By: Mr. High Sky

Mechanical Workshop

Week_1

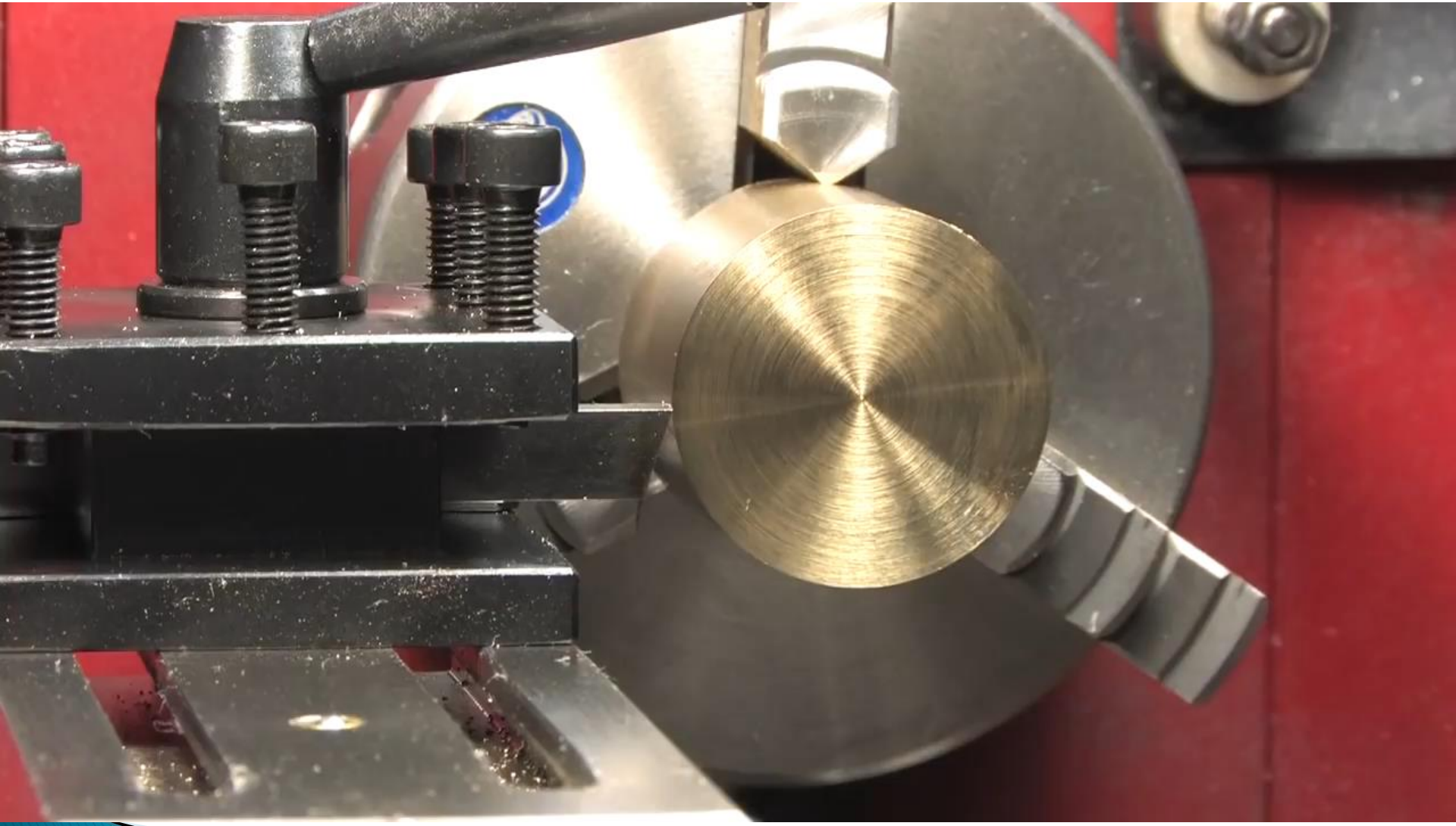
Instructor: Dr. Muhammad Mujtaba Abbas

Mechanical Engineering Department

MACHINING OPERATIONS AND MACHINE TOOLS

MACHINING OPERATIONS AND MACHINE TOOLS

- Turning and Related Operations
- Drilling and Related Operations
- Milling and Related Operations
- Machining Centers and Turning Centers
- Other Machining Operations
- High Speed Machining



Machining

A material removal process in which a sharp cutting tool is used to mechanically cut away material so that the desired part geometry remains.

- Most common application: to shape metal parts.
- Machining is the most versatile and accurate of all manufacturing processes in its capability to produce a diversity of part geometries and geometric features.
- Casting can also produce a variety of shapes, but it lacks the precision and accuracy of machining.

Classification of Machined Parts

1. Rotational - cylindrical or disk-like shape
2. Nonrotational (also called prismatic) - block-like or plate-like

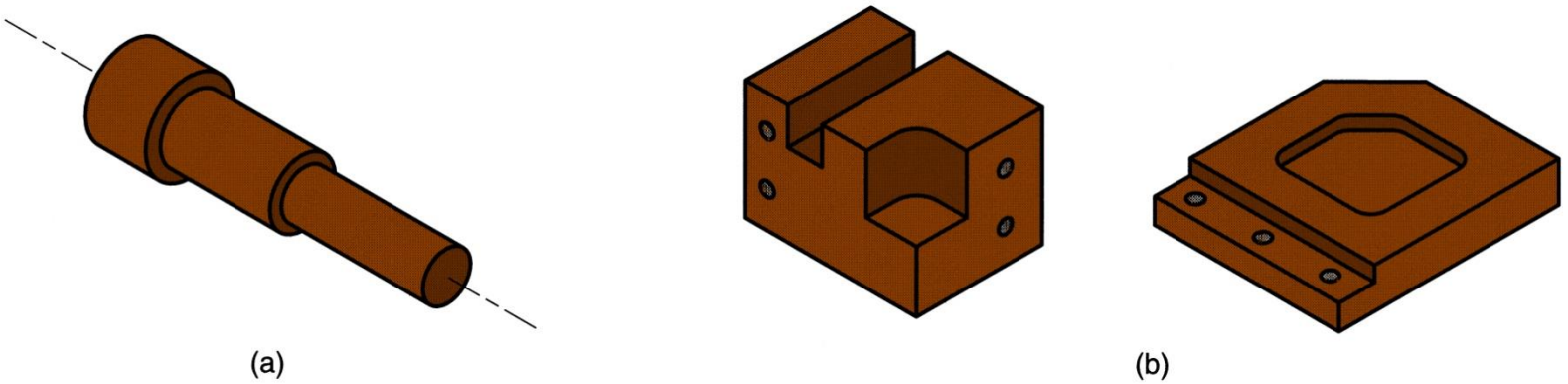


Figure 1.1 - Machined parts are classified as: (a) rotational, or (b) non-rotational, shown here by block and flat parts

Machining Operations and Part Geometry

Each machining operation produces a characteristic part geometry due to two factors:

1. Relative motions between the tool and the work part
   - Generating-part geometry is determined by the feed trajectory of the cutting tool
2. Shape of the cutting tool
   - Forming-part geometry is created by the shape of the cutting tool

Operations in Lathe Machine

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Machining Operations and Part Geometry

