151222126 - Engineering Graphics

Lecture 3

Projections & Sections

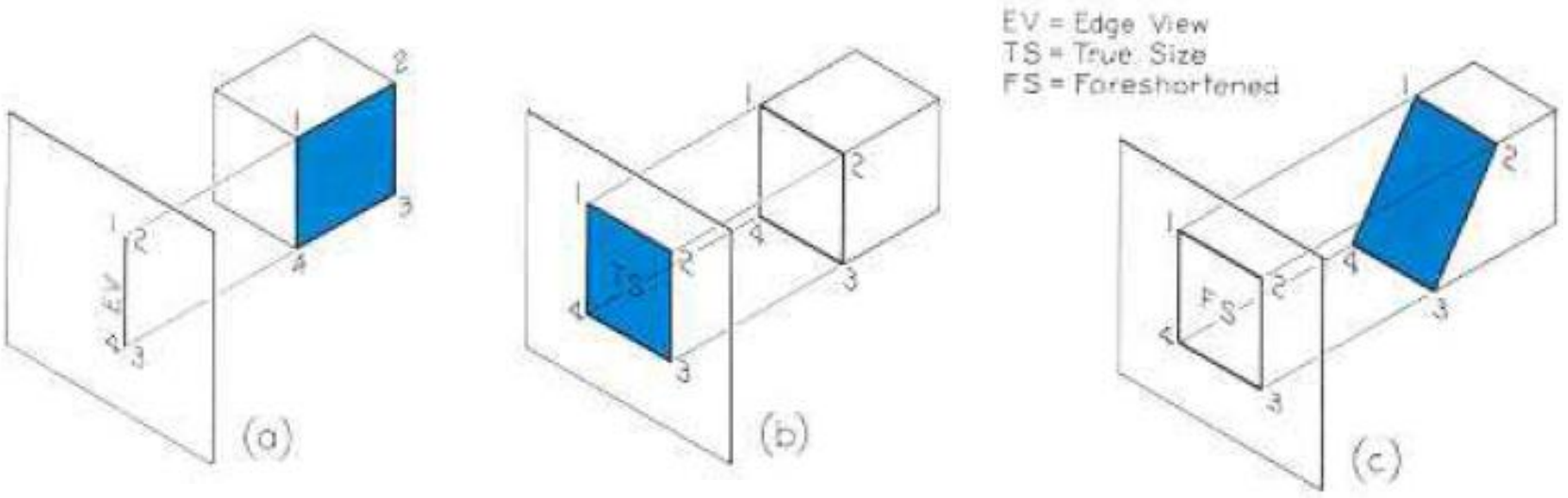
Views of Surfaces

(a) A plane surface that is perpendicular to a plane of projection appears on edge as a straight line.

(b) If it is parallel to the plane of projection, it appears true size.

(c) If it is angled to the plane of projection, it appears foreshortened or smaller than its actual size.

A plane surface always projects either on edge or as a surface in any view. It can appear foreshortened, but can ***never appear larger*** *than its true size in any view.*



Views of Surfaces

- **Normal Surfaces**

A normal surface is parallel to a plane of projection. It appears true size and true shape on the plane to which it is parallel, and as a vertical or a horizontal line on adjacent planes of projection.

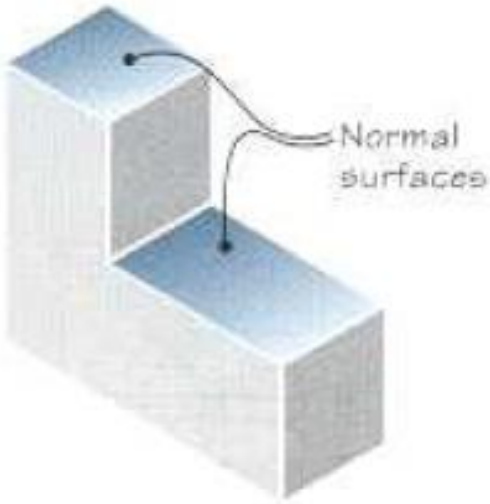


FIGURE 5.21 Normal Surfaces.

- **Inclined Surfaces**

An inclined surface is perpendicular to one plane of projection, but inclined or tipped to adjacent planes.

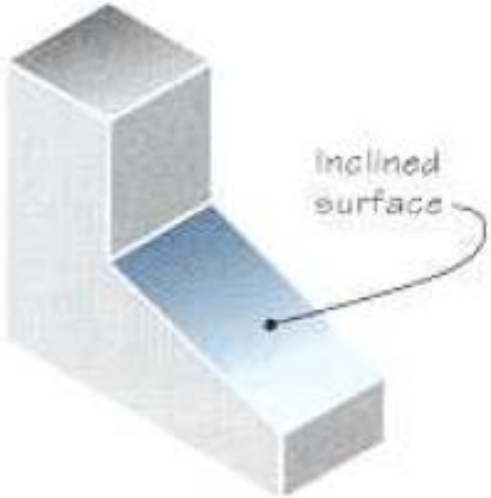


FIGURE 5.22 Inclined Surface.

Views of Surfaces

- **Oblique Surfaces**

  An oblique surface is tipped to all principal planes of projection.

  It cannot appear true size in any standard view.

  An oblique surface always appears as a foreshortened surface in all three standard views.

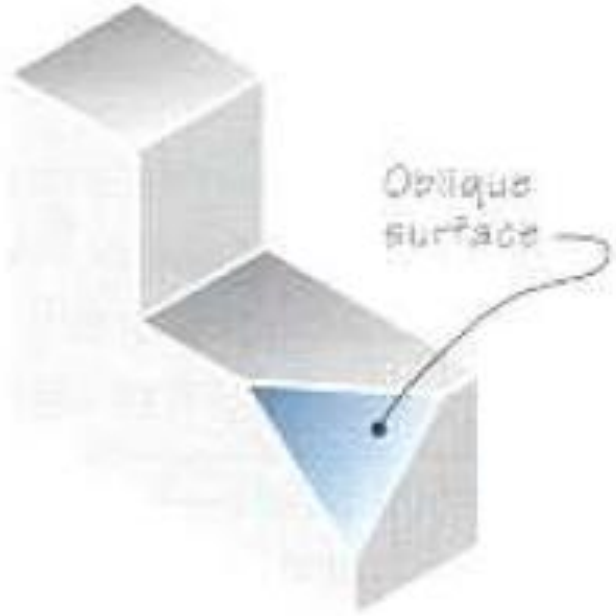


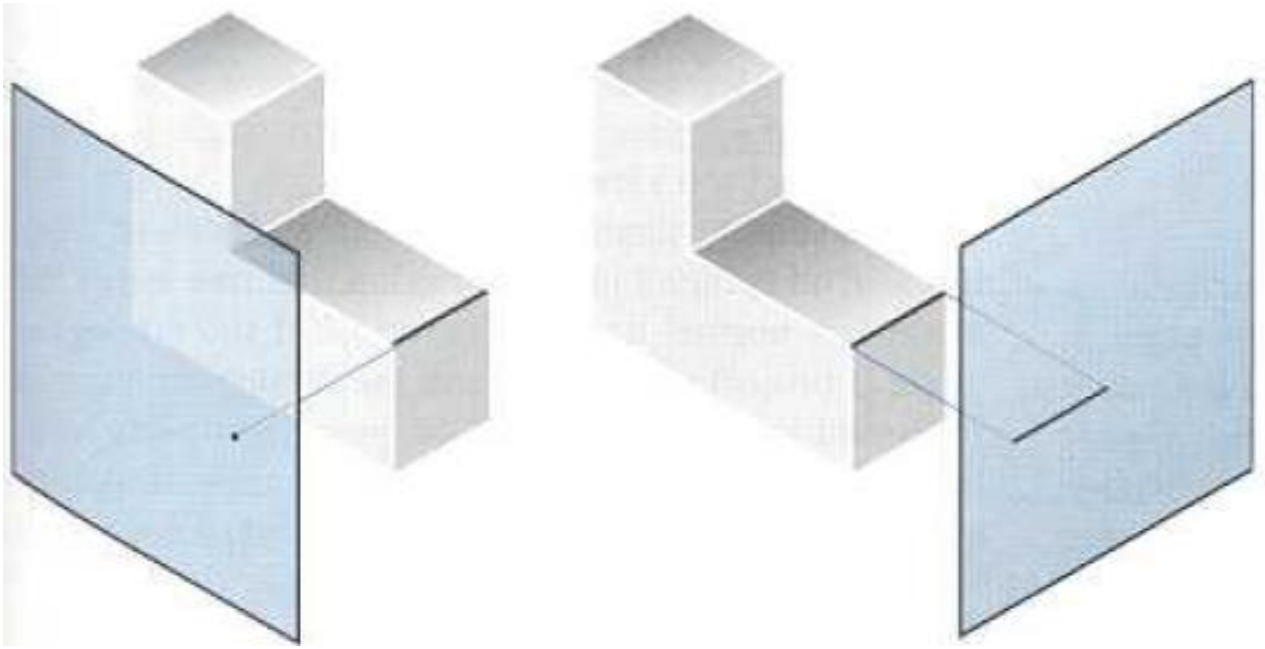
FIGURE 5.23 Oblique Surface.

Views of Edges

- **Normal Edges**

  A normal edge is a line that is perpendicular to a plane of projection.

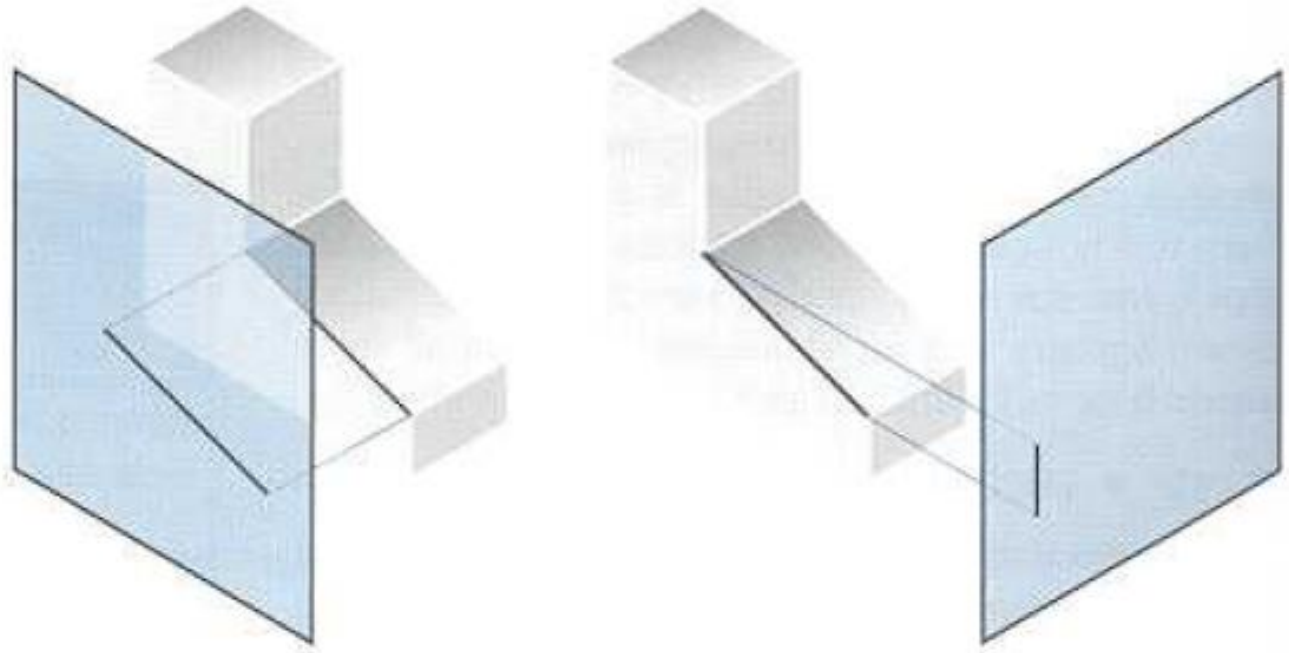
  It appears as a point on that plane of projection and as a true-length line an adjacent planes.



Views of Edges

- **Inclined Edges**

An inclined edge is parallel to one plane of projection but inclined to adjacent planes. It appears as a true-length line on the plane to which it is parallel and as a foreshortened line on adjacent planes.



Views of Edges

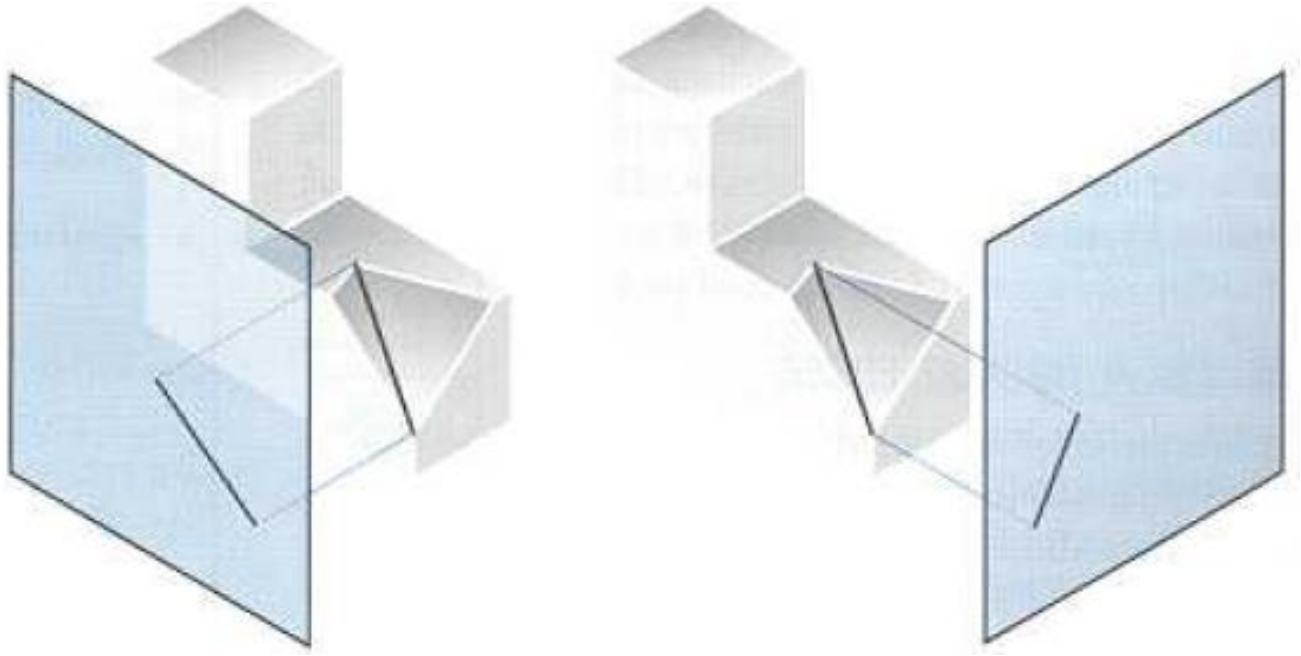
- **Oblique Edges**

  An oblique edge is tipped to all planes of projection.

  Since it is not perpendicular to any projection plane, it cannot appear as a point in any standard view.

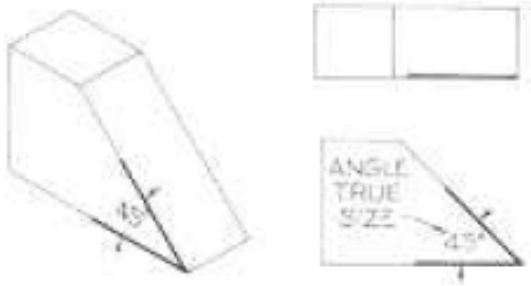
  Since it is not parallel to any projection plane, it cannot appear true length in any standard view.

  An oblique edge appears foreshortened and as an angled line in every view.

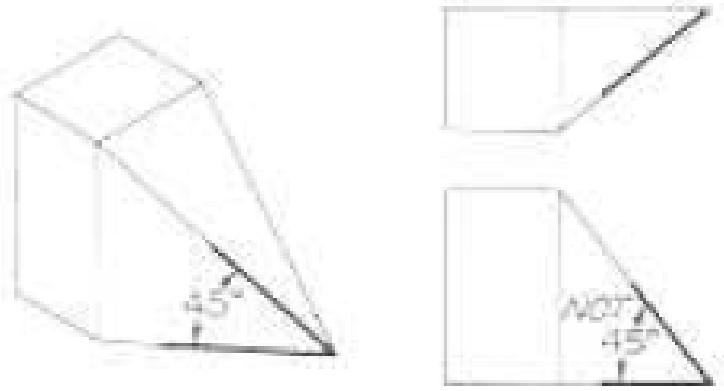


Views of Angles

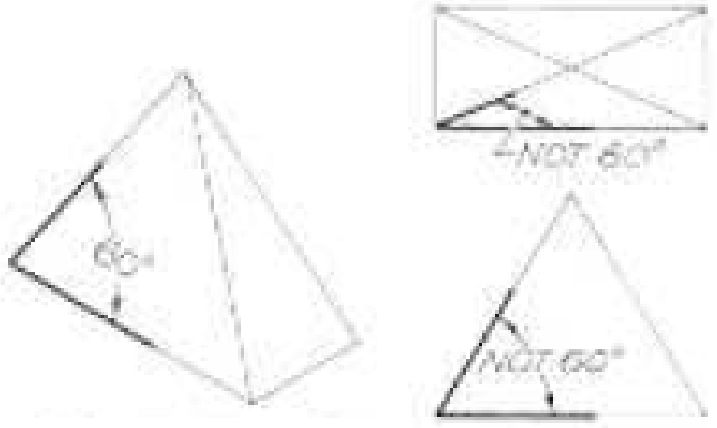
If an angle is in a normal plane, the angle will be shown true size on the plane of projection to which it is parallel.



