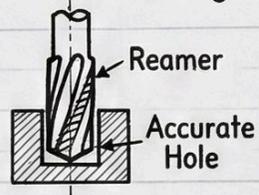
## 2. Spot Facing:

- The surface around the drilled hole is smoothed and squared to prepare a seat for the head of a bolt, screw or nut.
- A special tool is used for the operation.



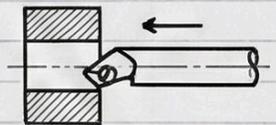
## 3. Reaming:

- The drilled hole is finished to an accurate size by the process of reaming. [cite: 125]
- The tool is called a reamer which is automatically fed into slightly undersized drilled hole.
- Reamer has multiple cutting edges.



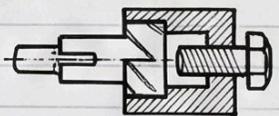
## 4. Boring:

- Performed on a drilling machine to achieve the following:
  - To enlarge a hole to a size which cannot be ordinarily drilled.
  - To finish an accurate hole to required size.
  - To machine a hole already existing in a casting.
  - To correct the roundness of a hole.
  - To correct the location of a hole.
- An adjustable cutting tool with only one cutting edge is used.



## 5. Counter Boring:

- The end of a cylindrical hole may be enlarged to form a square shoulder to accommodate heads of bolts, nuts and screws.
- The counter boring tool has straight or spiral teeth and a pilot at the end to guide the tool.



## 6. Counter Sinking:

- The end of the hole is given a cone-shaped enlargement for a flat head screw or counter sunk rivet fitted into the hole.
- Standard counter sinks have 60°, 82° or 90° included angle.



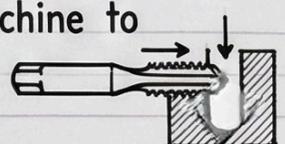
## 7. Hole Milling:

- An end mill is mounted in the spindle of a drilling machine to perform hole milling operation.



## 8. Tapping:

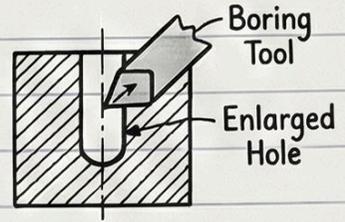
- A thread cutting tool called a tap is used on a drilling machine to cut internal threads in a drilled hole.
- The tap is a bolt with accurate threads cut on it.



# Boring

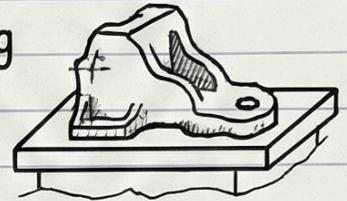
## 1. What is Boring?

- A machining operation for generation of **internal surface of revolution**.
- It is an operation of **enlarging a hole** that has **already been drilled or cored**.
- The boring tool is an **adjustable single point tool**.



## 2. Machine & Purpose:

- Can be carried out on **boring machines, turning lathes, or other machine tools**.
- Boring machine construction is justified for holding and machining **very heavy workpieces** which cannot be handled by lathes.
- These machines can also be used for **drilling, milling, and facing**.



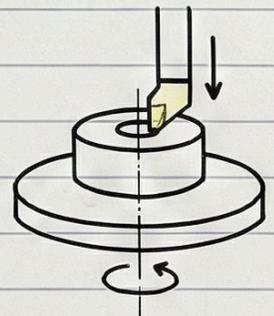
## 3. Applications:

- Used for boring, facing, and turning of **locomotive and car wheels, pulleys, flywheels, large gear blanks, cylinder liners, turbine parts**.
- Also for irregular, unsymmetrical components like **engine blocks, compress housings, bearings**.

## 4. Principle of Boring:

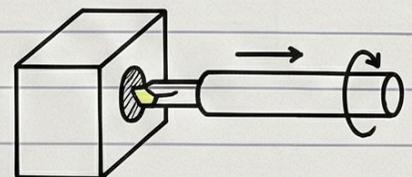
### A. Vertical Boring Machine:

- The **workpiece is held and rotated** with the machine table.
- The single point **tool is fed** parallel, perpendicular, or at an angle to the axis of rotation.