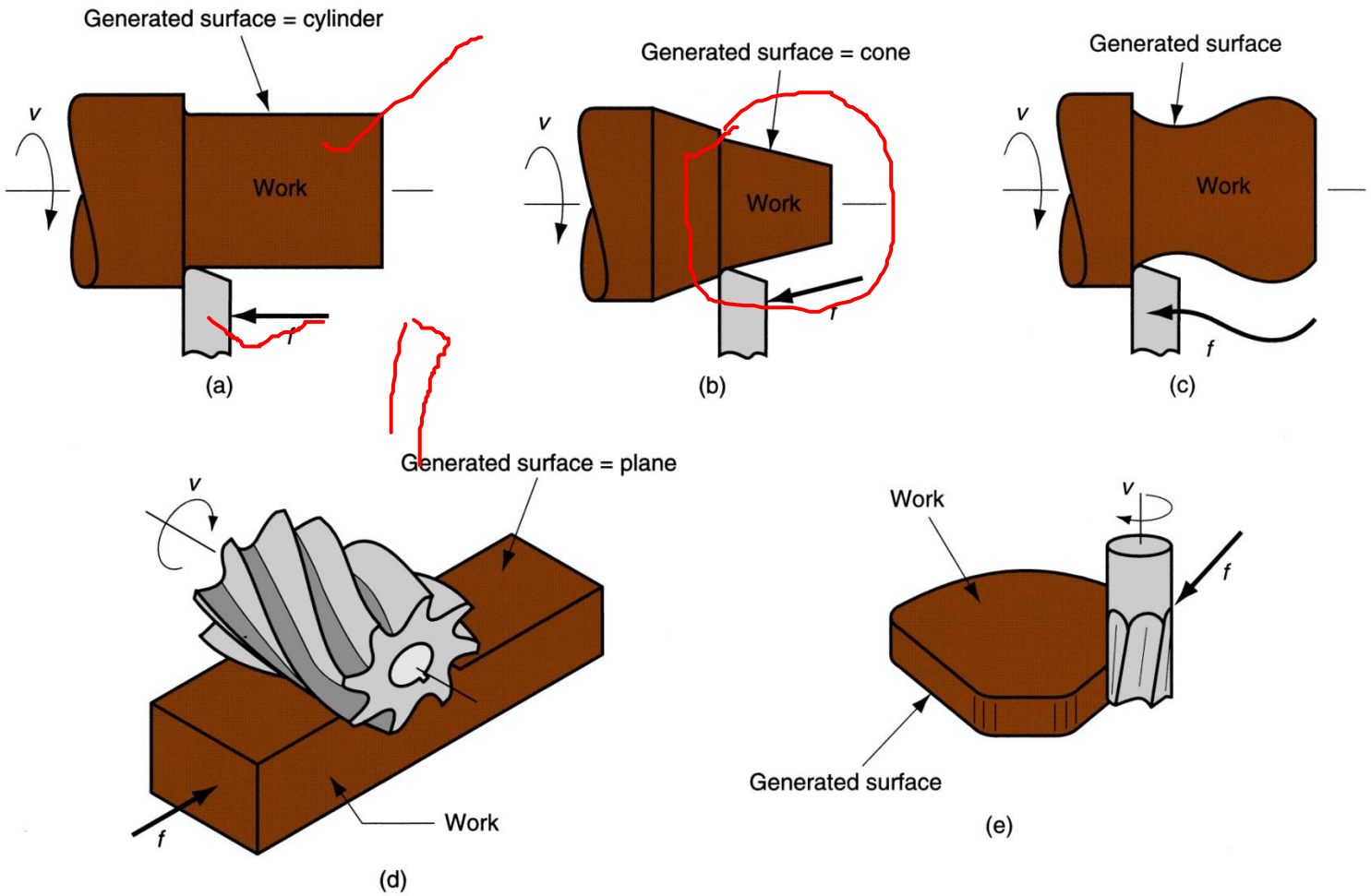


Figure 1.2 - Generating shape: (a) straight turning, (b) taper turning, (c) contour turning, (d) plain milling, (e) profile milling

Machining Operations and Part Geometry

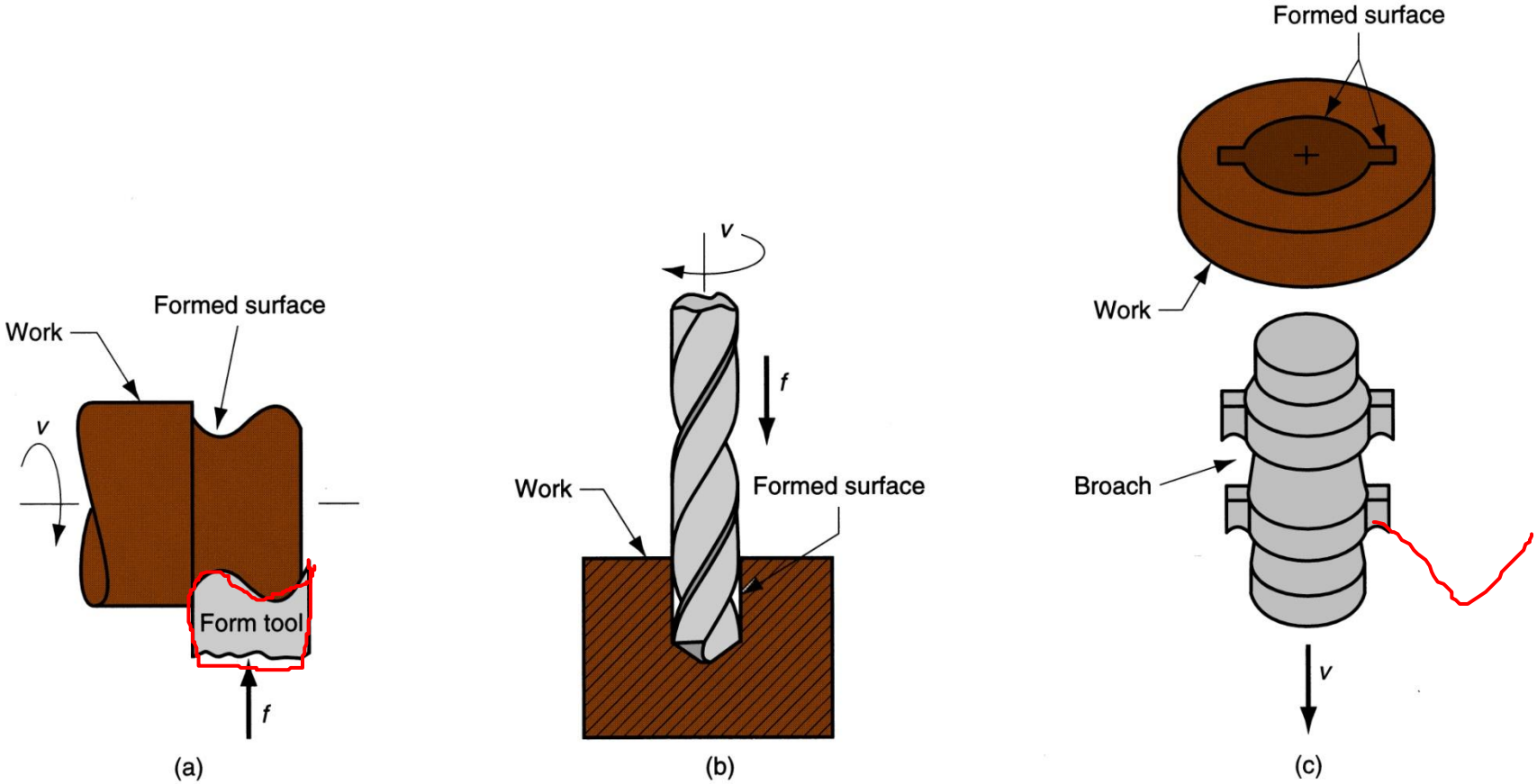


Figure 1.3-Forming to create shape: (a) form turning, (b) drilling, and (c) broaching

Machining Operations and Part Geometry

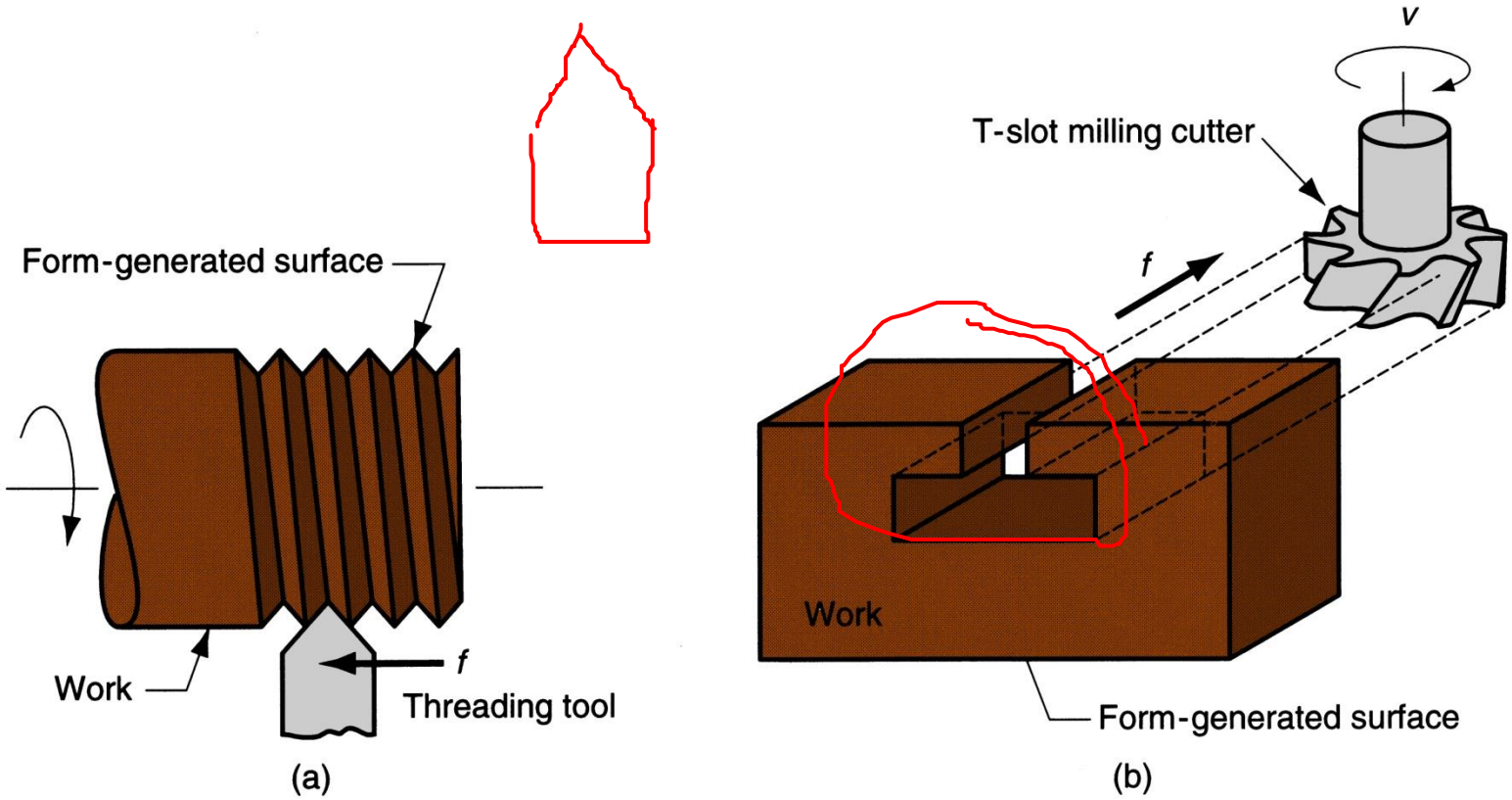


Figure 1.4-Combination of forming and generating to create shape: (a) thread cutting on a lathe, and (b) slot milling

Turning

A single point cutting tool removes material from a rotating workpiece to generate a cylindrical shape.