If the angle is in an inclined plane, it may be porjected either larger or smaller than the true angle, depending on its position.



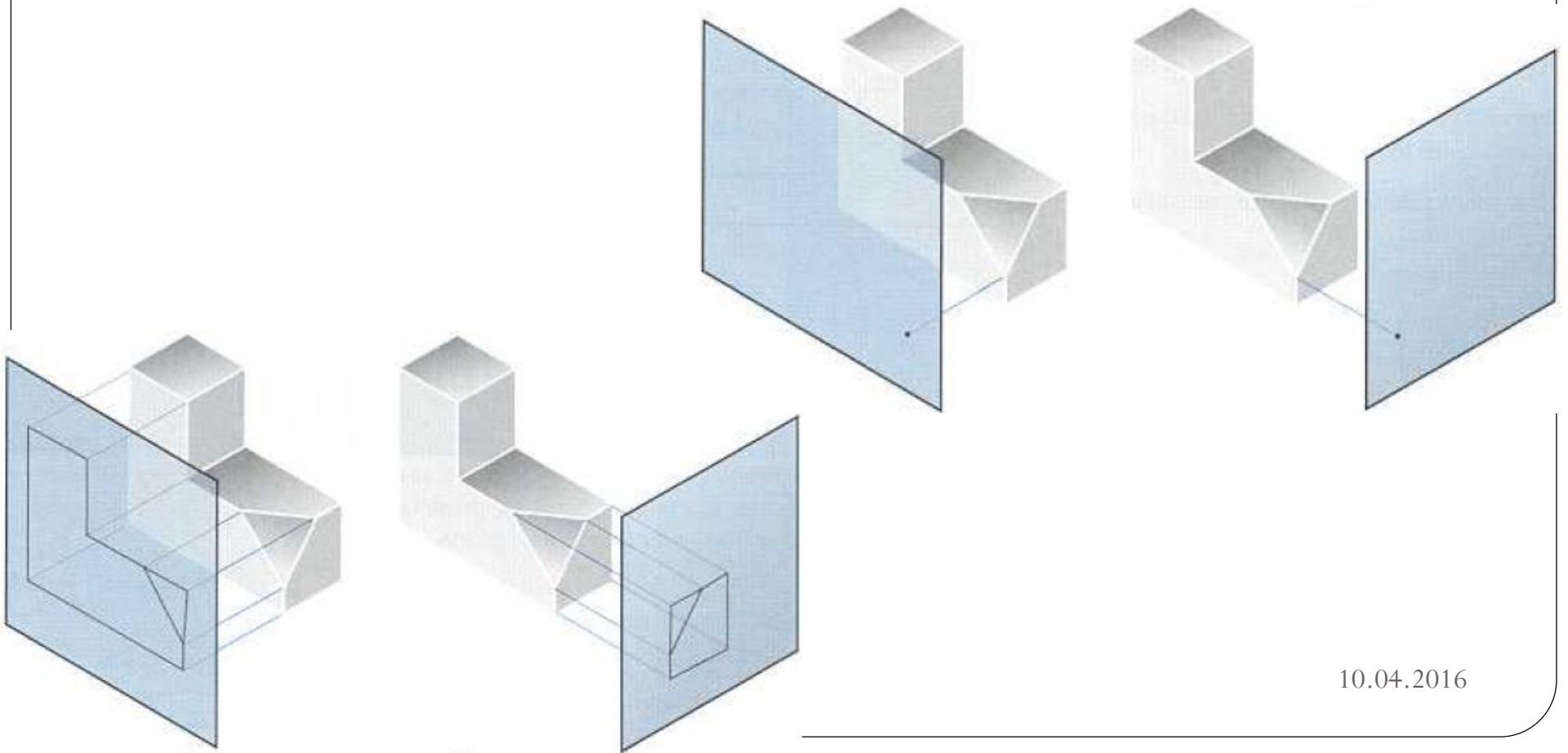
45- degree angle is shown oversize in the front view.



60- degree angle is shown undersize in both views.

Views of a Point

A corner, or point, is the common intersection of three or more surfaces. A point appears as a point in every view.



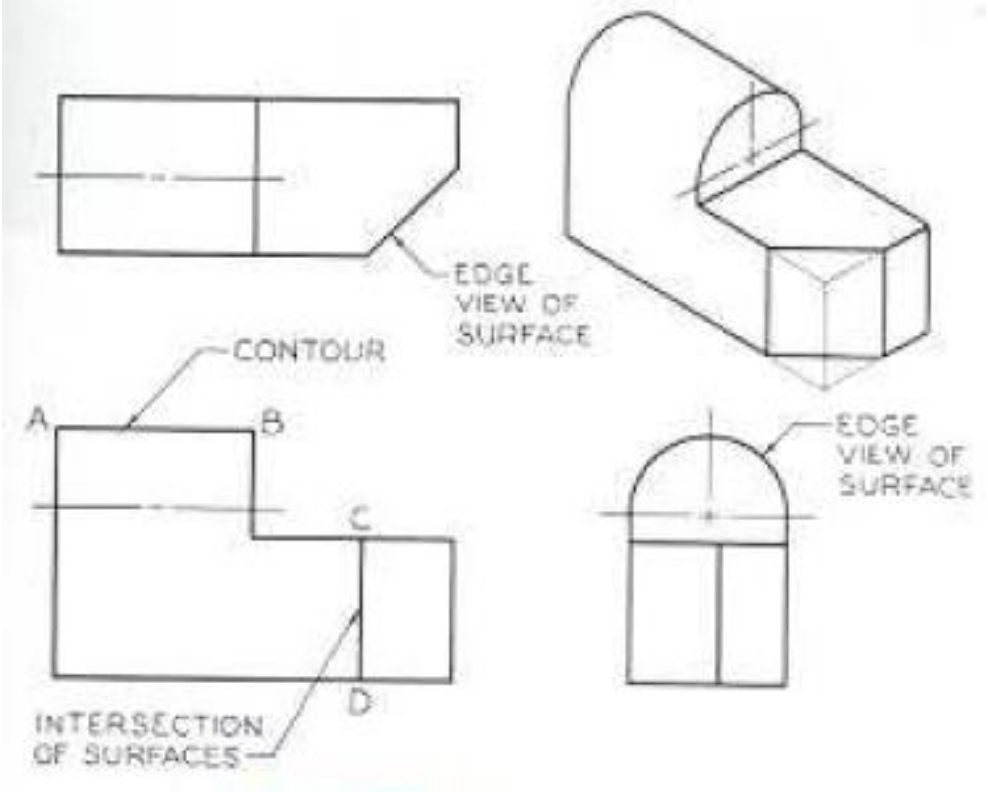
Meaning of Lines

A straight visible or hidden line in a sketch has three possible meanings;

An edge (intersection) between two surfaces

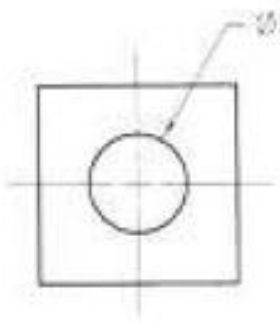
The edge view of a surface

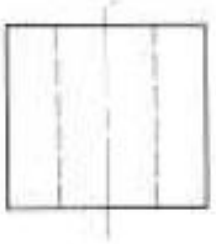
The limiting element of a curved surface



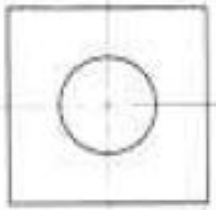
Representing Holes

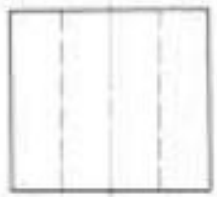
- Always specify hole sizes by diameter-never by radius.





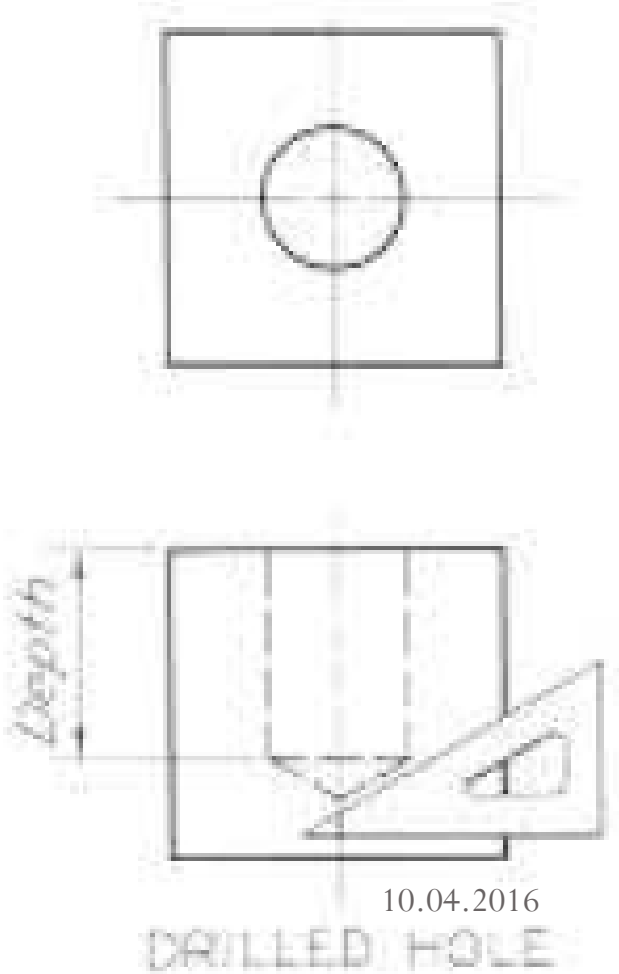
- A hole that goes through a member is called a through hole





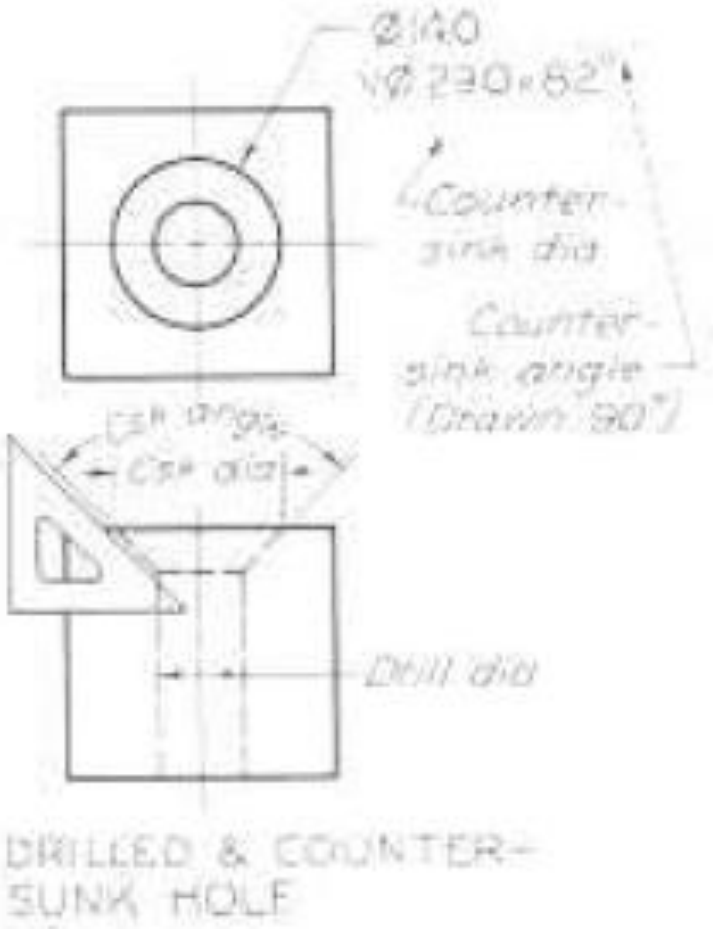
Representing Holes

- A hole with a specified depth is called a **blind hole**. In a blind hole, the depth includes the cylindrical portion of the hole only.



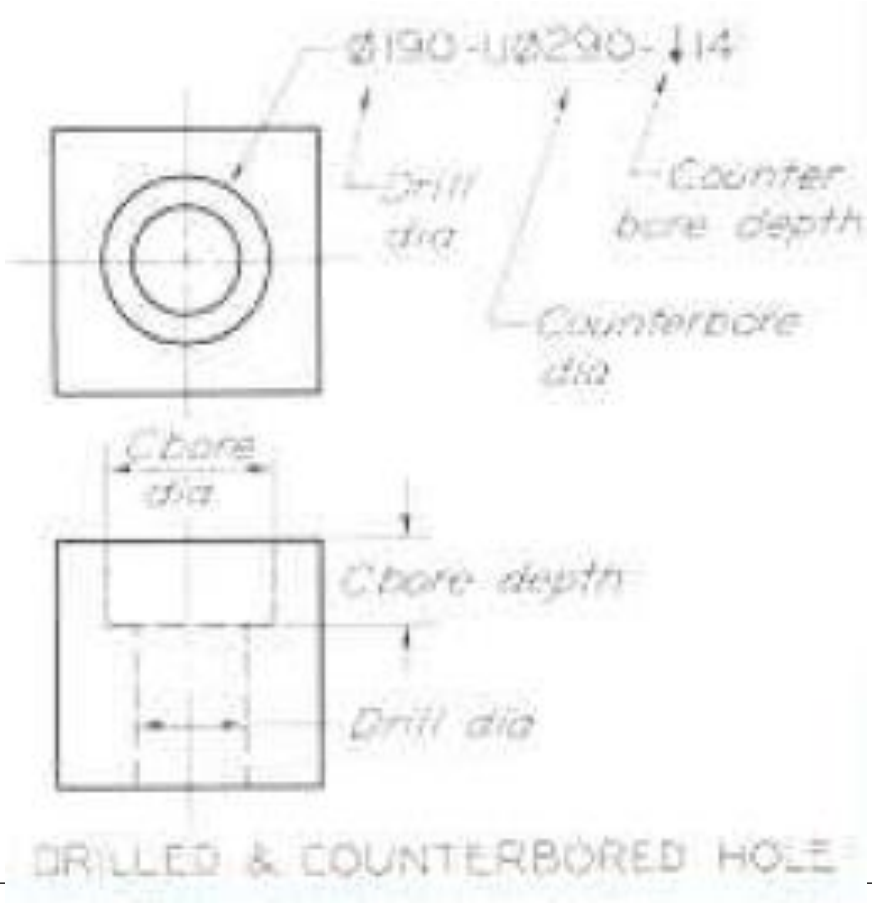
Representing Holes

- If a hole is to be drilled with the upper part enlarged conically to a specified angle and diameter – called **counter sinking** – the angle is commonly 82 degrees