### B. Horizontal Boring Machine:

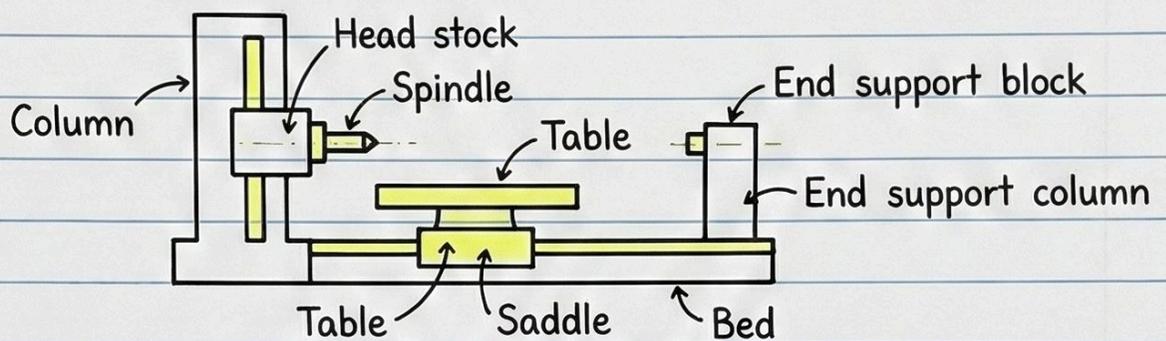
- The **workpiece is held stationary** on the machine table.
- The **cutting tool is rotated**.
- The **tool may be fed** in a direction parallel or perpendicular to its axis of rotation.



# Horizontal Boring Machines

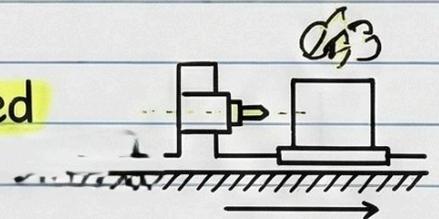
## 1. Introduction & Principle Parts:

- These machines have a horizontal spindle to finish horizontal bore.
- The principle parts are: : : : : :
  1. Bed
  2. Table
  3. Saddle
  4. Head supporting column
  5. End supporting column
  6. Head stock

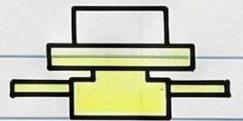


## 2. Different Designs/Types:

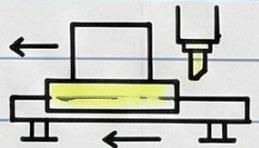
1. Floor type: The spindle is traversed along the runway past the work.



2. Table type: Most widely used. The work supporting mechanism consists of a table and saddle.



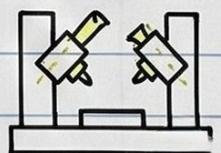
3. Planer type: Has a reciprocating table which moves past the tool. Used for large components.



4. Jig mill type: Used to finish holes accurately.



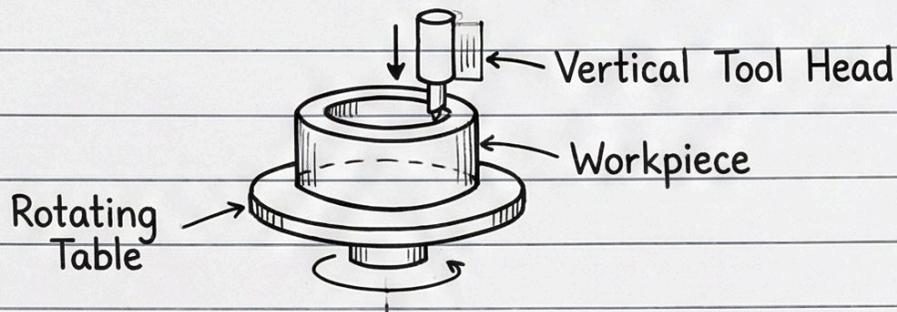
5. Multiple head type: Has more than one headstock, can be swivelled for angular work. Similar to planer type.