- Performed on a machine tool called a *lathe*
- Variations of turning that are performed on a lathe:
  1. Facing
  2. Contour turning
  3. Chamfering
  4. Cutoff
  5. Threading

Turning

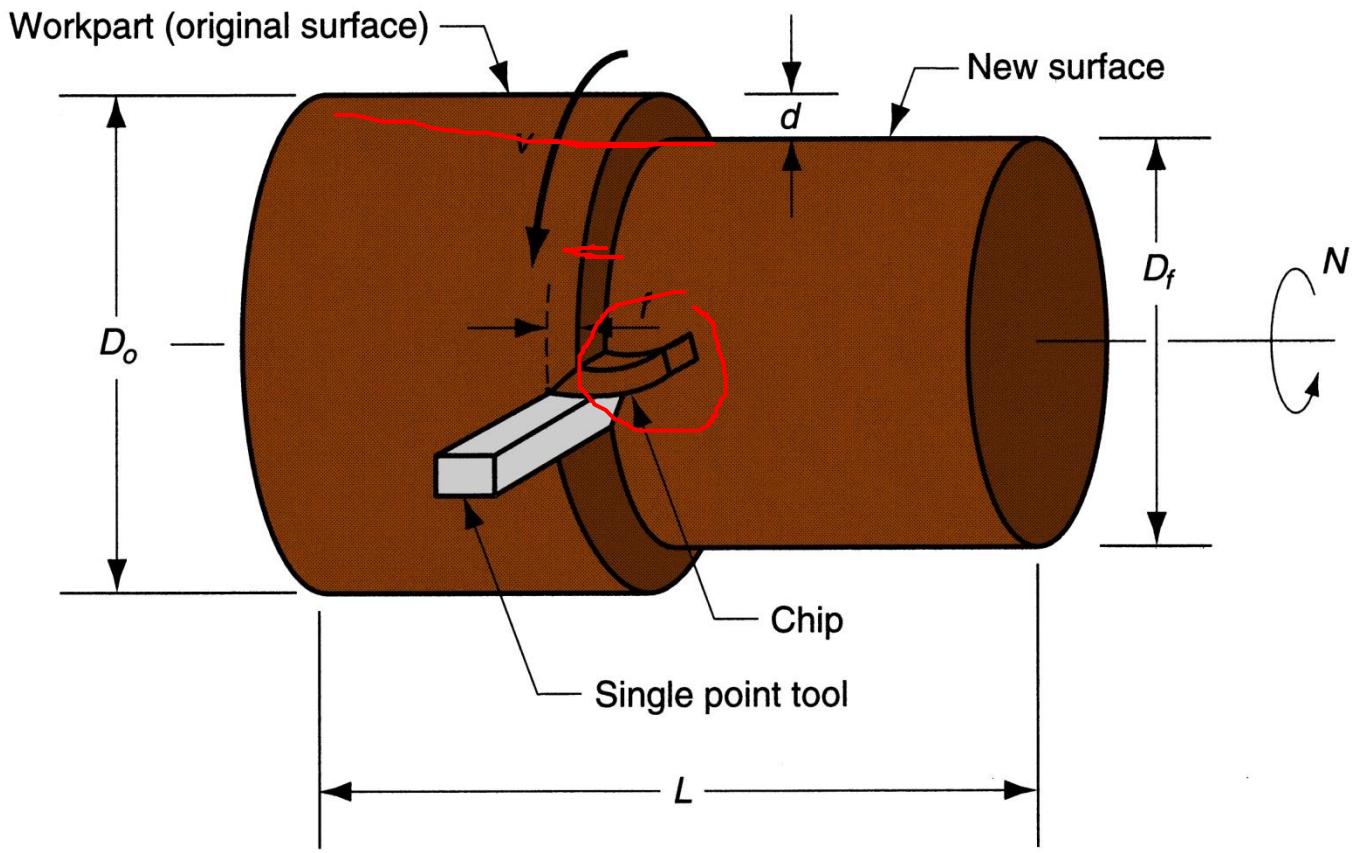


Figure 1.5-Turning operation

Facing

Tool is fed radially inward

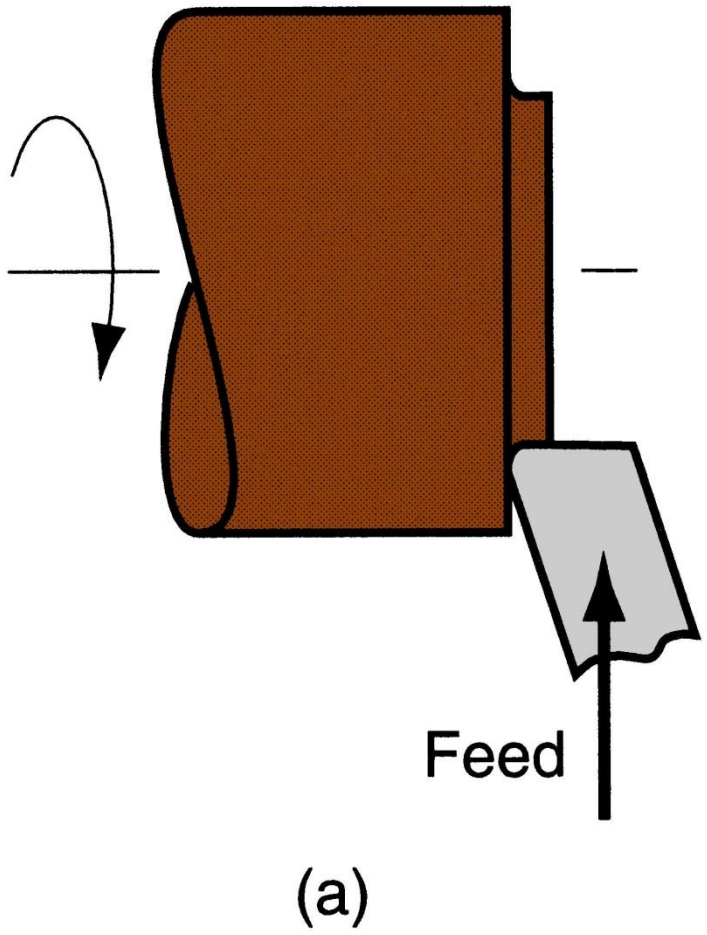


Figure 1.6 (a) facing

Contour Turning

Instead of feeding the tool parallel to the axis of rotation, tool follows a contour that is other than straight, thus creating a contoured form.