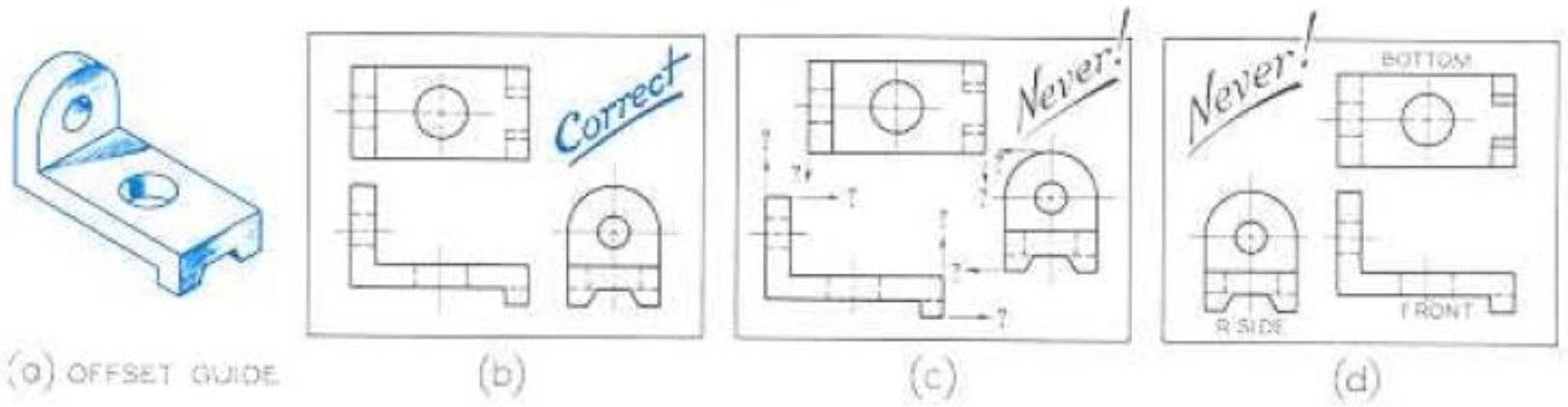


Representing Holes

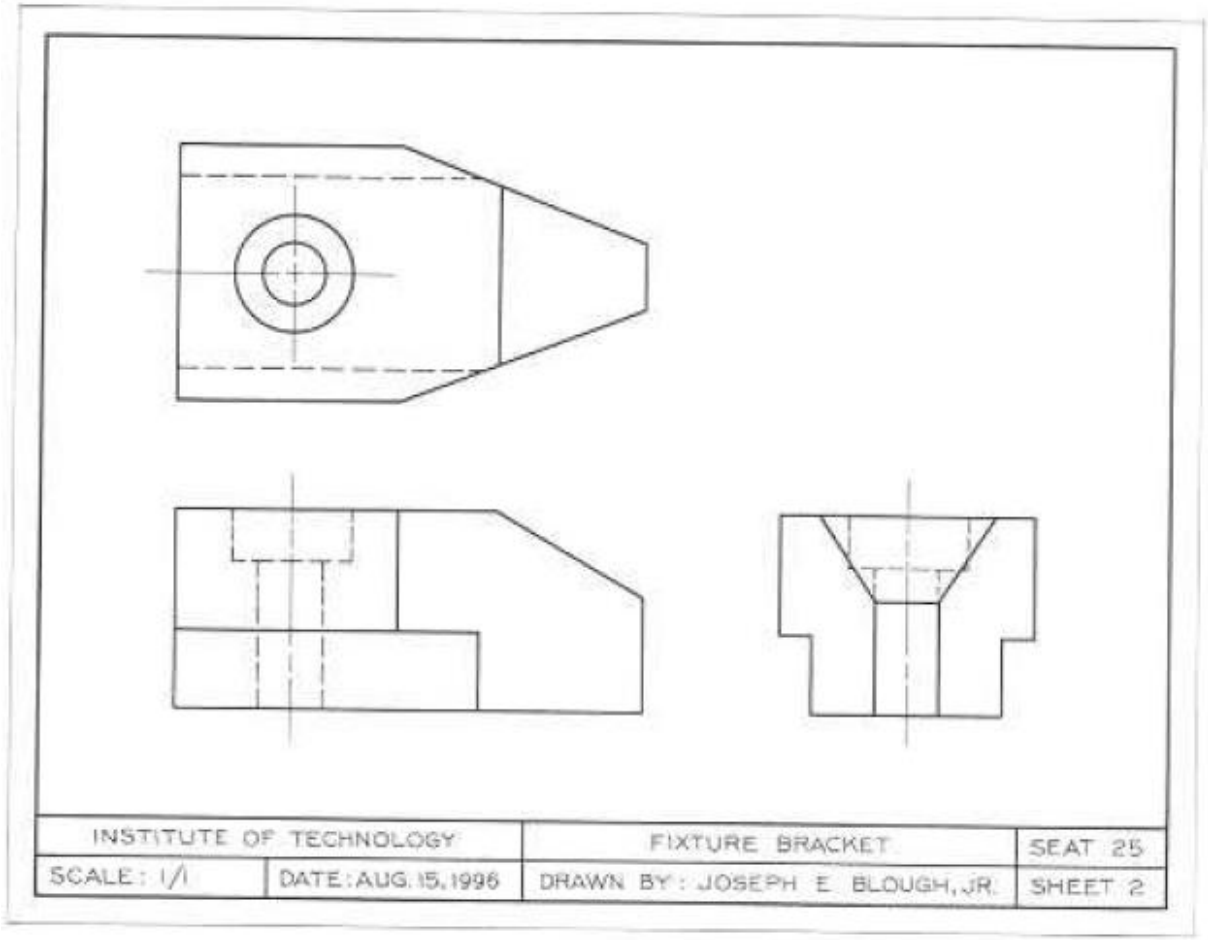
- If a hole is to be drilled and the upper part is to be enlarged cylindrically to a specified diameter and depth, called **counterboring.**



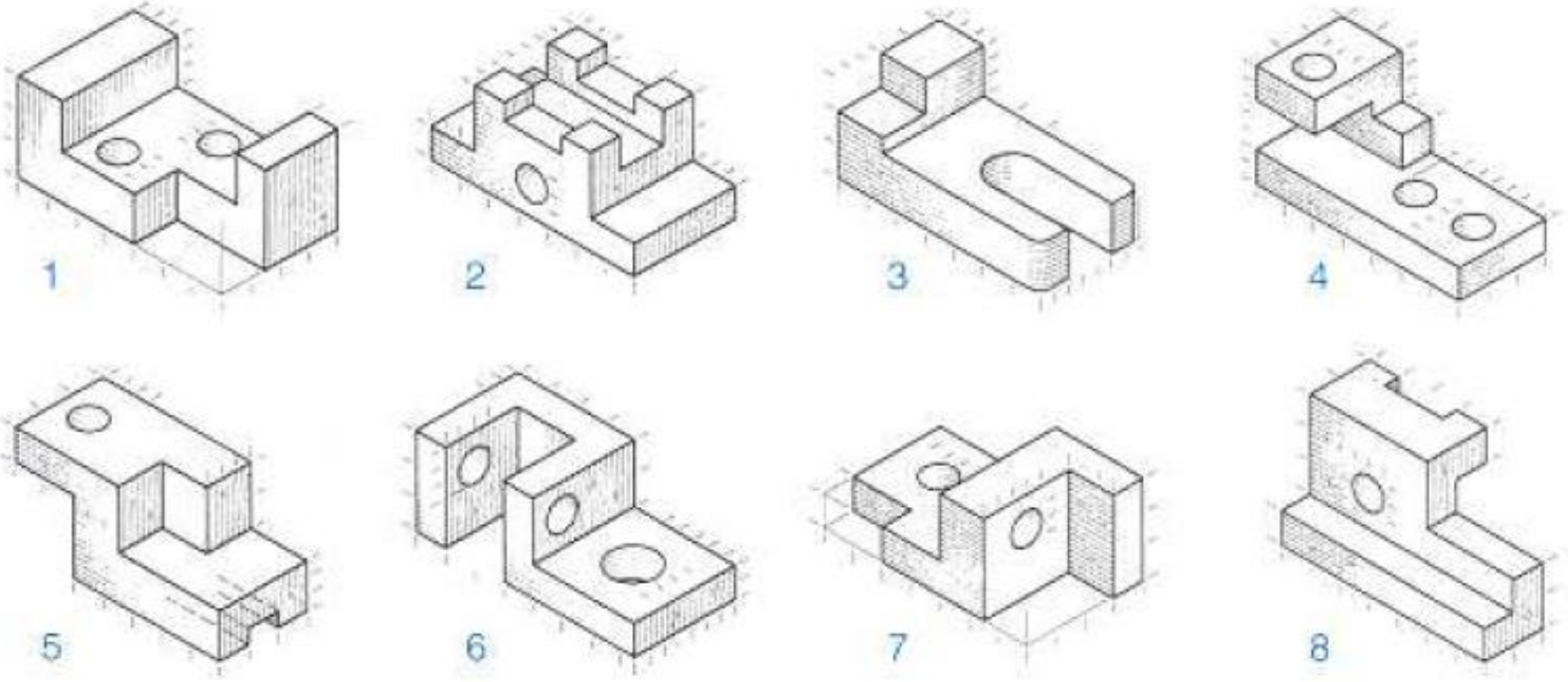
Position of views



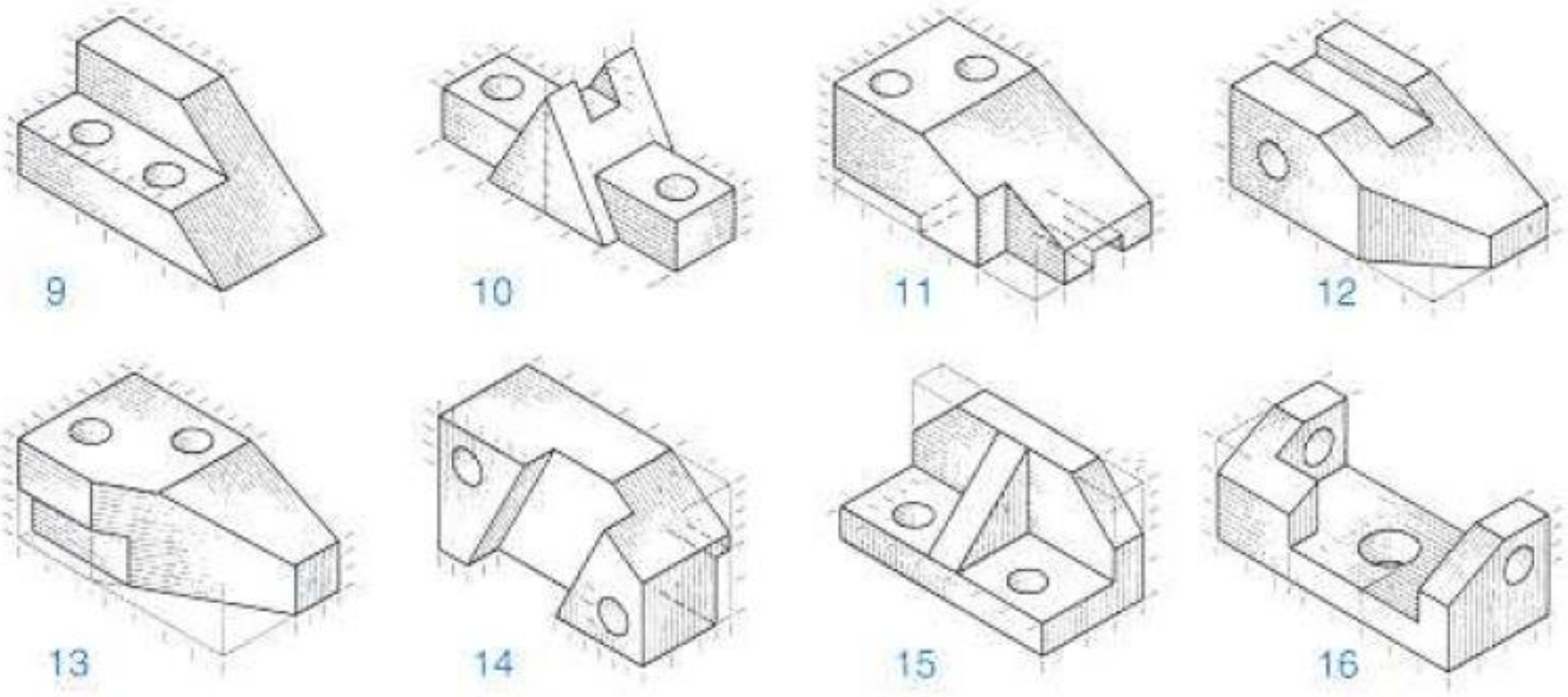
Suggested Layout for Mechanical Drawing



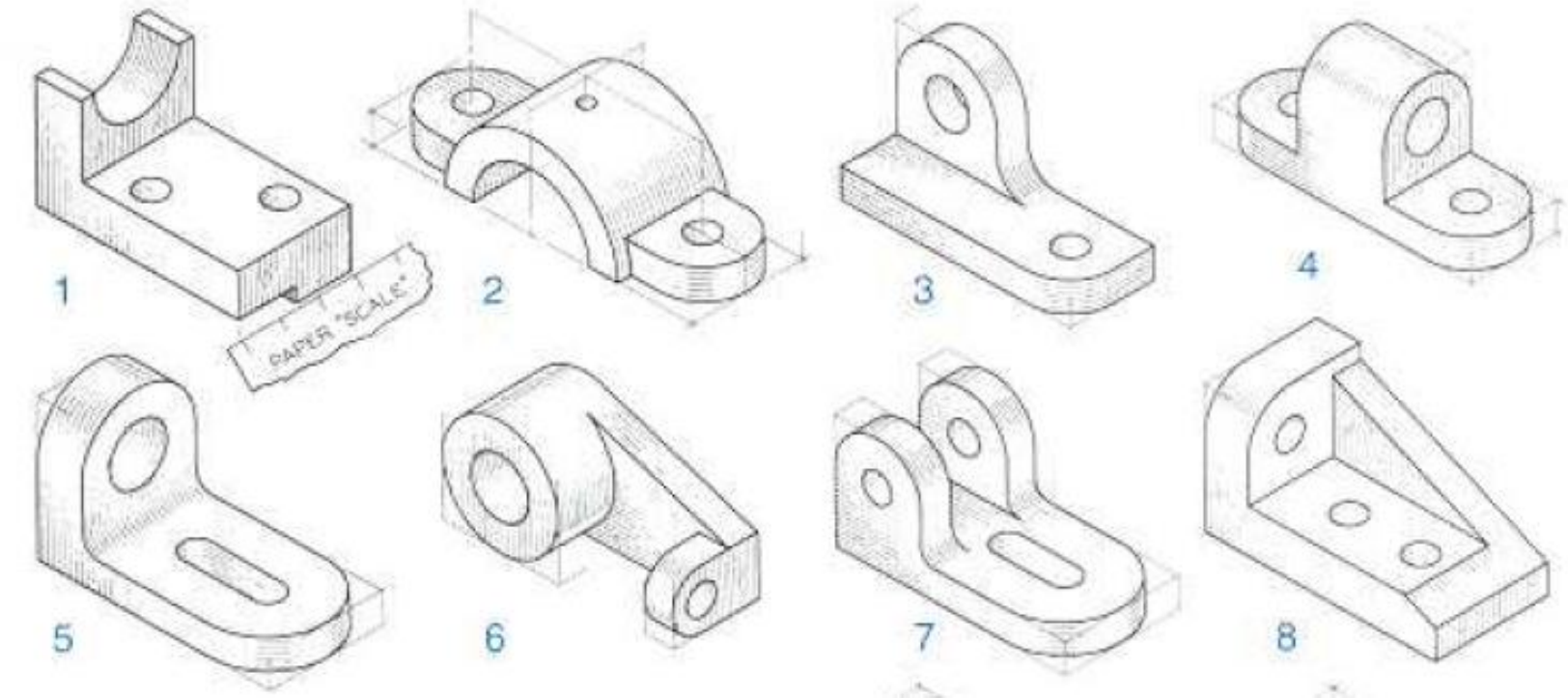
Multiview Sketching Problems



Multiview Sketching Problems



Multiview Sketching Problems



SECTION VIEW

To Produce section view, a cutting plane is imagined cutting through the part. Picture the two halves of the object pulled apart, exposing the interior construction.

- The direction of sight for the sectional view is toward the left half, with the right half mentally discarded.
- The sectional view replaces the right side view.
- Used when the interior of a part is complicated and the customary dashed (i.e. hidden) lines in regular orthographic views are confusing
- One or more views are drawn to show the part as if a portion had been cut away to reveal the interior