# Vertical Boring Machines

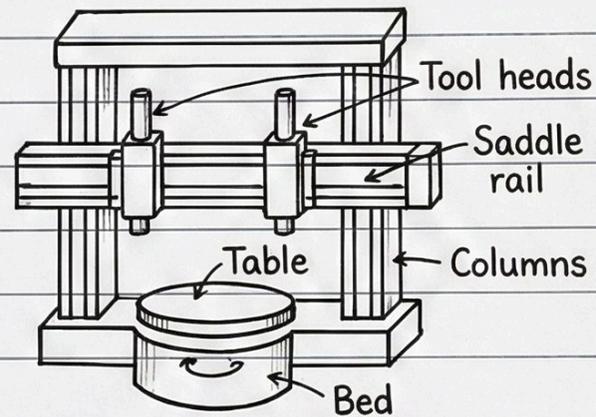
## 1. Principle & Purpose:

- This machine has a revolving work table about vertical axis.
- It is used to finish vertical bores.



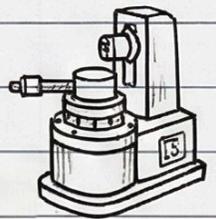
## 2. Main Parts

1. Bed
2. Table
3. Columns (Housing)
4. Cross rail
5. Saddle
6. Tool head and ram assemblies



## 3. Vertical Turret Lathe:

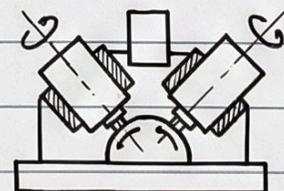
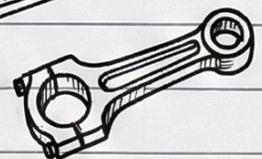
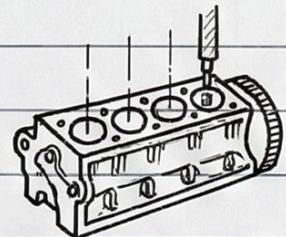
- Belongs to this group of machines.
- Can be used only for small components.



## 4. Special Purpose Boring Machines:

- Designed for specific jobs. Examples:

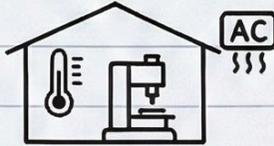
1. I.C. Engine cylinder borer
2. Locomotive connecting rod borer
3. Locomotive cylinder borer
4. Double and angular precision cylinder boring machine



# Jig Boring Machines

## 1. Purpose & Location:

- Designed for locating and boring holes in jigs, fixtures, dies, gauges and other precision parts.
- Located in an air-conditioned room for precision.



## 2. Main Features (as per Fig. 4.24):

- It's a vertical boring machine of very rigid and accurate construction.
- Saddle and table movements are similar to a plain milling machine.
- Spindle is adjustable in vertical position and accurately aligned in preloaded bearings.
- Spindle moves inside a quill for considerable spindle extension.

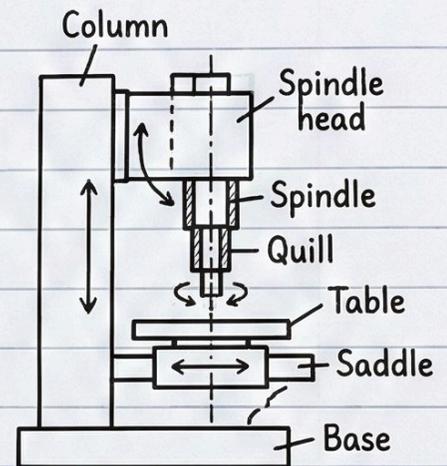


Fig. 4.24

## 3. Measuring Systems:

- Equipped with special measuring devices for absolute reliability of table movement. [cite: 137]
- Includes:
  1. Precision lead-screw mechanism.
  2. End measurement system.
  3. Scale and microscope system.
  4. Electromagnetic system.
  5. Dial indicator with grasshopper leg.
  6. Tool makers microscope for centring work.



## 4. Capabilities:

- Wide range of speeds (30 to 1500 rpm).
- Can bore a wide variety of holes.
- Quick fastening of boring heads, quills, chucks, collects.