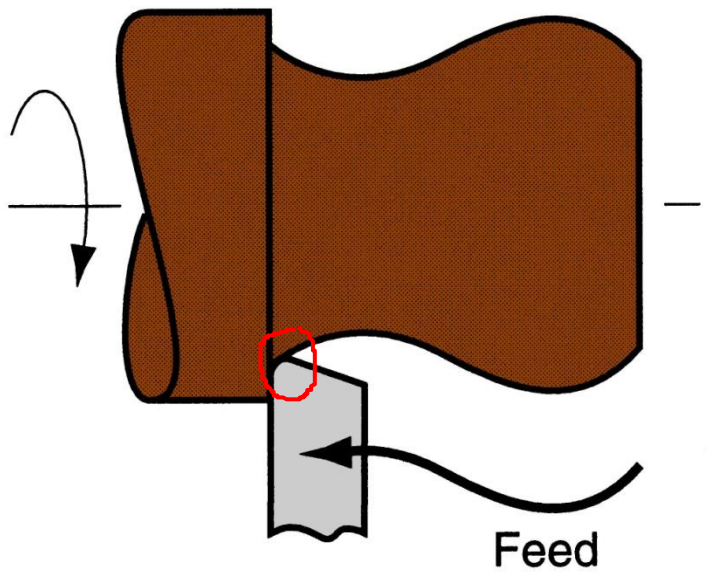


Figure 1.6 (c) contour turning

Chamfering

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

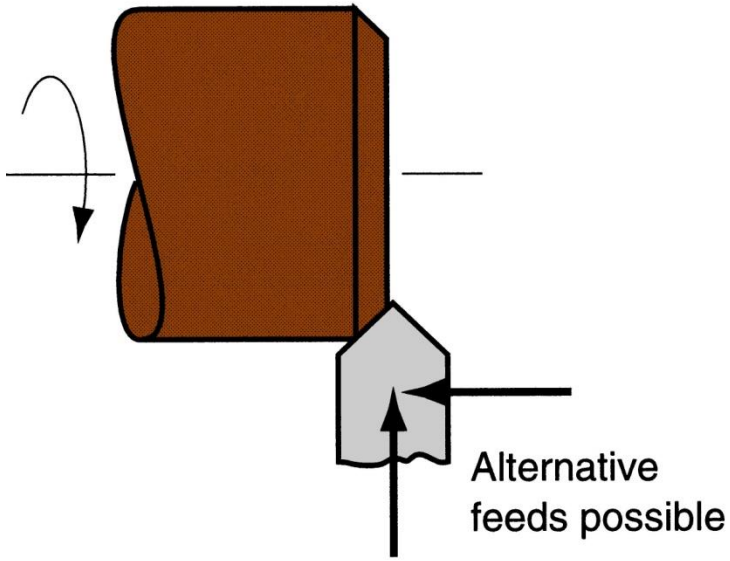


Figure 1.6 (e) chamfering

Cutoff

Tool is fed radially into rotating work at some location to cut off end of part

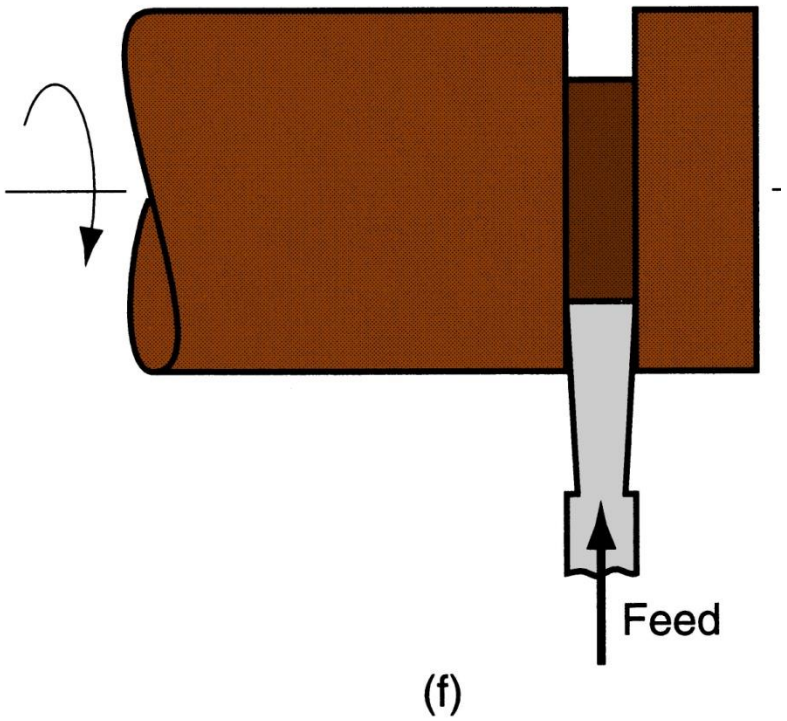
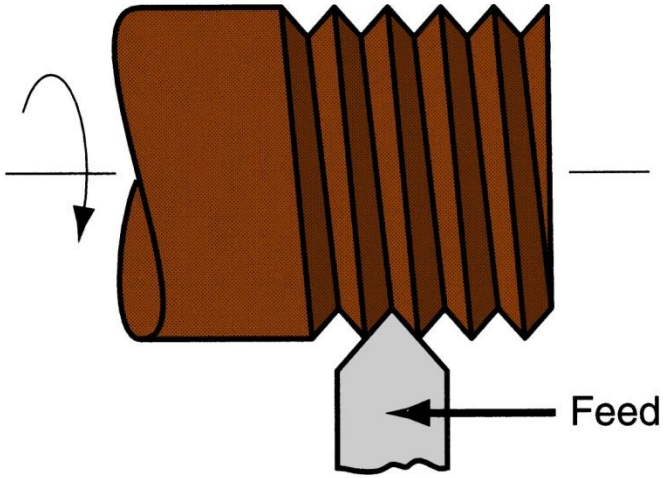


Figure 22.6 (f) cutoff

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



(g)