SECTION VIEW

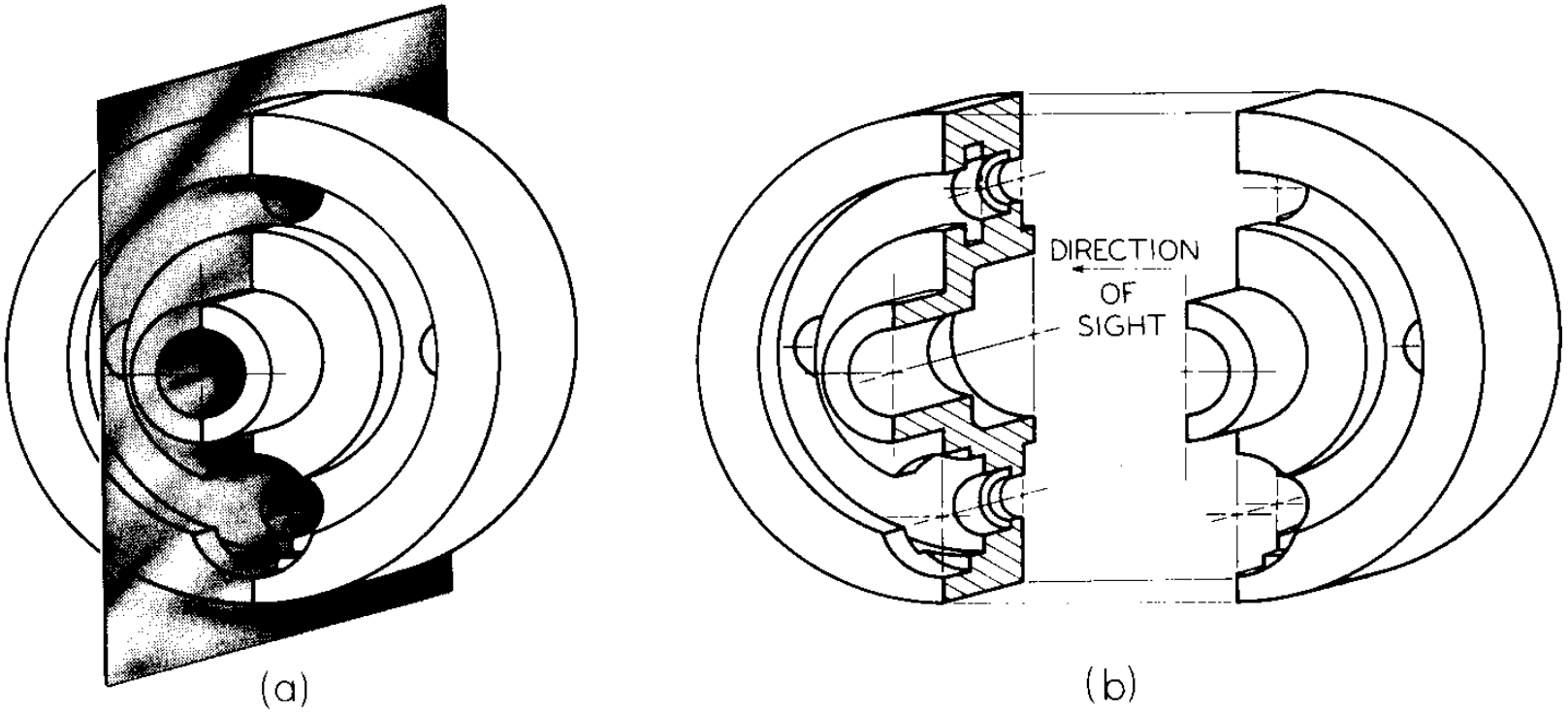
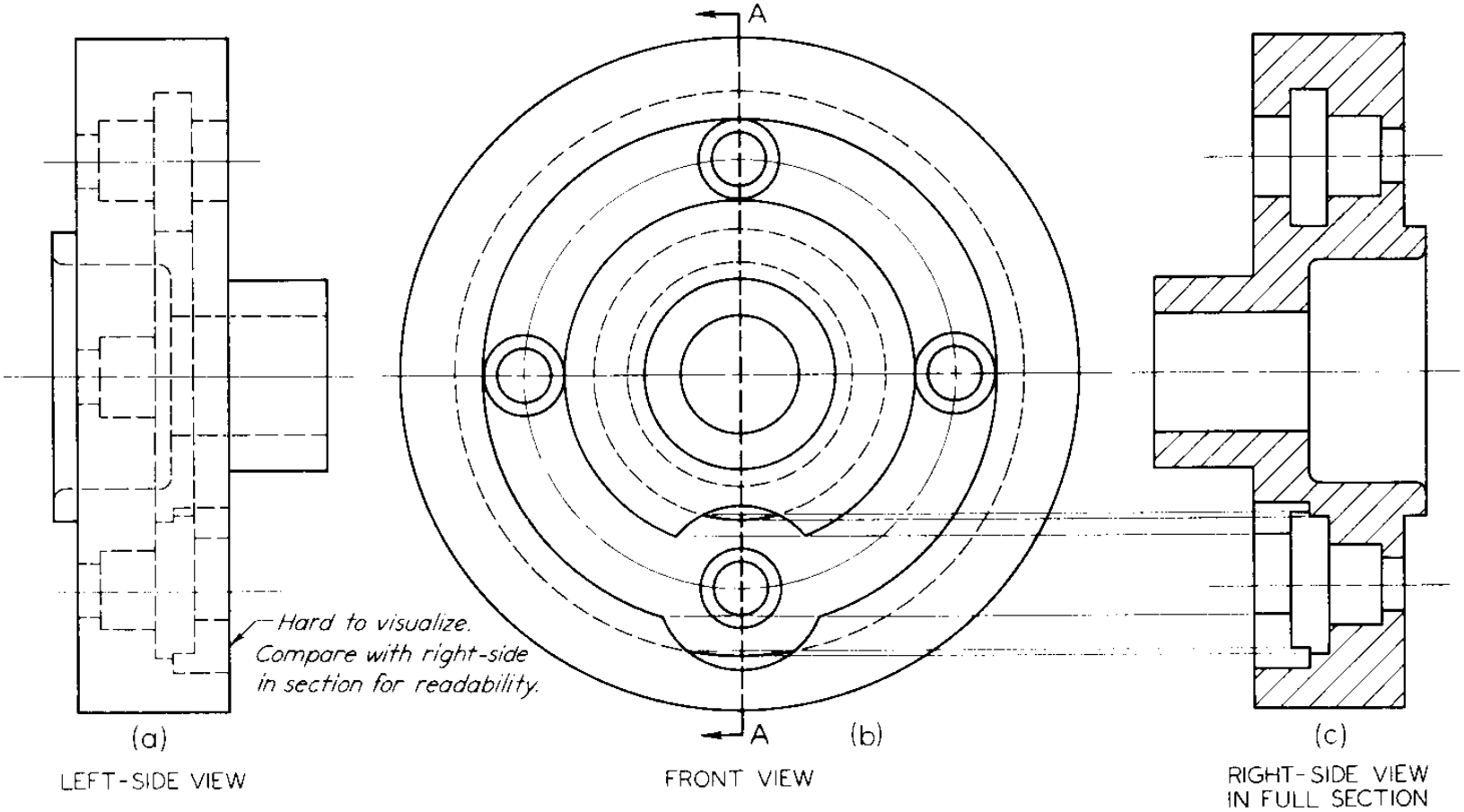


Fig. 7.1 **A Section.**

SECTION VIEW

Fig. 7.2 **Full Section.**



The section produced by cutting through entire object is callled a full section.

Interpreting cutting Planes and Sections

- Visible edges and contours behind the cutting plane should be shown.
- Hidden lines should be omitted in sectional views. Sometimes hidden lines are necessary for clarity.
- A section-lined area is always completely bounded by a visible line-never by hidden line.
- The cross hatching in all hatched areas must be parallel in a sectinal view of a single object. Using hatching in different directions indicates different part, as when two or more parts are adjacent in an assembly.

SECTION VIEW

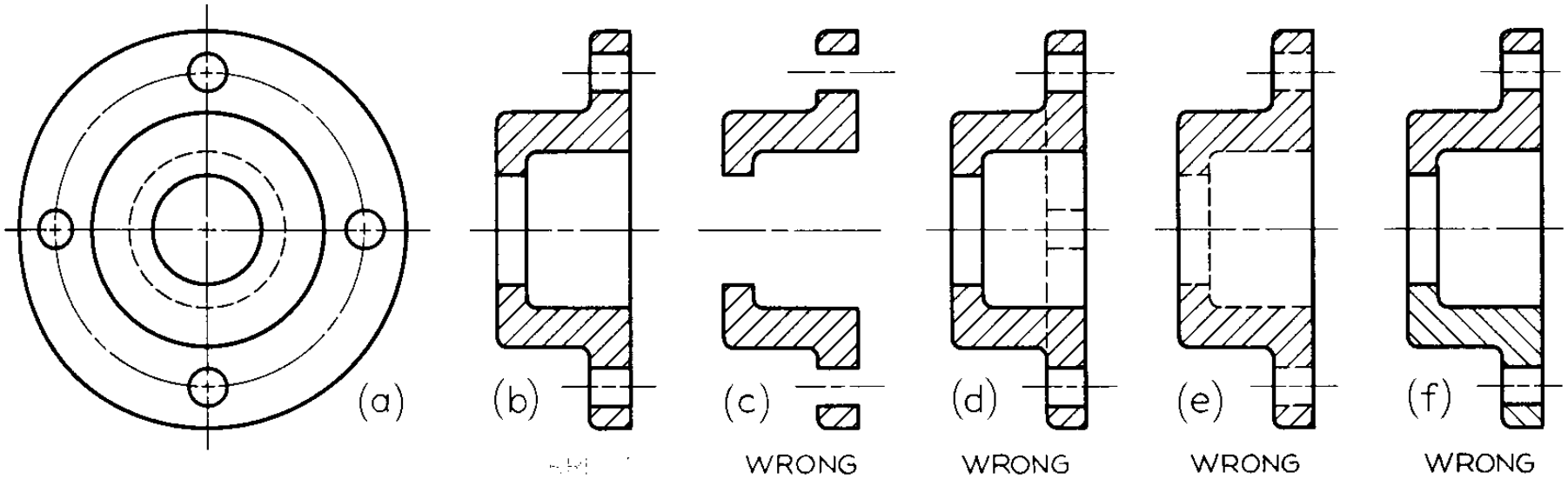


Fig. 7.3 Lines in Sectioning.

Missing Lines of object that are visible behind cuting planes.

Hidden lines are not usually shown.

Hatched areas are visible, never bounded by hidden lines.

Hatching always runs a single direction on a single part.

Fig. 7.4 Hidden Lines in Sections.

Hidden Lines in Section

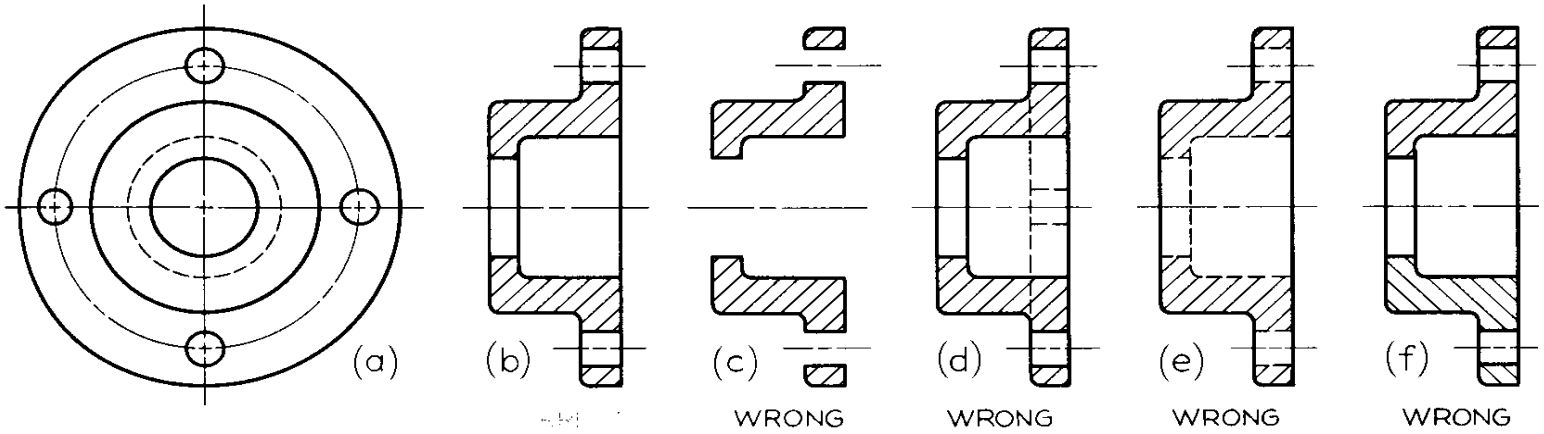


Fig. 7.3 **Lines in Sectioning.**

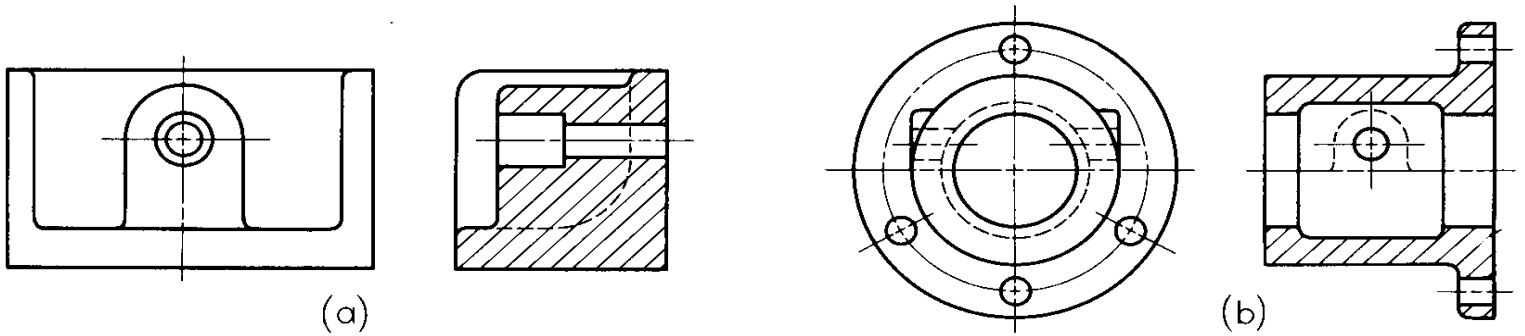
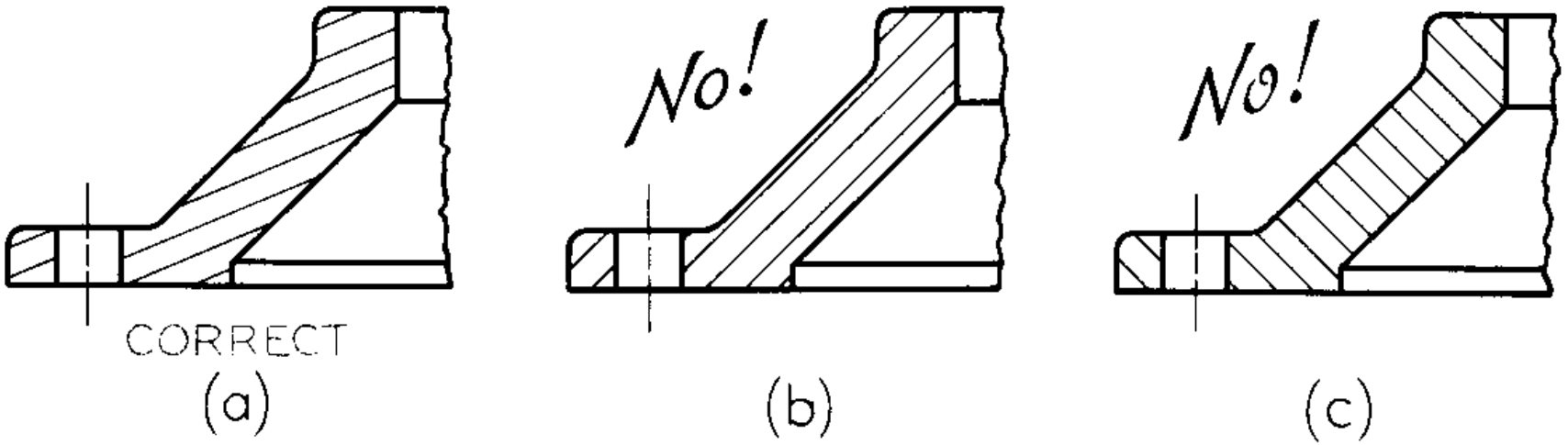


Fig. 7.4 **Hidden Lines in Sections.**

SECTION VIEW

Fig. 7.7 **Direction of Section Lines.**



Make hatching lines at 45 degrees with horizontal, unless they look better at different angle.

Dimensions should be kept off hatched areas, but when this is unavoidable the cross-hatching should be omitted where the dimension figure is placed.

SECTION VIEW

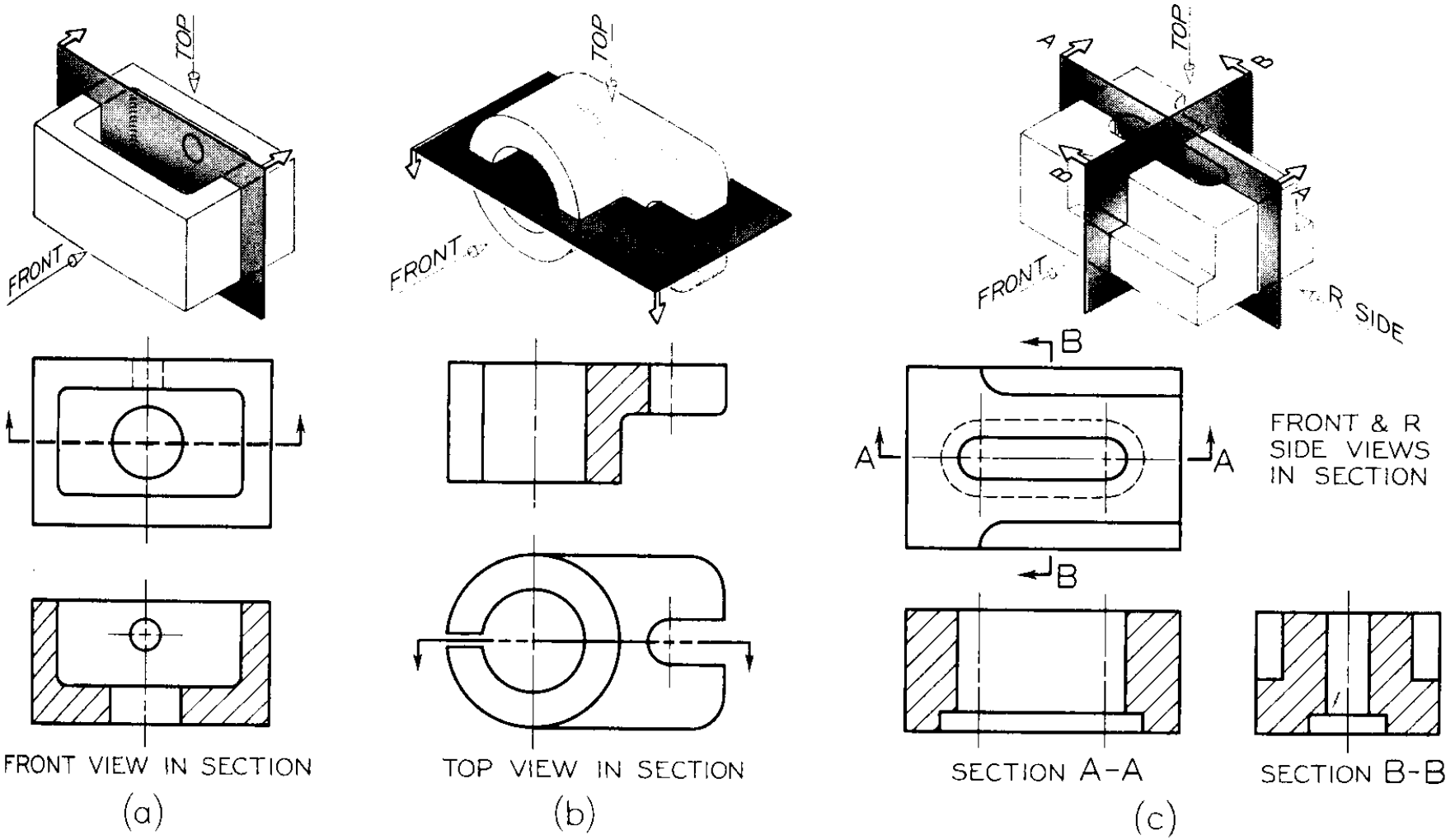
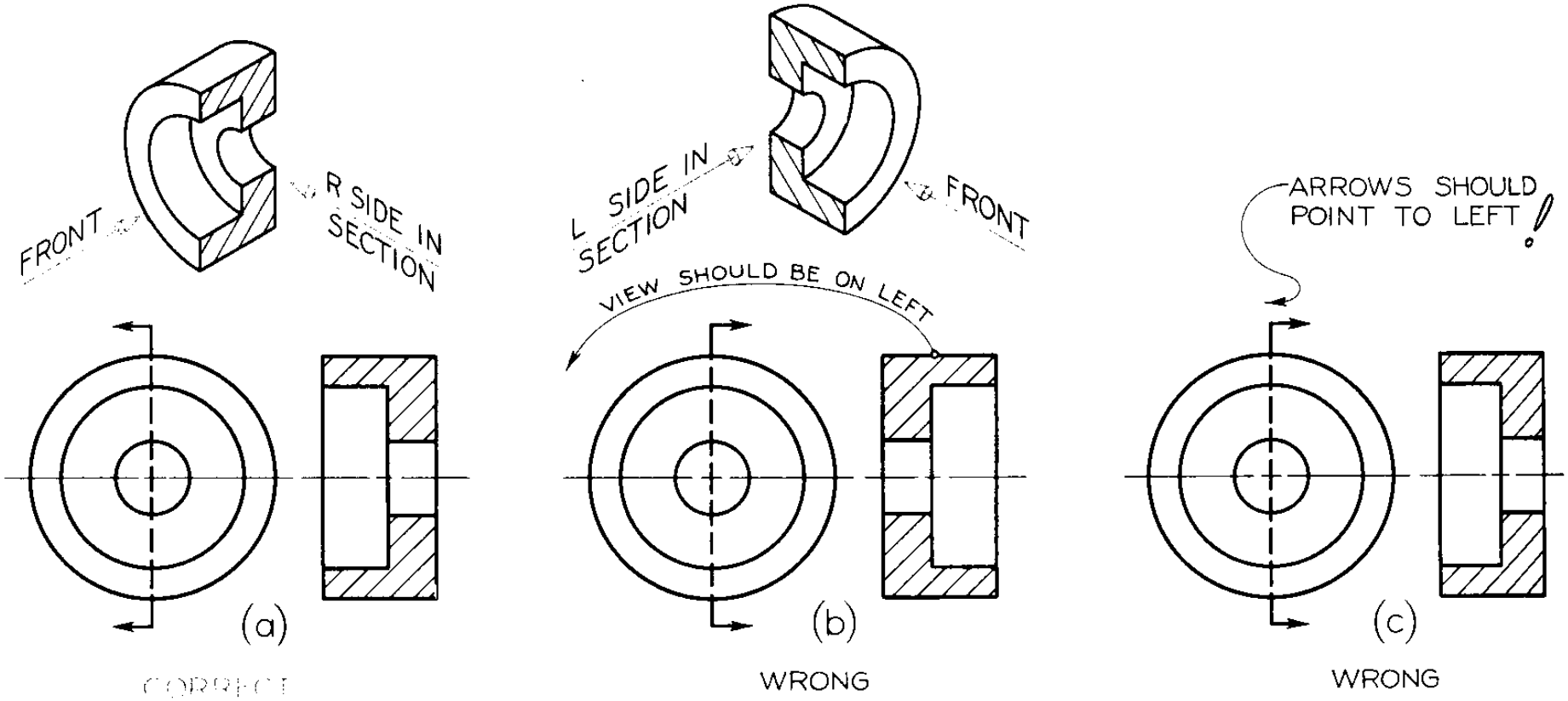