Figure 1.6 (g) threading

Lathe Machine

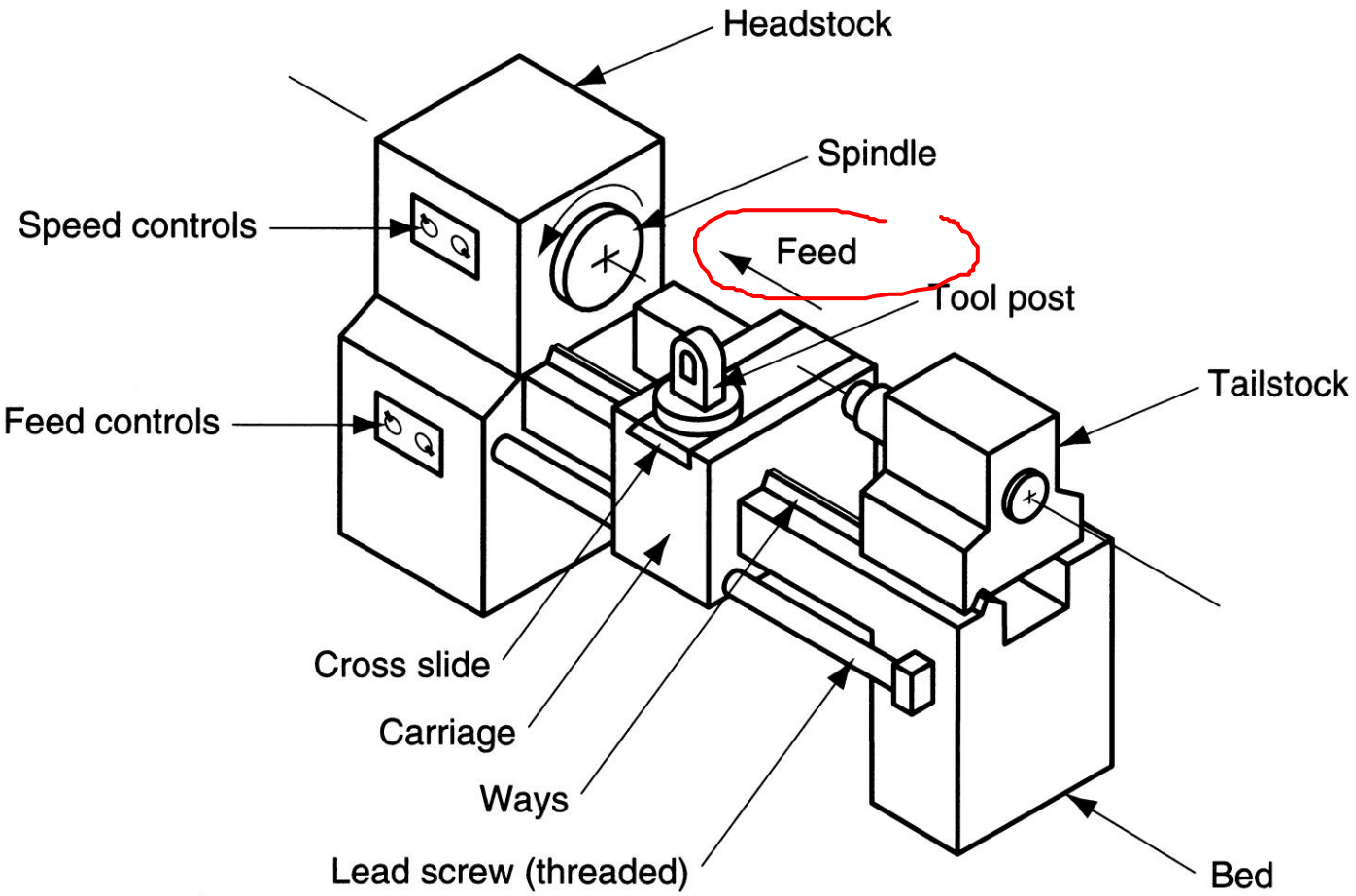


Figure 1.7- Diagram of an engine lathe, showing its principal components

Chuck

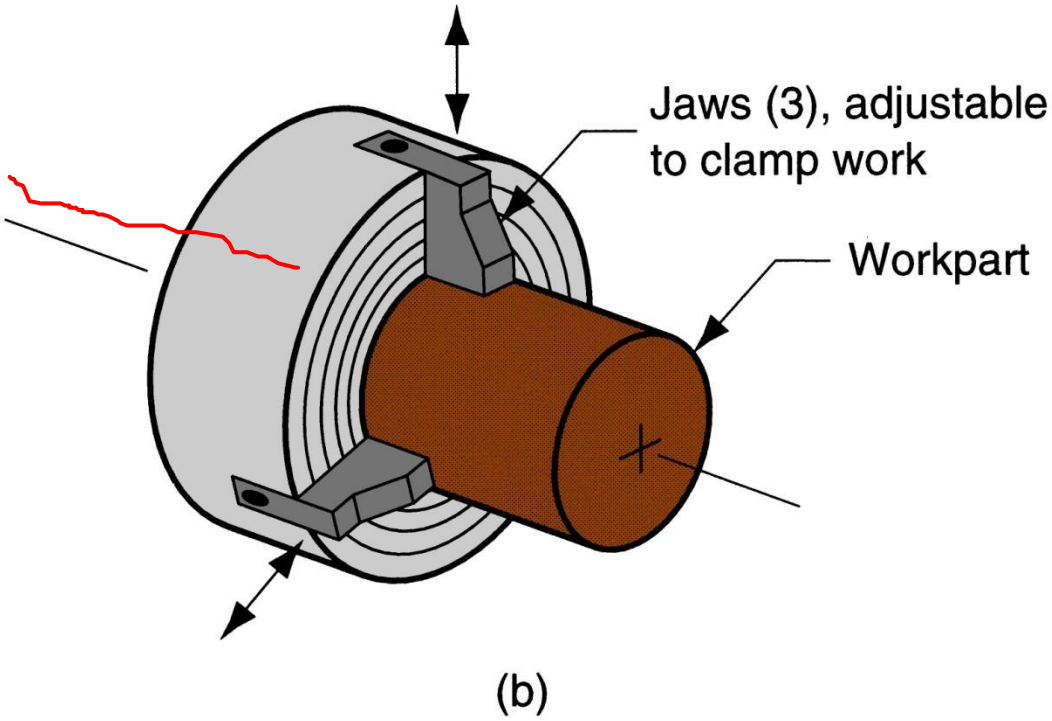


Figure 1.8 (b) three-jaw chuck

Collet

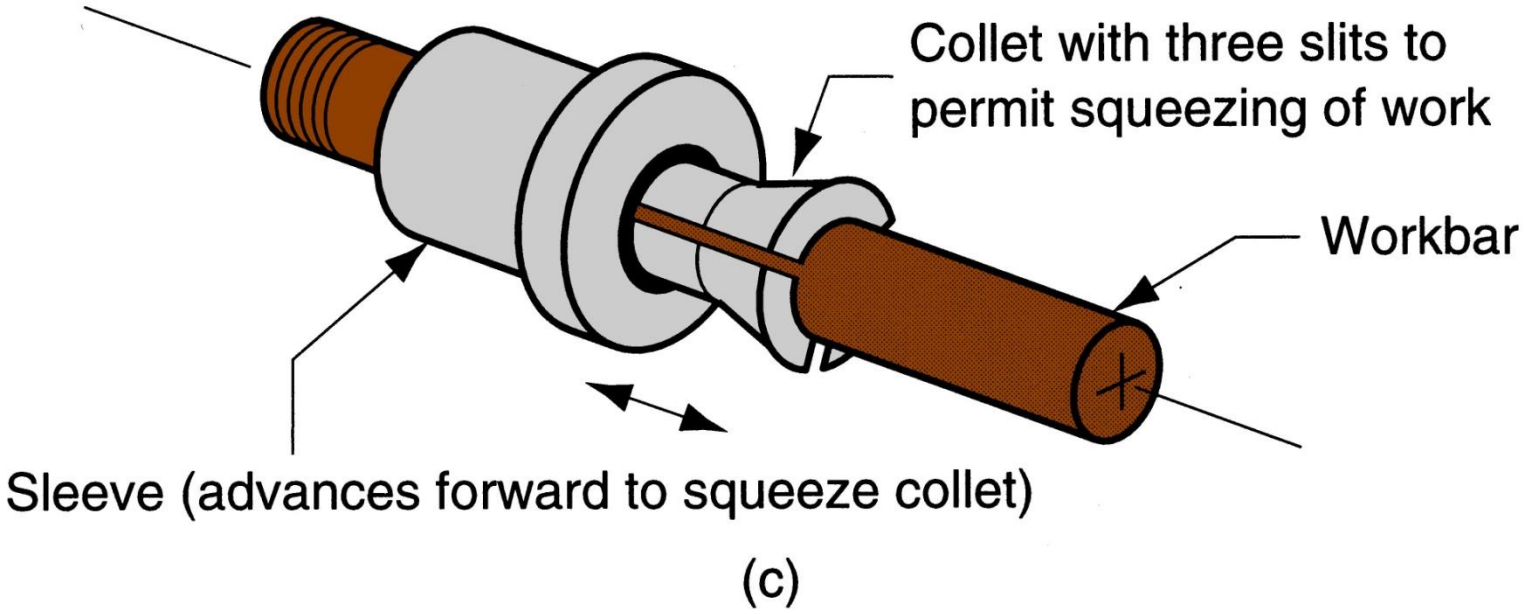


Figure 1.8 (c) collet

Face Plate

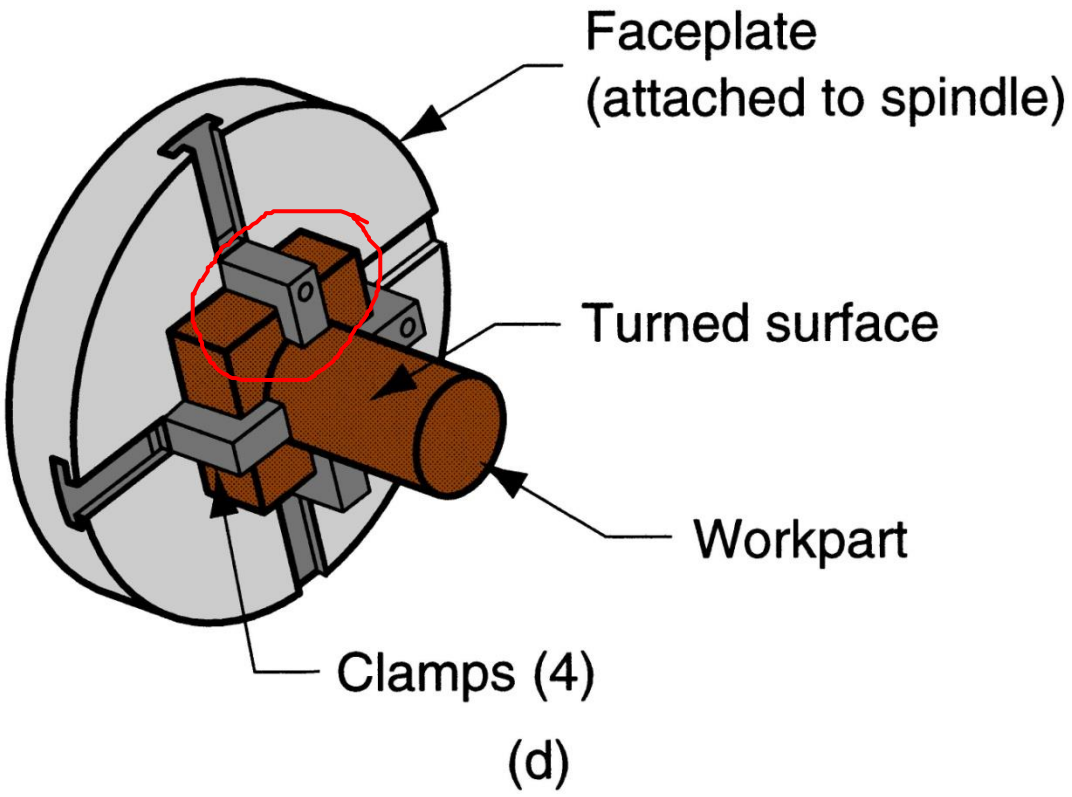
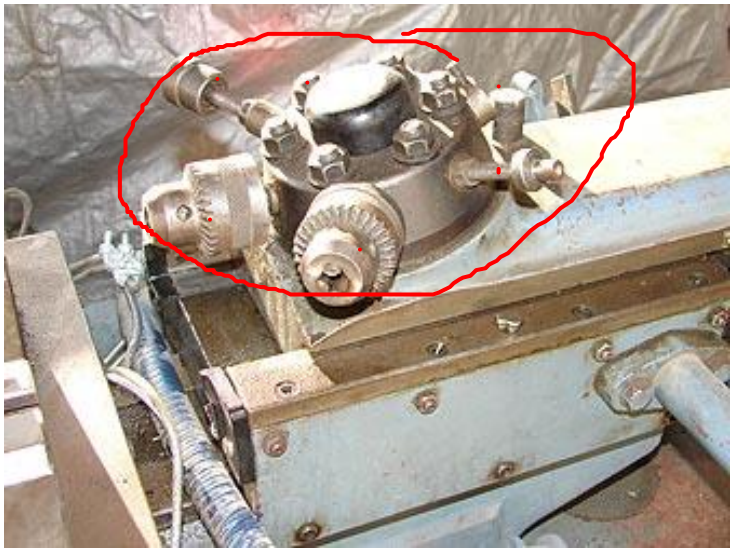


Figure 1.8 (d) face plate for non-cylindrical work parts

Turret Lathe

Tailstock replaced by “turret” that holds up to six tools

- Tools rapidly brought into action by indexing the turret
- Applications: high production work that requires a sequence of cuts on the part



Chucking Machine

- Uses chuck in its spindle to hold work part
- Parts cannot be mounted between centers
- Cutting tool actions controlled automatically
- Operator’s job: to load and unload parts
- Applications: short, light-weight parts


Thank You!

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Mechanical Workshop

Week_02

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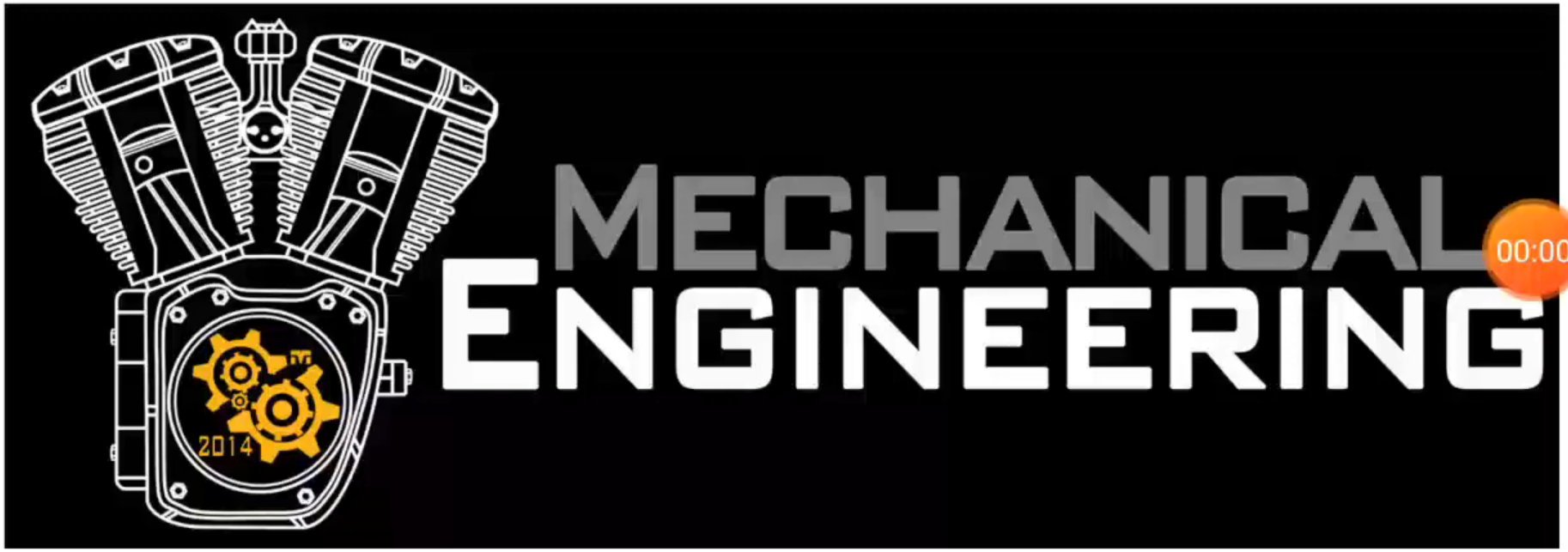
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Boring

- Difference between boring and turning:
  - *Boring* is performed on the inside diameter of an existing hole
  - *Turning* is performed on the outside diameter of an existing cylinder
- In effect, boring is an internal turning operation
- Boring machines
  - Horizontal or vertical - refers to the orientation of the axis of rotation of machine spindle

Boring

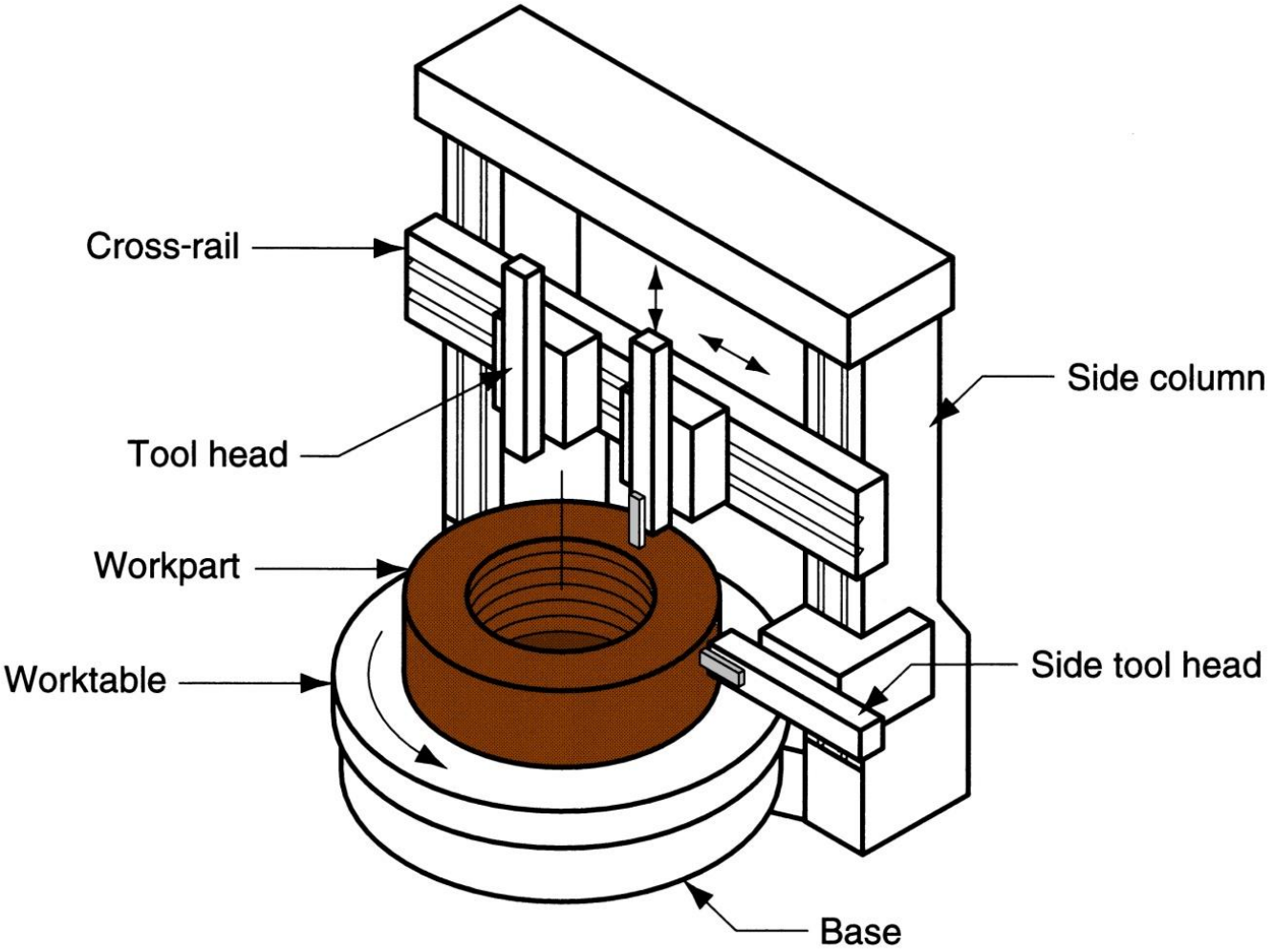


Figure 1.12 - A vertical boring–for large, heavy work parts

Drilling

- Creates a round hole in a work part
- Contrasts with boring which can only enlarge an existing hole
- Cutting tool called a *drill* or *drill bit*
- Customarily performed on a *drill press*