Fig. 7.8 Cutting Planes and Sections.

SECTION VIEW

Fig. 7.10 **Cutting Planes and Sections.**



Half Section

- Symmetrical objects can be sectioned using a cutting plane passing halfway through an object, resulting in a half section.
- The half section express the interior of one half of the object and still shows exterior of the other half.
- In general, hidden lines are omitted from both halves of a half section. However, they may be used in the unsectioned half if necessary for dimensioning.

Half Section

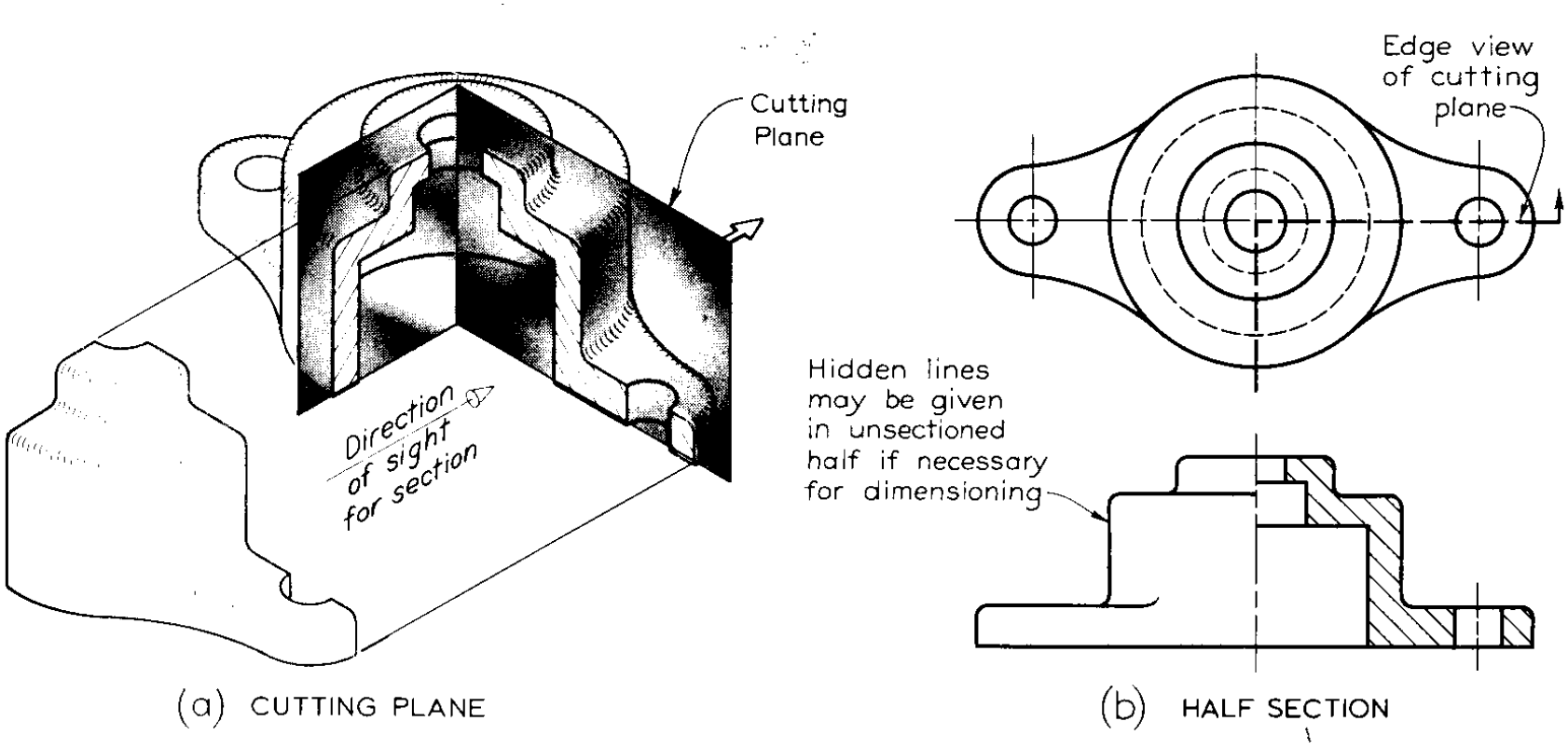
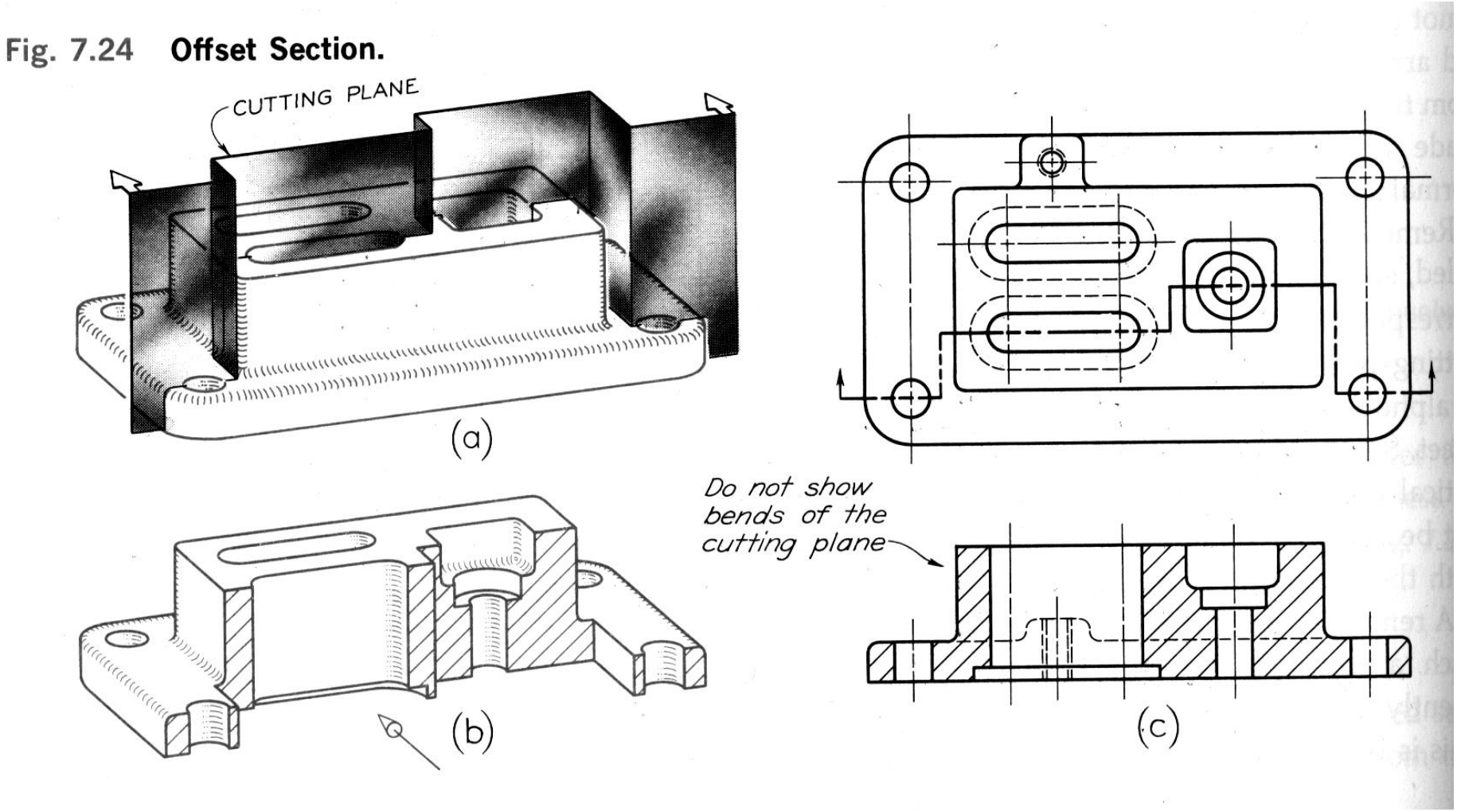


Fig. 7.13 Half Section.

Offset Sections

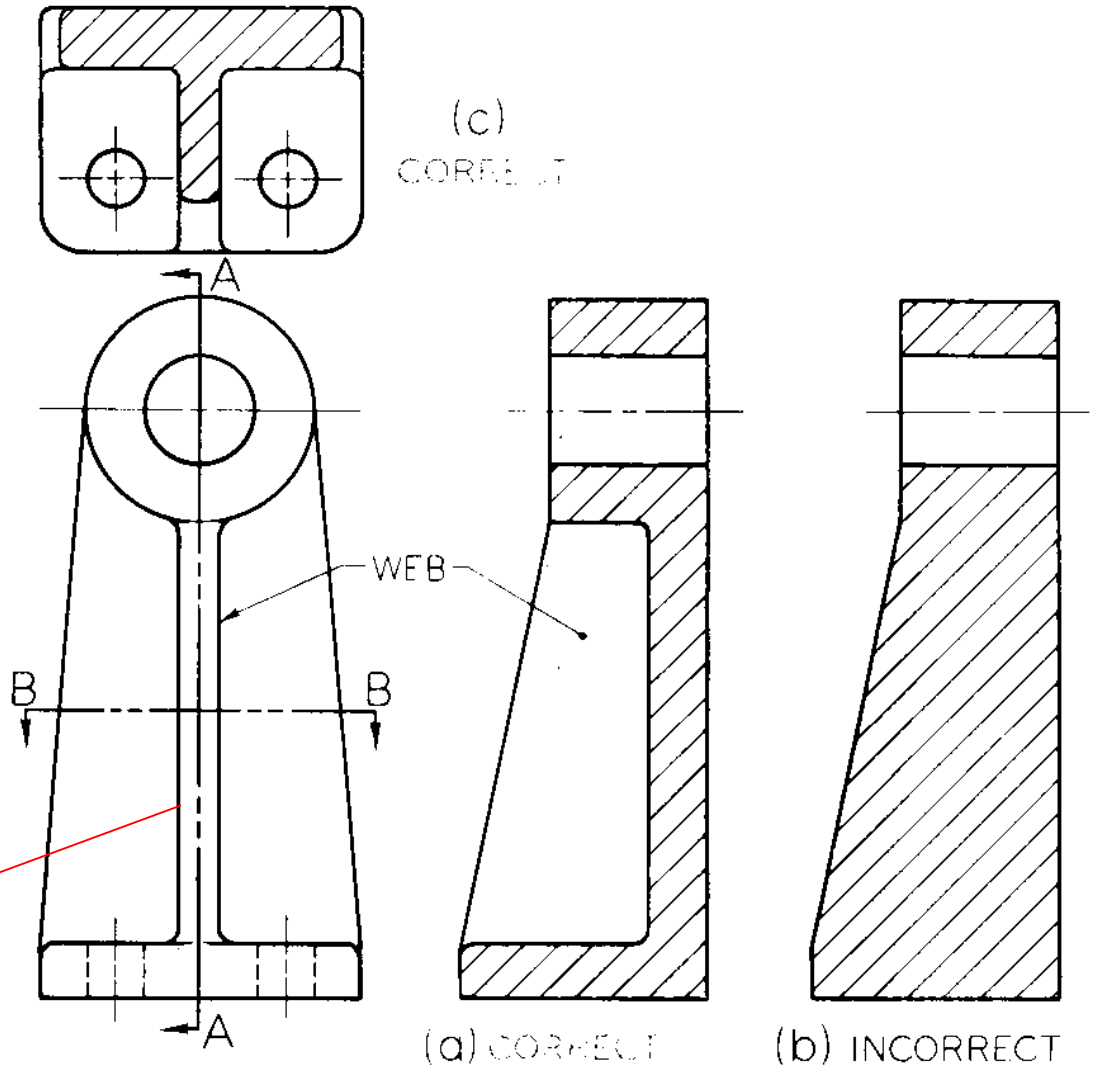
- In sectioning irregular objects, you may show features that do not lie in a straight line by offseting, or bending the cutting plane. Such a section is called an offset section.
- The visible background shapes, without hidden lines, appear in each sectional view.

SECTION VIEW



RIBS IN SECTIONS

To avoid a false impression of thickness and solidity, ribs, webs, gear teeth, and other similar flat features are not sectioned, even though the cutting plane passes along the center plane of the feature.



Such thin features should not be section lined.

Fig. 7.26 **Webs in Section.**

RIBS IN SECTIONS

In the circular view, the cutting plane is offset in circular-arc bends to include the upper hole and upper rib, the keyway and center hole, the lower rib, and one of the lower holes. These features are imagined to be revolved until they line up vertically and are then projected from that position to obtain the section shown in Fig. 7.31 (b).

If a regular full section of the object were drawn without using the conventions discussed, the resulting section, shown in Fig. 7.31(c). Would be incomplete and confusing.