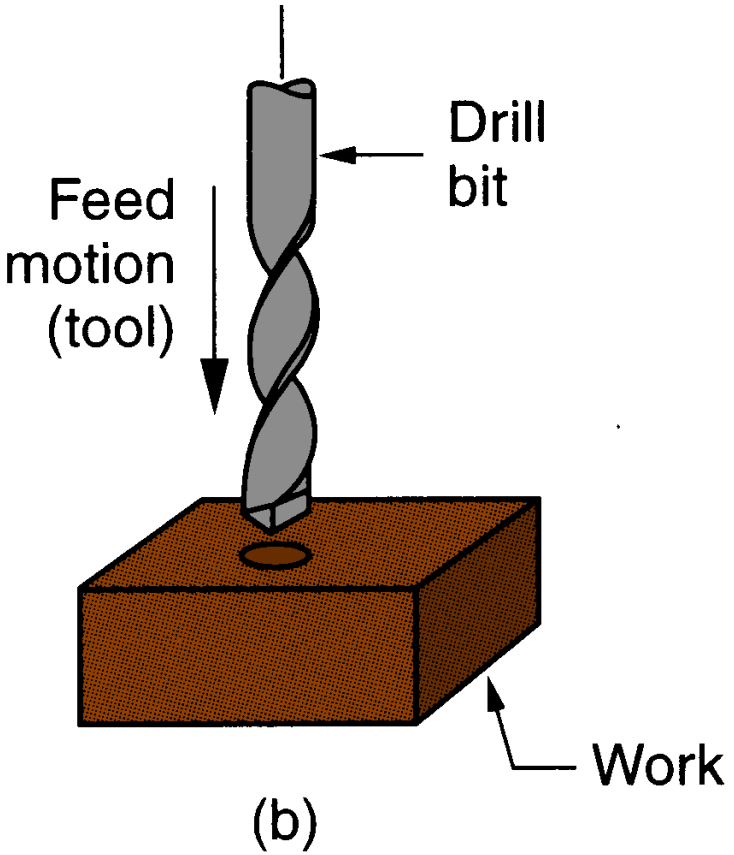


Figure 1.13 (b) drilling

Through Holes vs. Blind Holes

Through-holes - drill exits the opposite side of work

Blind-holes – drill does not exit work on opposite side

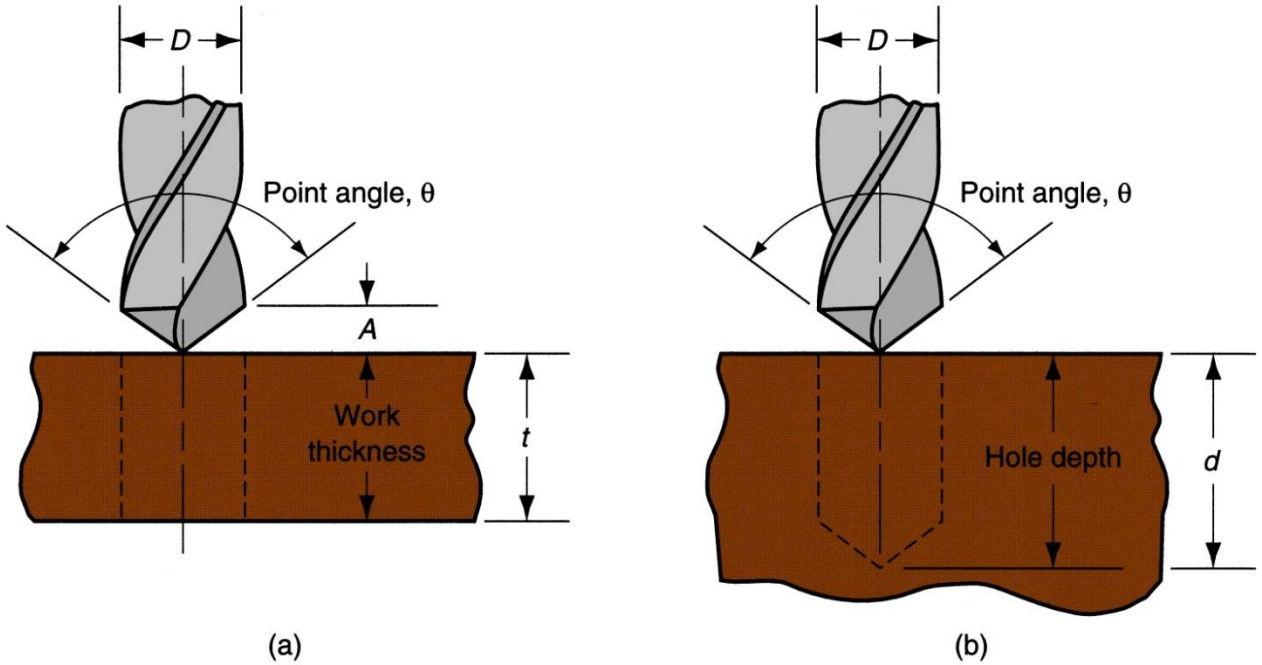
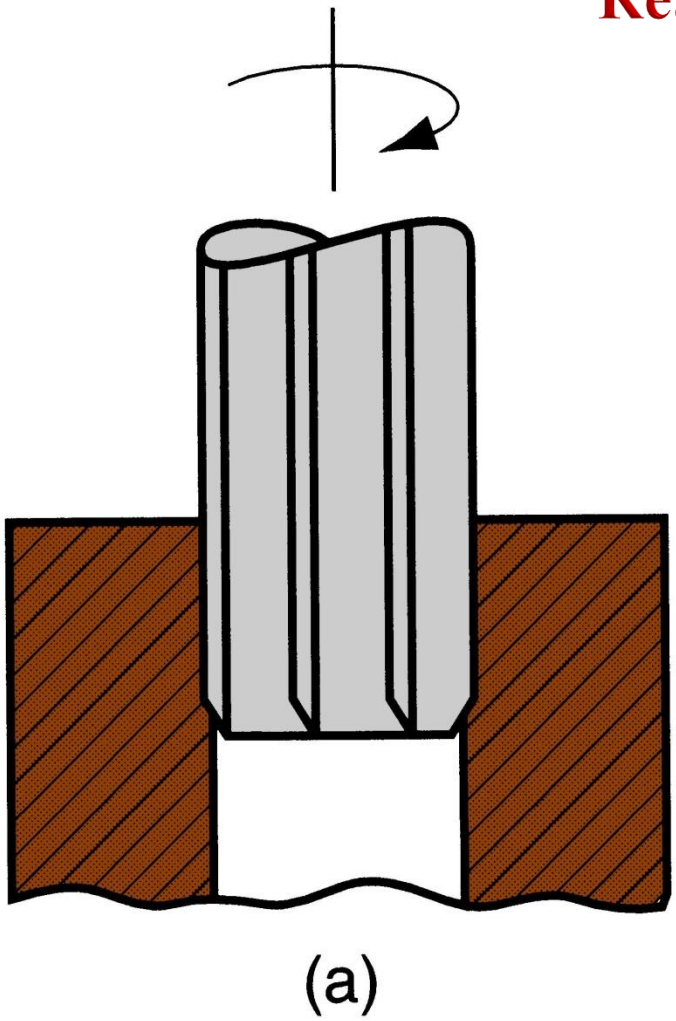


Figure 1.13 - Two-hole types: (a) through-hole, and (b) blind hole

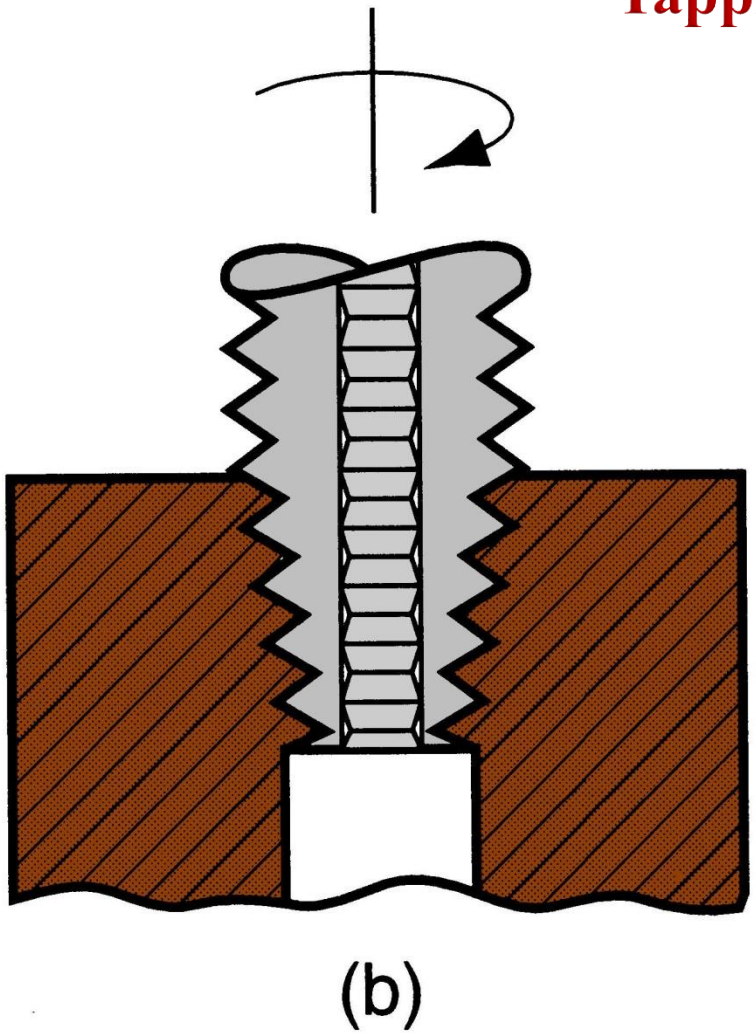
Reaming



Used to slightly enlarge a hole, provide better tolerance on diameter, and improve surface finish