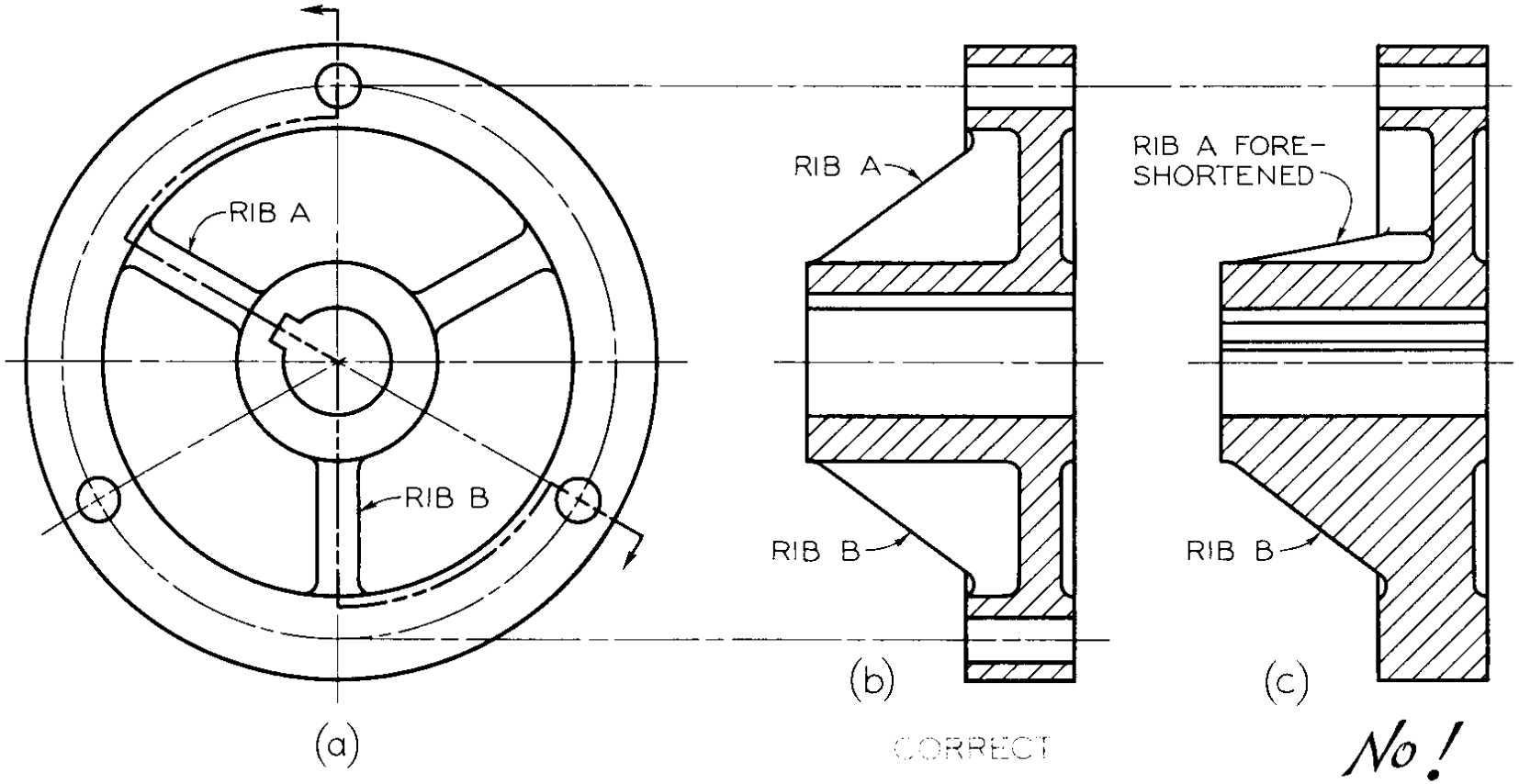


Fig. 7.31 **Symmetry of Ribs.**

Dimensioning

- The need for interchangeability of parts is the basis for modern dimensioning.
- Dimensioning requires the following
  - Technique of dimensioning; The standart for appearance of lines, the spacing of dimensions, the size arrowheads
  - Placement of dimensions; Use logical placement for dimensions according to standart practices
  - Choice of dimensions; the dimensions you choose to show affect how your design is manufactured.

Lines Used in Dimensioning

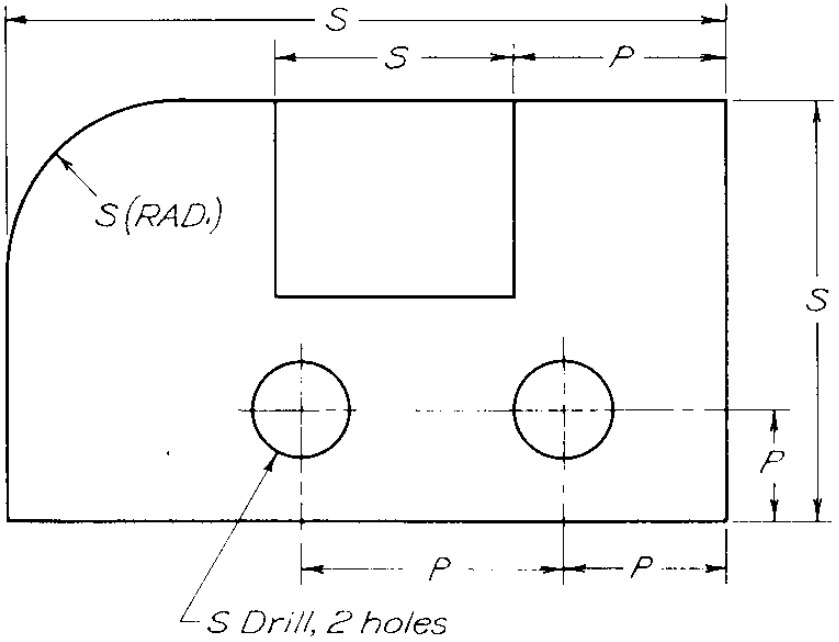
- A dimension line is a thin, dark, solid line terminated by arrowheads, indicating the direction and extent of a dimension.
- The dimension line nearest the object outline should be spaced at least 10mm away.
- The spacing of dimension lines should be uniform throughout the drawing.
- An extension line is a thin, dark, solid line that extends from a point on the drawing to which a dimension refers.
- The dimension line meets the extension lines at right angles, except in special cases.
- A gap of about 1.5 mm should be left where the extension line would join the object outline.
- The **extension line** should extend about 3 mm beyond the outermost arrowhead.
- **Centerlines** are commonly used as extension lines in locating holes and other symmetrical features.
- Arrowheads indicate the extent of dimension. They should be uniform in size and style throuhout the drawing.

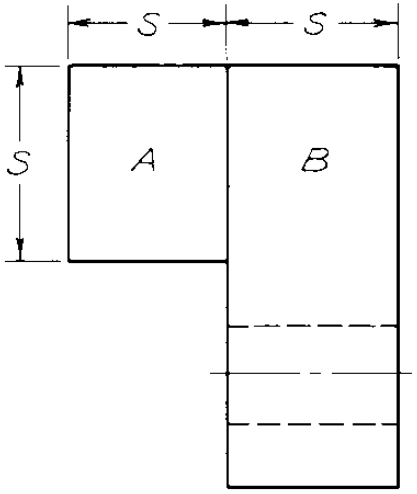
Leaders

- A leader is thin, solid line directing attention to a note or dimension and starting with an arrowhead or dot.
- For the best appearence, make leaders;
  - Near each other and parallel
  - Accross as few lines as possible
- Don't make leaders;
  - Parallel to nearby lines of the drawing
  - Through a corner of the view
  - Across each other
  - Longer than needed
  - Horizontal or vertical

Dimensioning

- Dimensioning Angles
  - Dimension angles by specifying the angle in degrees
- Dimensioning Arcs
  - A circular arc is dimensioned in the view where you see its true shape by giving the value for its radius preceded by the abbreviation R.
- Fillets and Rounds
  - Individual fillets and rounds are dimensioned like other arcs.
- Dimensioning Holes
  - A drilled hole is dimensioned in the view where you see its true shape by giving the value for its diameter preceded by the abbreviation Φ. The radius of a hole or cylinder should never be given because measuring tools, such as the micrometer caliper, are designed to check diameter.





19. Dimensions of size and position. *S* indicates size, *P* position.

DIMENSIONS:

- Dimensions of size
- Dimensions of position

DIMENSIONING

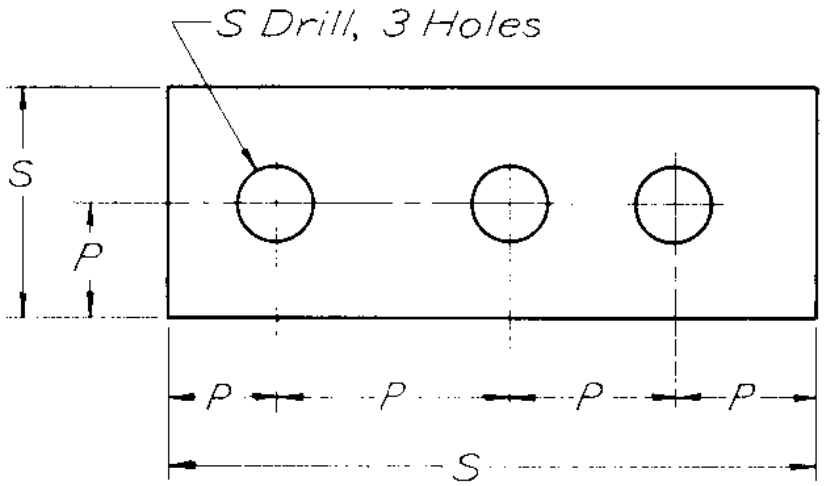


FIG. 24. One unnecessary dimension.

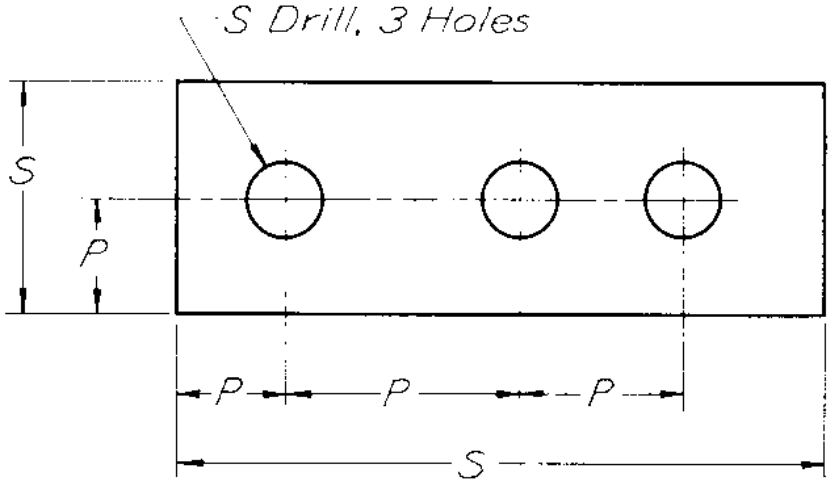


FIG. 25. Unnecessary dimension omitted.

DIMENSIONING

- Front and top views are dimensioned as shown in fig a and b. The height and width are usually given in the front view, and the depth in the top view. Place the horizontal dimension between views as shown not above the top or below the the front view
- Front and side view should be dimensioned as in figure c and d.

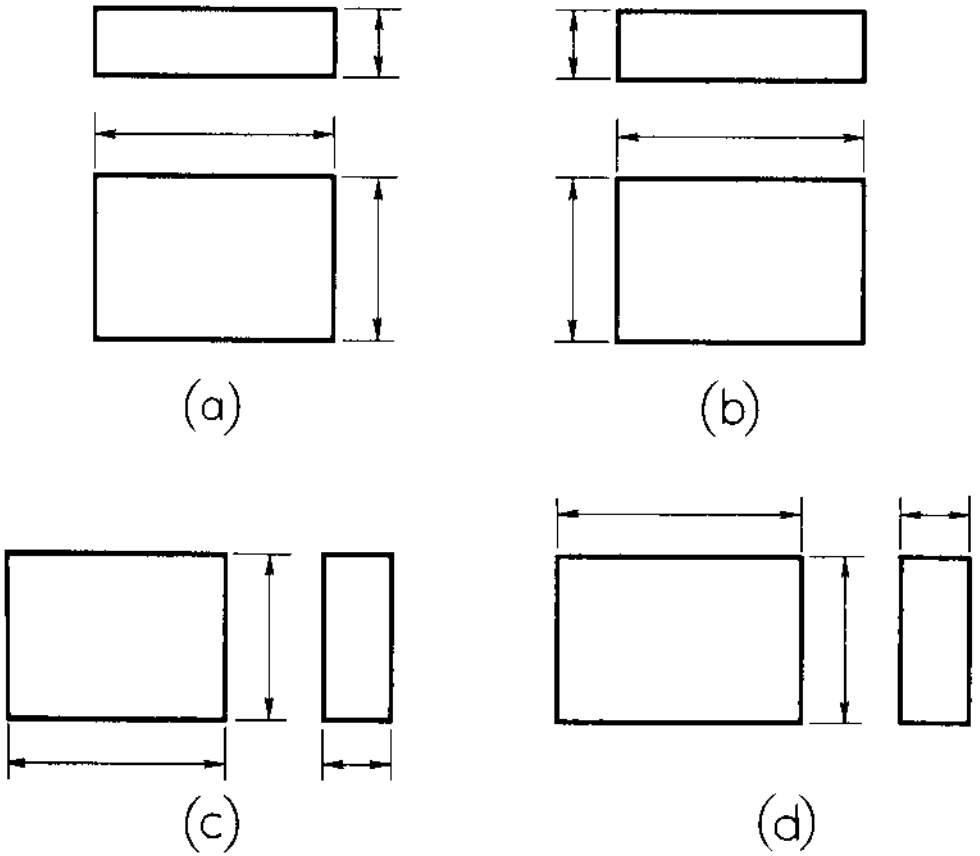


Fig. 11.24 Dimensioning Rectangular Prisms.

DIMENSIONING

- Cylinders are usually dimensioned by giving the diameter and length where cylinder appears as a rectangle.
- If the cylinder is drawn vertically, give the length at the right or left.
- If the cylinder is drawn horizontally give the length above or below the rectangular view.

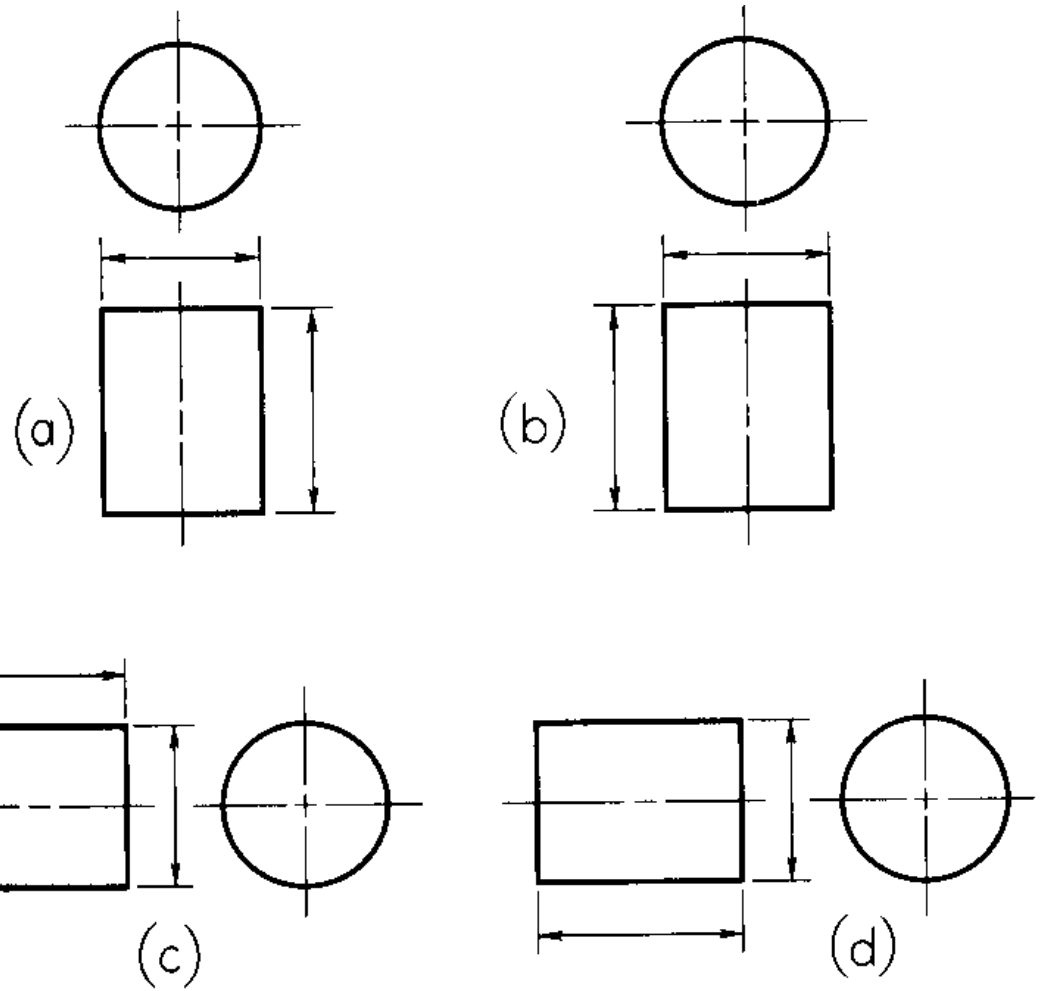


Fig. 11.26 Dimensioning Cylinders.

DIMENSIONING

Location dimensions from holes are preferably given where holes appear circular.

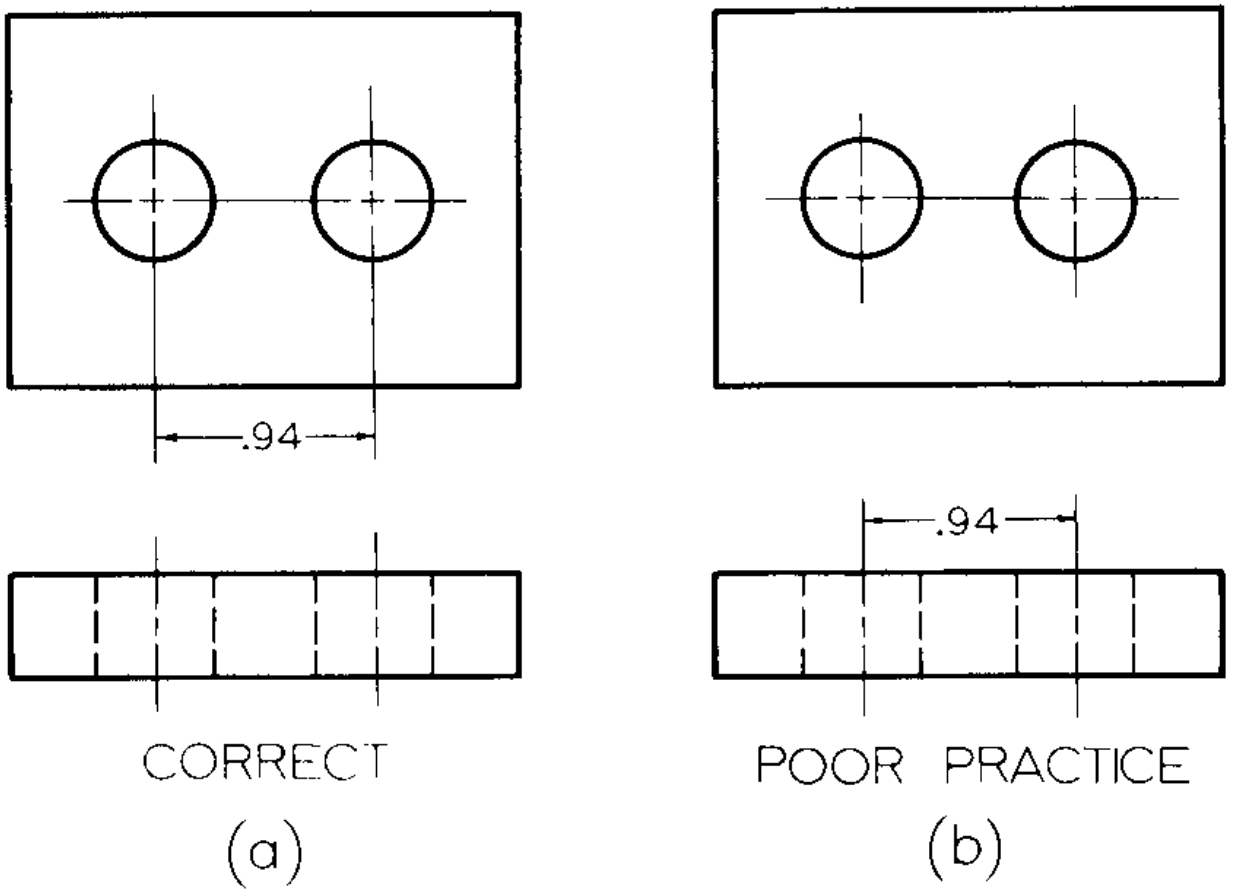


Fig. 11.32 Locating Holes.

DIMENSIONING

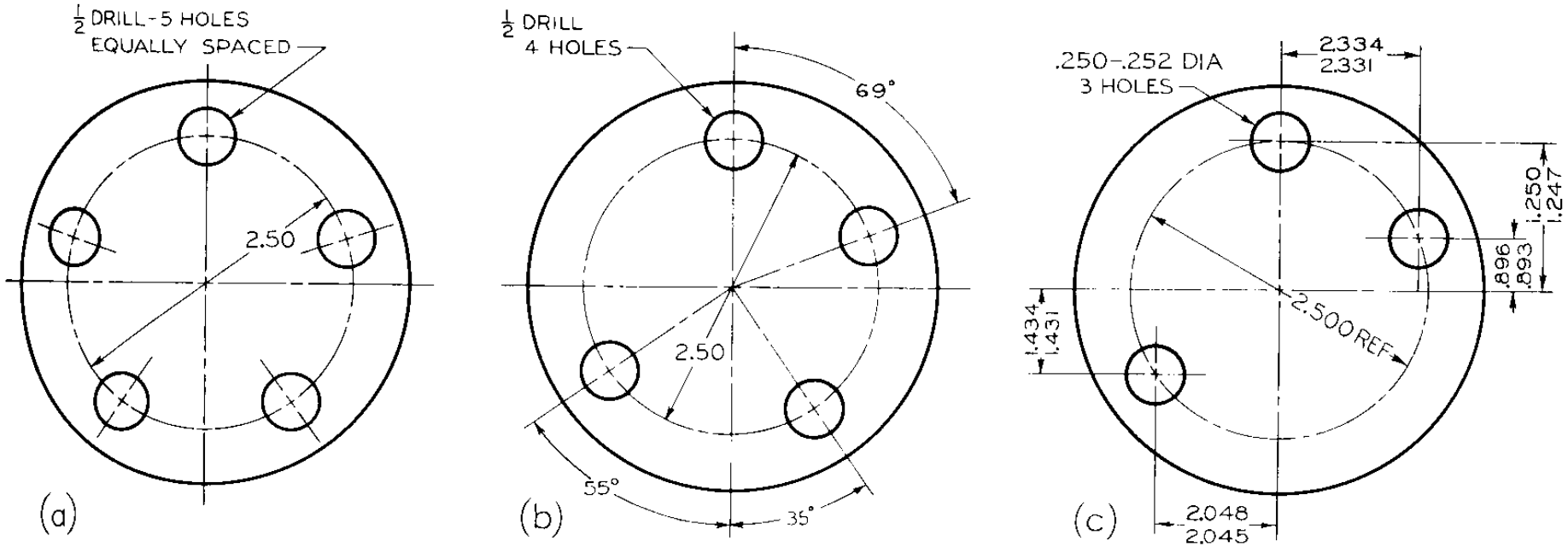


Fig. 11.34 Locating Holes About a Center.

Unequally spaced holes are located by means of the bolt circle diameter plus angular measurements with reference to only one of the centerlines.

DIMENSIONING

Never letter a dimension value over any line on the drawing; if necessary, break the line.

Place dimension values outside sectioned areas, if possible.

When a dimension must be placed on a sectioned area, leave an opening in the section lining for the dimension.

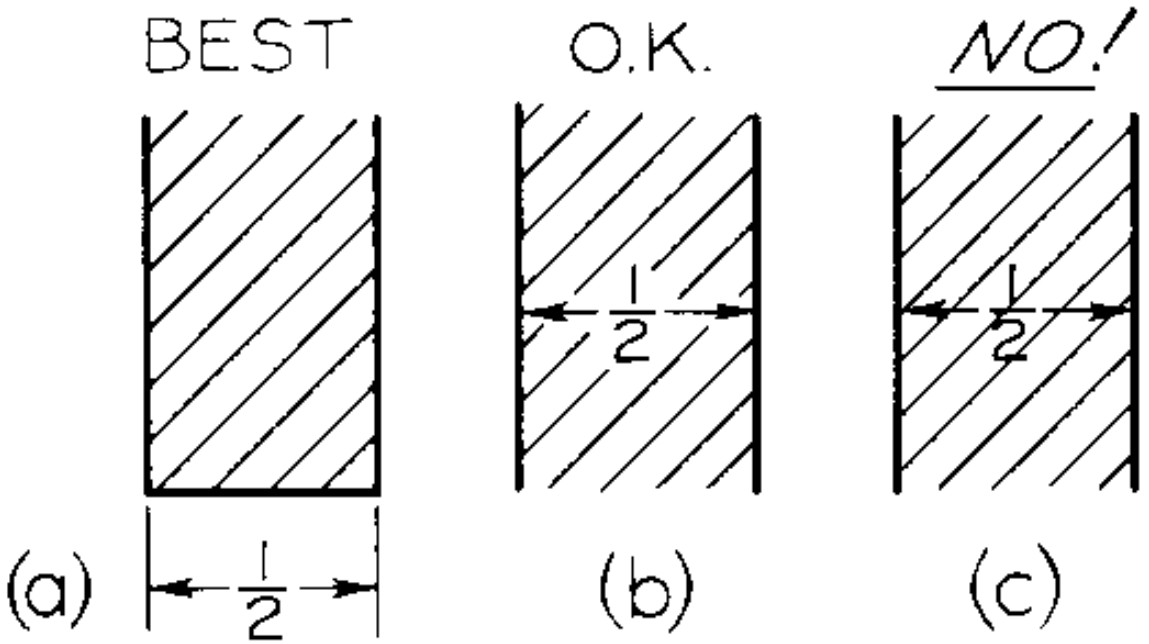


Fig. 11.13 Dimensions and Section Lines.

DIMENSIONING

In a group of parallel dimension lines, the numerals should be staggered.

Not stacked up one above the other.

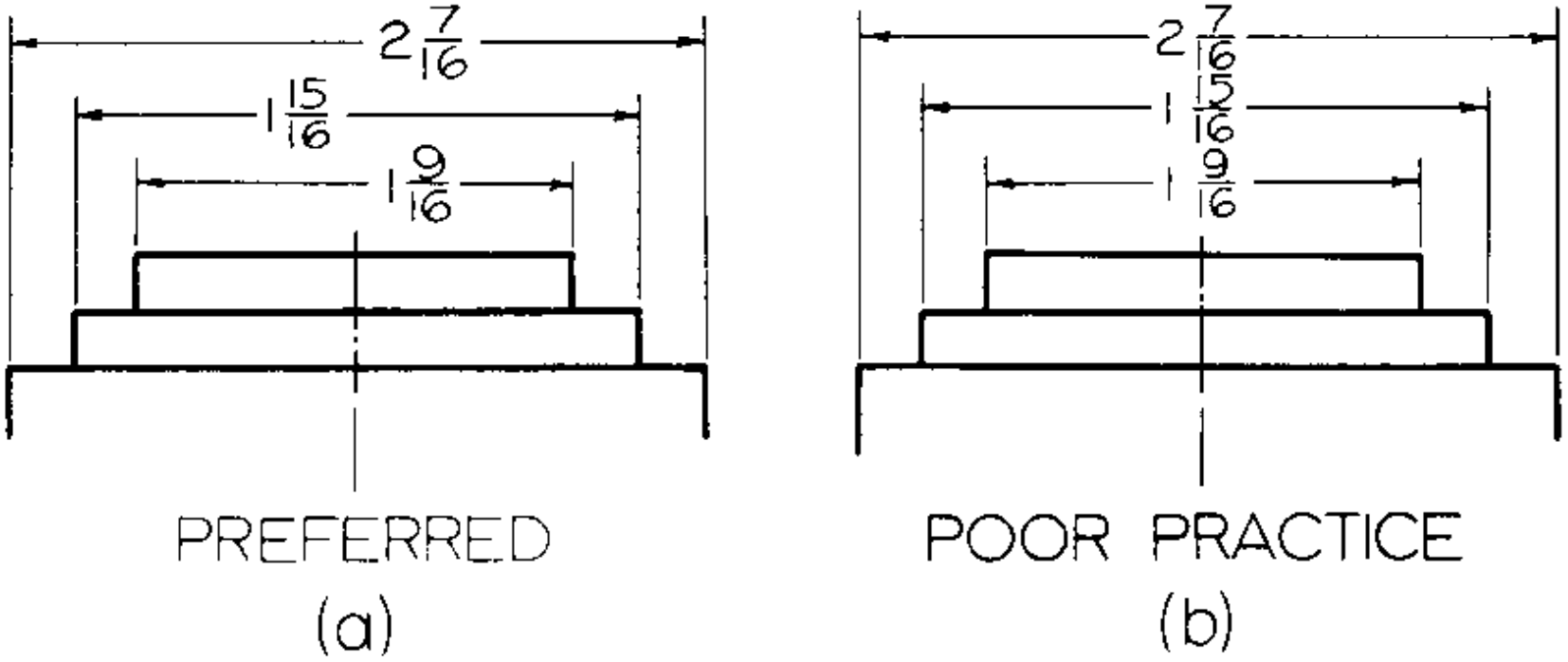
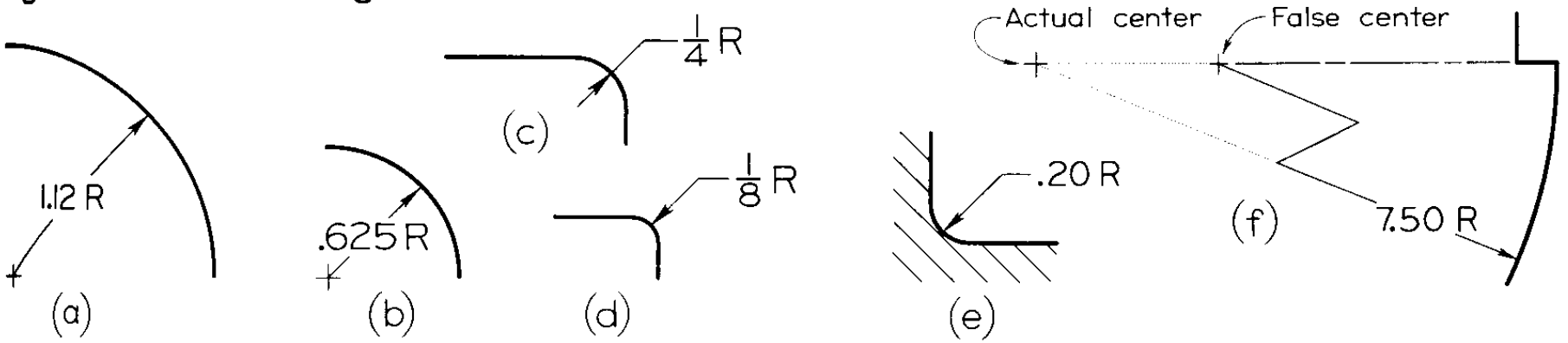


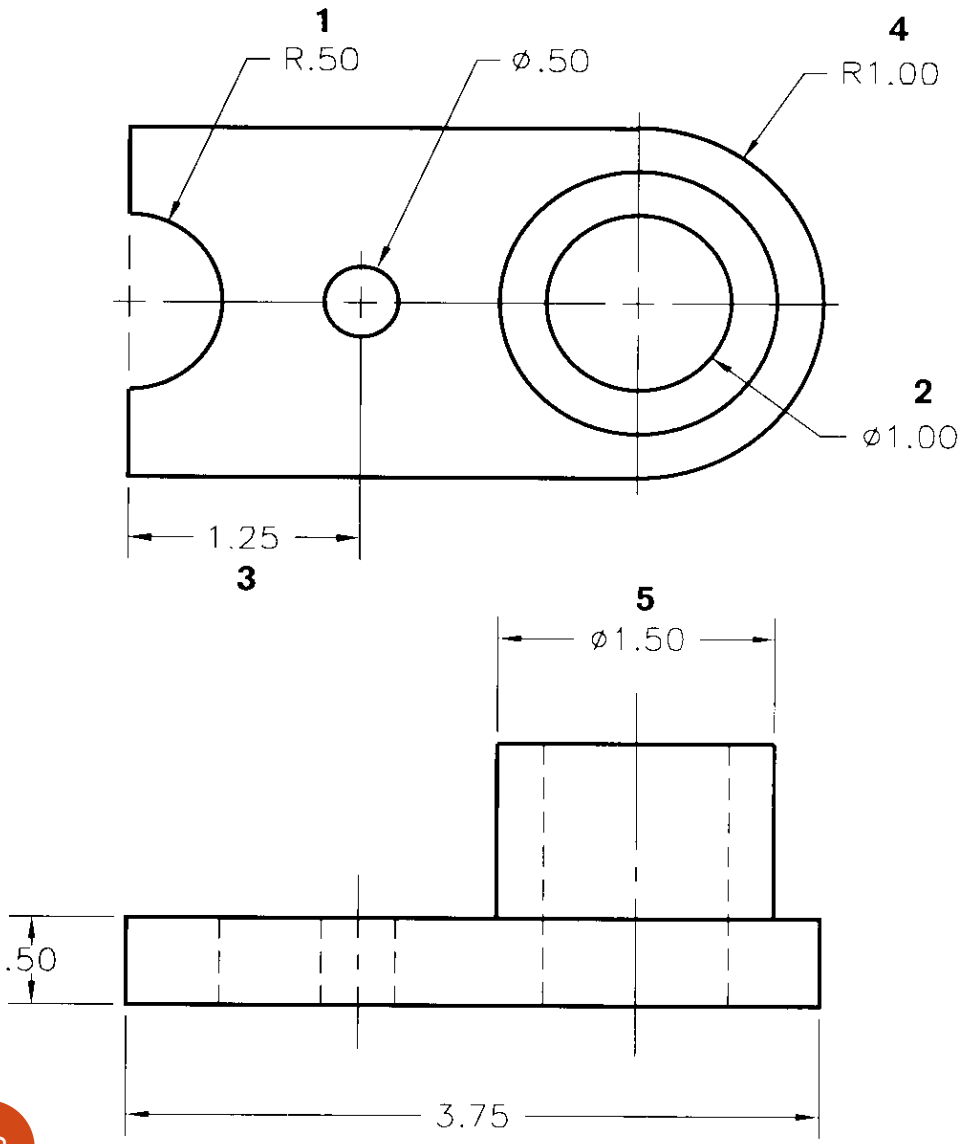
Fig. 11.14 Staggered Numerals.

DIMENSIONING

Fig. 11.19 Dimensioning Arcs.



DIMENSIONING



1. Give radius of arcs.
2. Give diameters of circles.
3. Locate holes where you see their circular shapes.
4. Rounded ends are self locating.
5. Dimension the diameters of cylinders where they appear rectangular.