Figure 1.14 - Machining operations related to drilling:
(a) Reaming

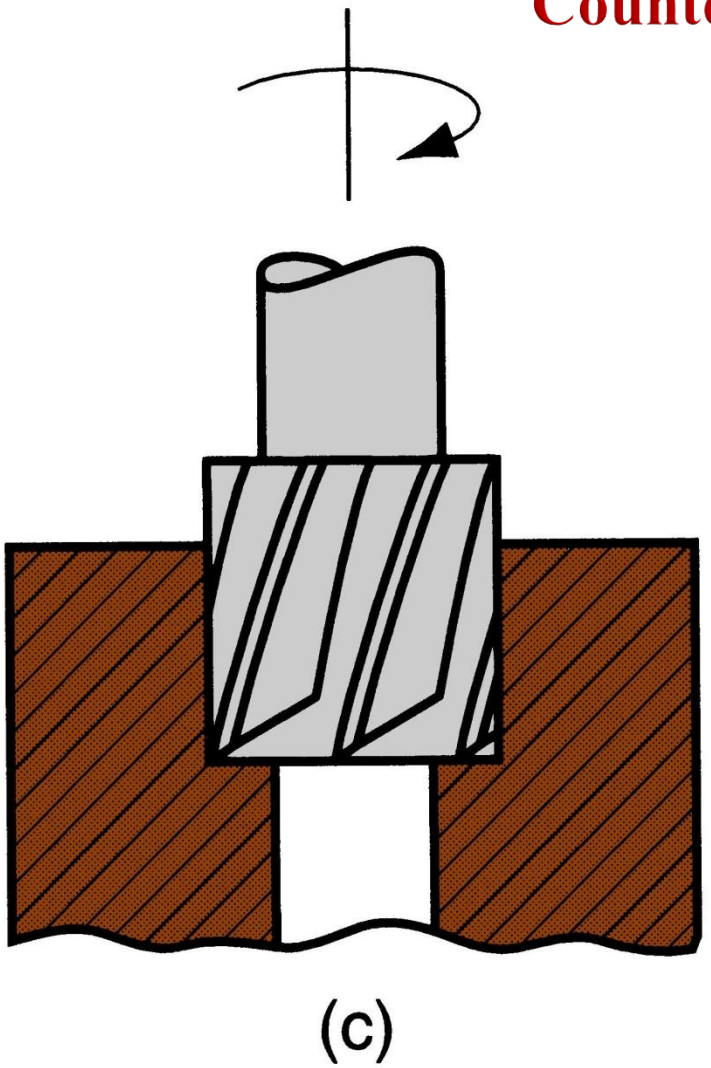
Tapping



Used to provide internal screw threads on an existing hole Tool called a *tap*

Figure 1.14 (b) tapping

Counterboring



Provides a stepped hole, in which a larger diameter follows a smaller diameter partially into the hole

Figure 1.14 (c) counterboring

Upright Drill

Stands on the floor

Bench Drill

Similar but smaller and mounted on a table or bench

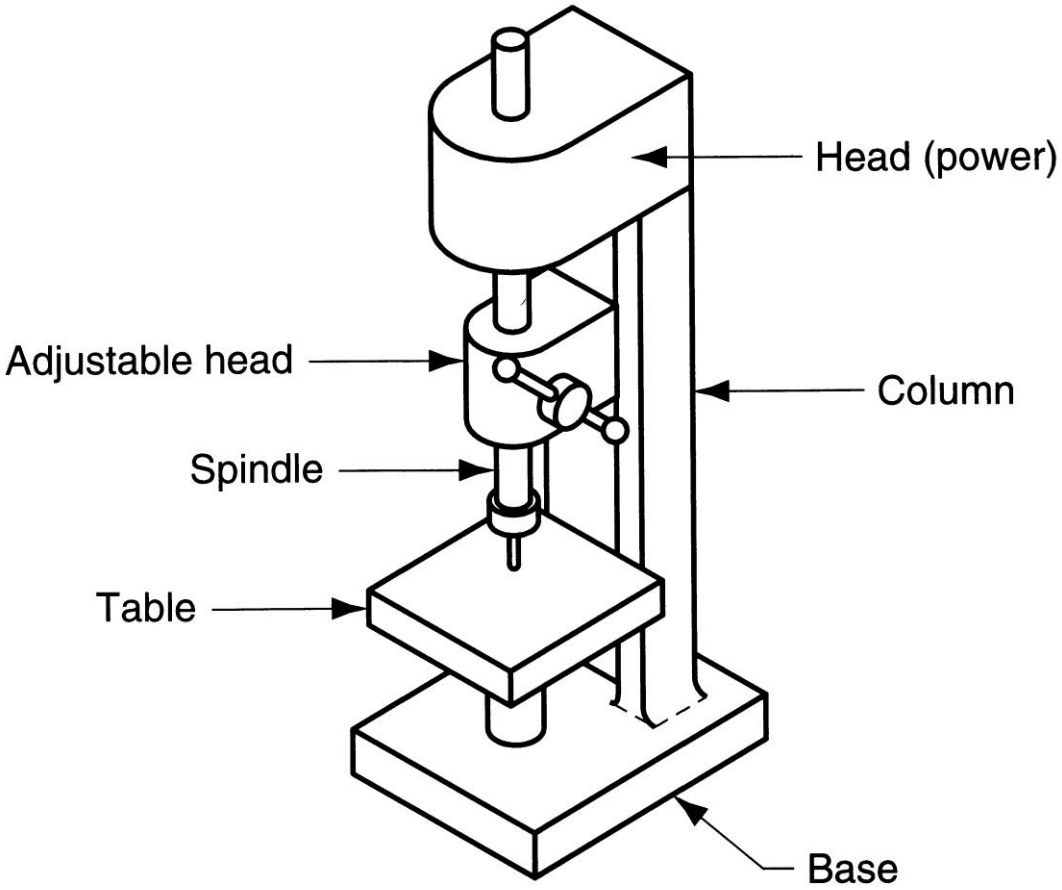
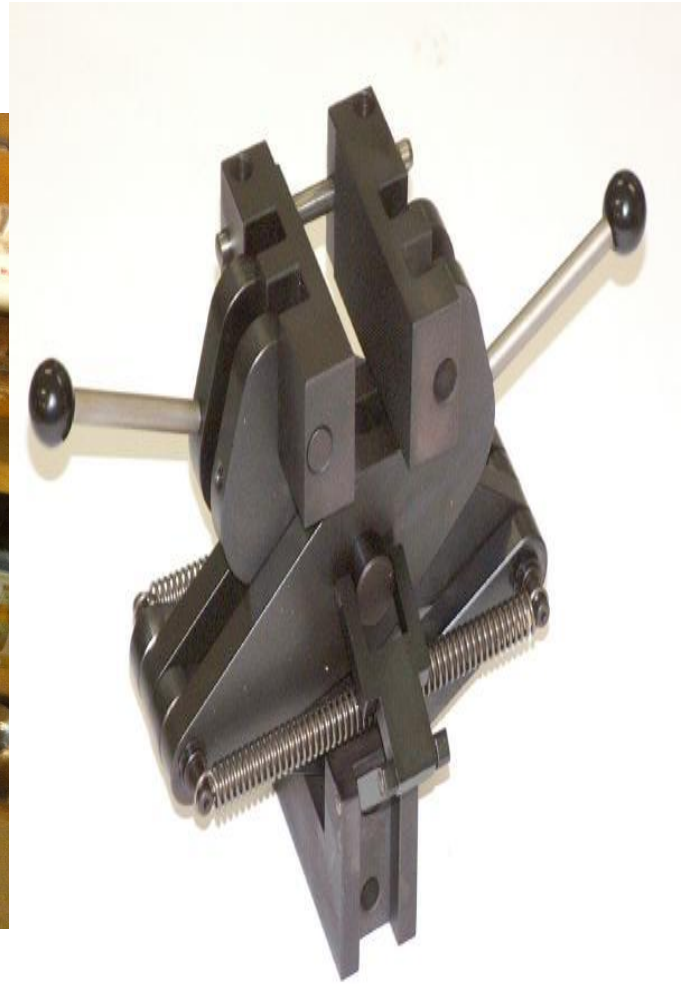
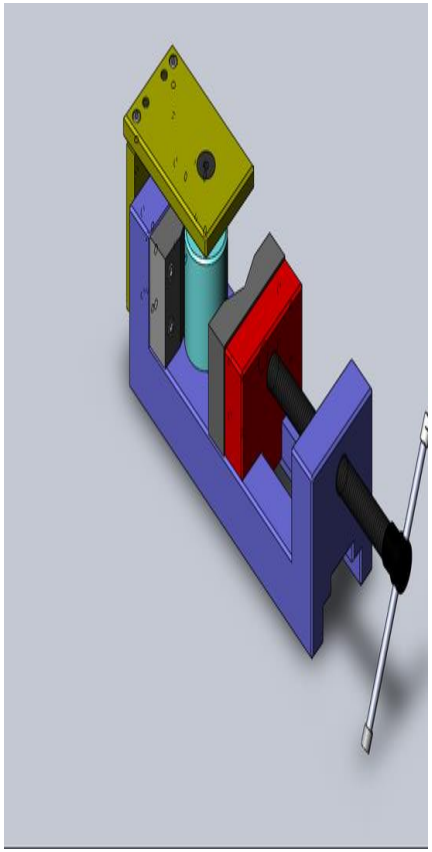


Figure1.15 - Upright drill press

Work Holding for Drill Presses

- Work part can be clamped in a vise, fixture, or jig
  - *Vise*-general purpose work holder with two jaws
  - *Fixture*-work holding device that is usually used
  - custom-designed for the particular workpart
  - *Jig*-jig's primary purpose is to provide repeatedly, accuracy, and interchangeability in the manufacturing of products. A jig is often confused with a fixture; a fixture holds the work in a fixed location. A device that does both functions (holding the work and guiding a tool) is called a jig.






Thank You!