DIMENSIONING

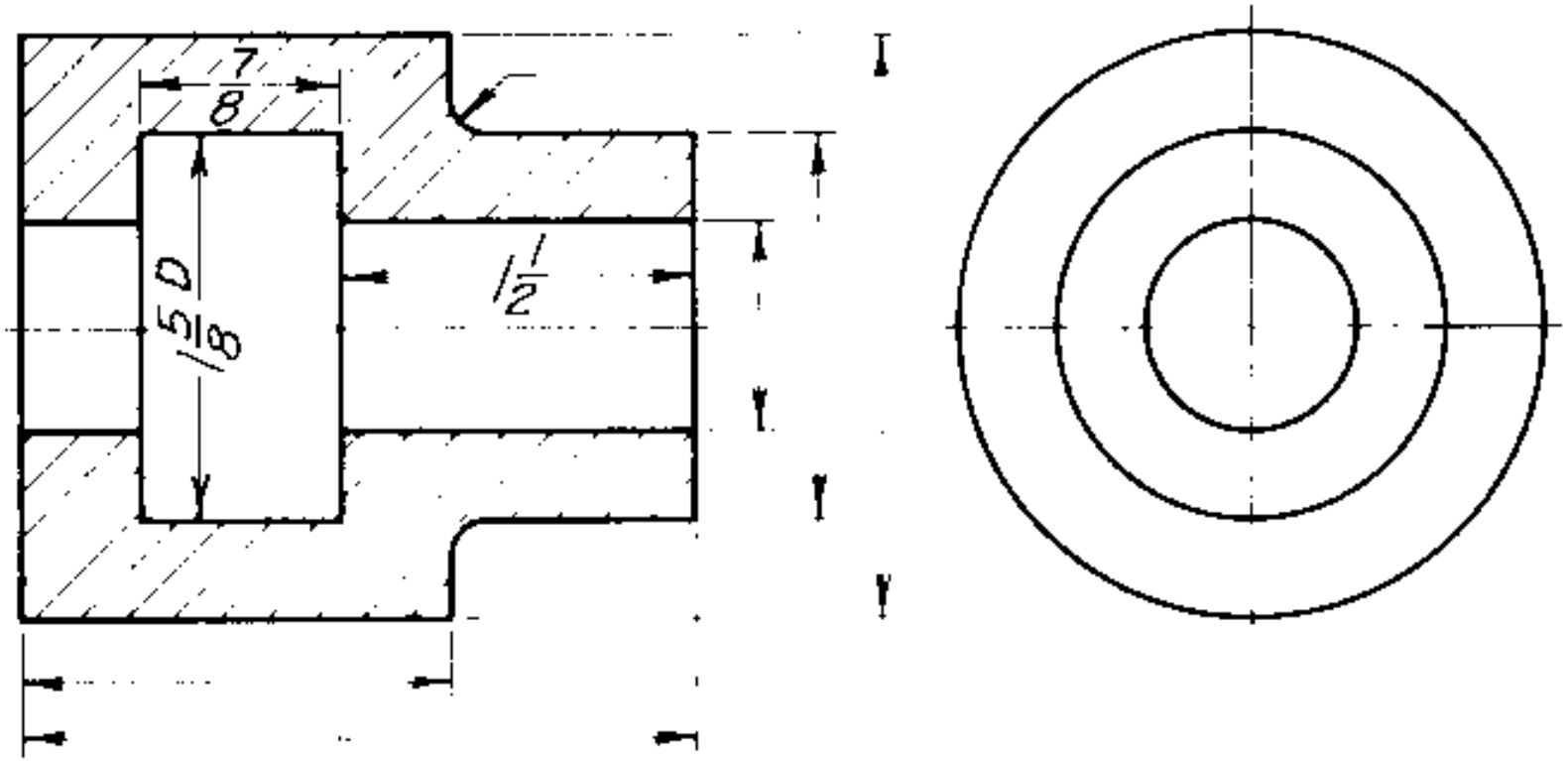


FIG. 31. Dimensions inside the view.

DIMENSIONING

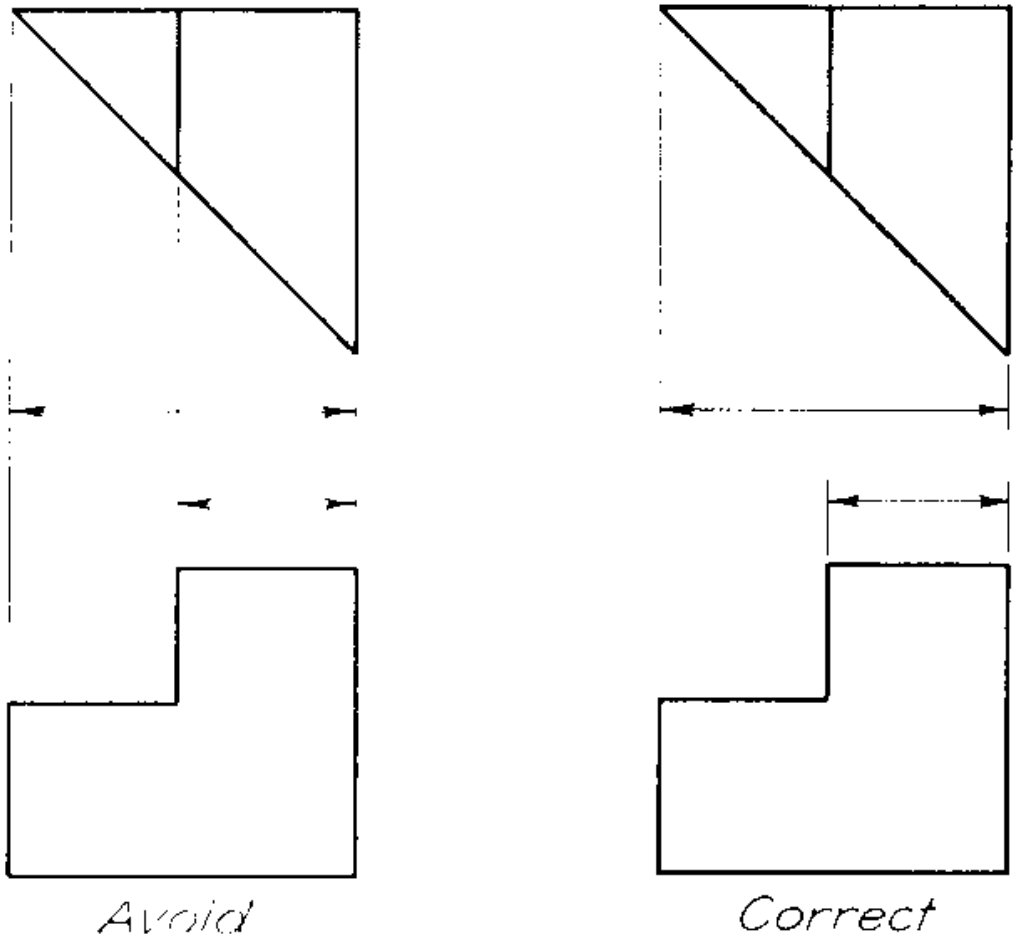


FIG. 32. Dimensions applied to one view only.

DIMENSIONING

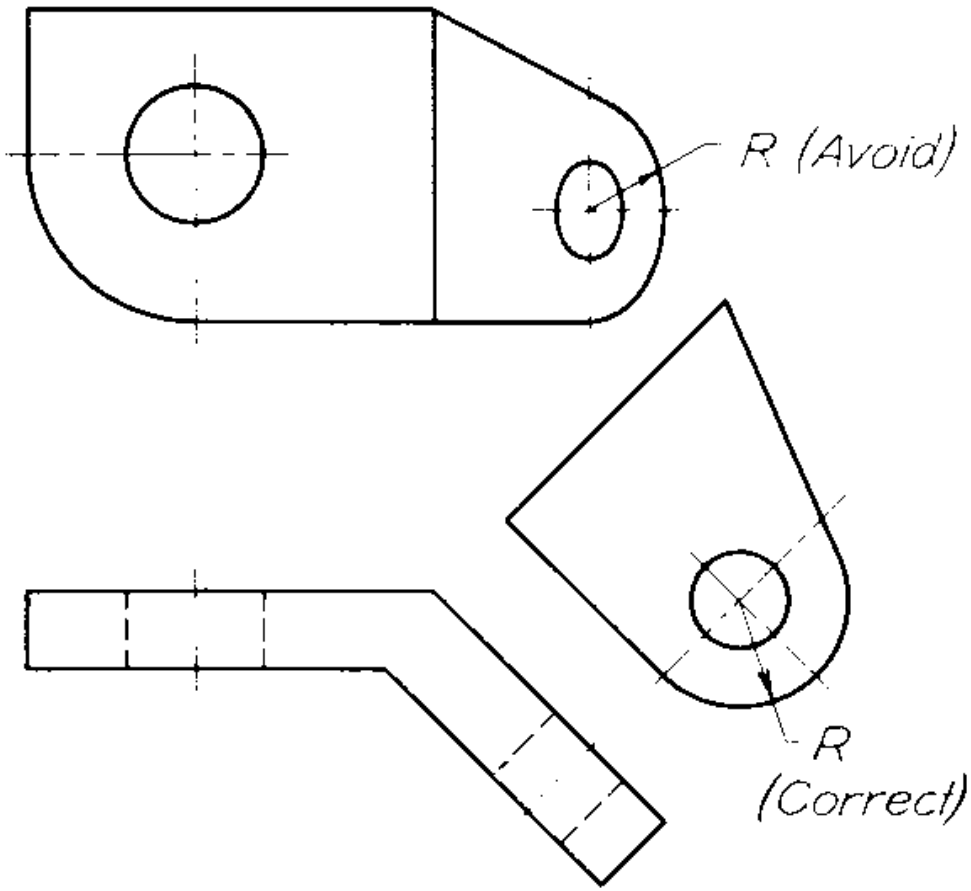


FIG. 33. Dimensioned distance given in normal view.

DIMENSIONING

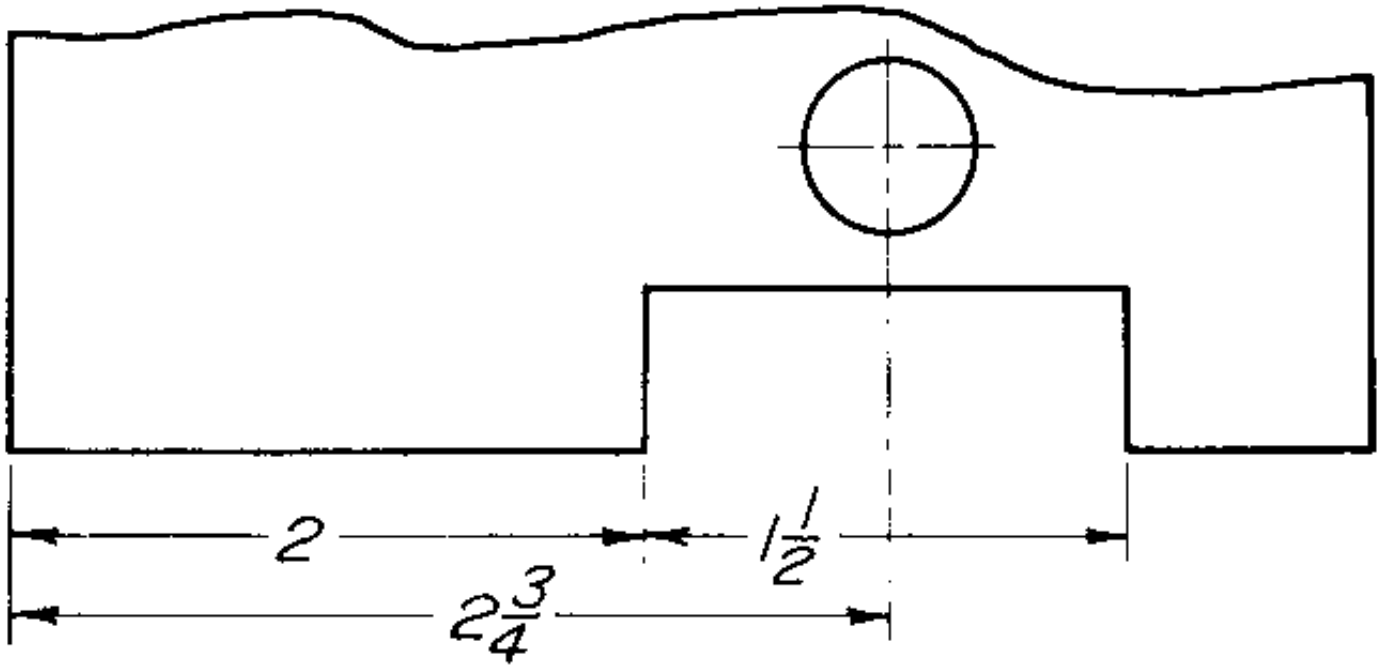


FIG. 34. Values midway between arrow-heads.

DIMENSIONING

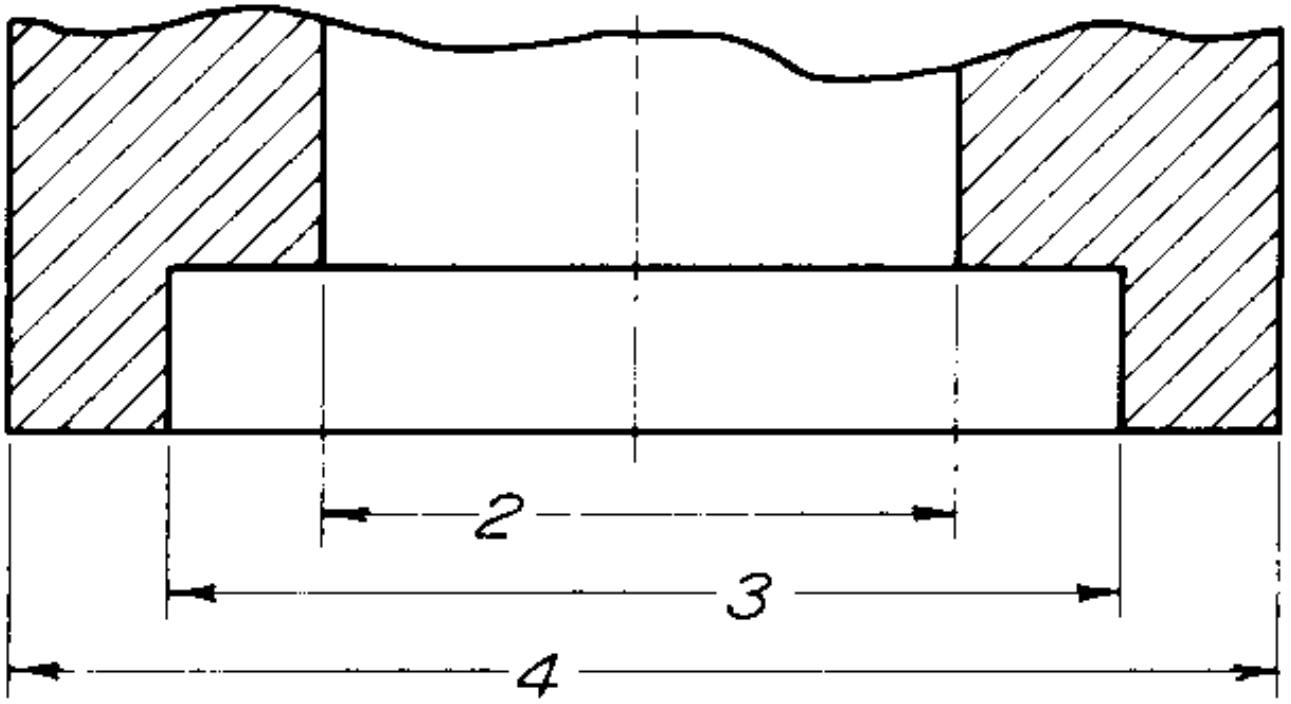


FIG. 35. Values staggered for clarity.

DIMENSIONING

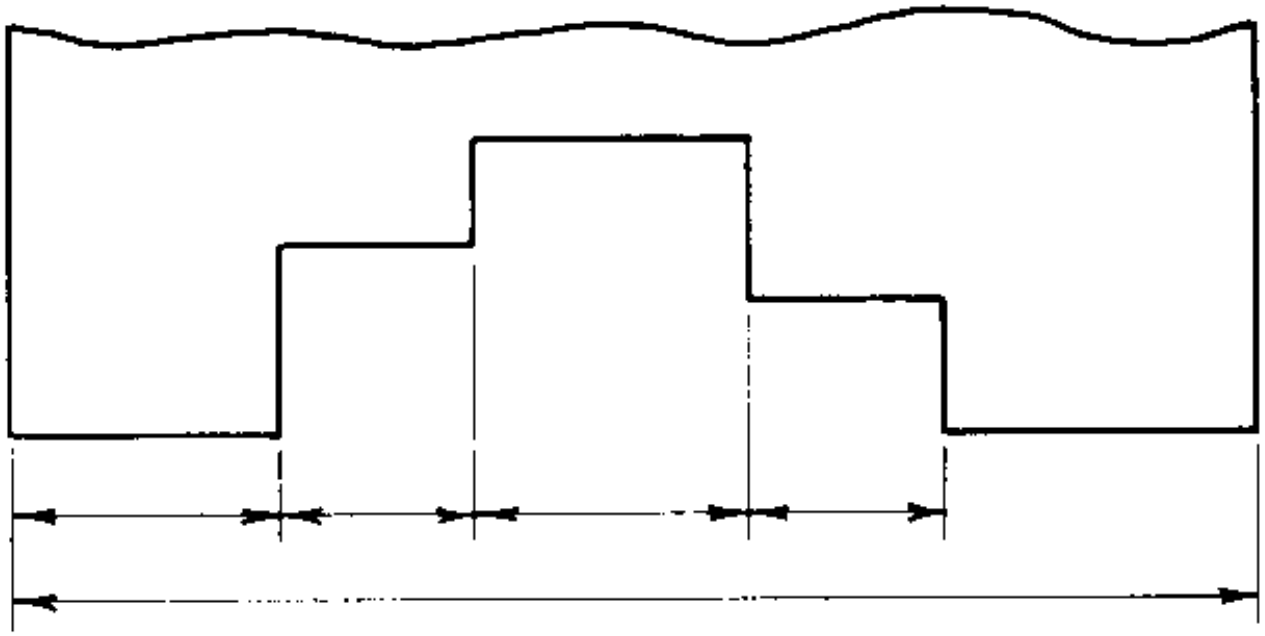


FIG. 36. Dimensions arranged in continuous form.

DIMENSIONING

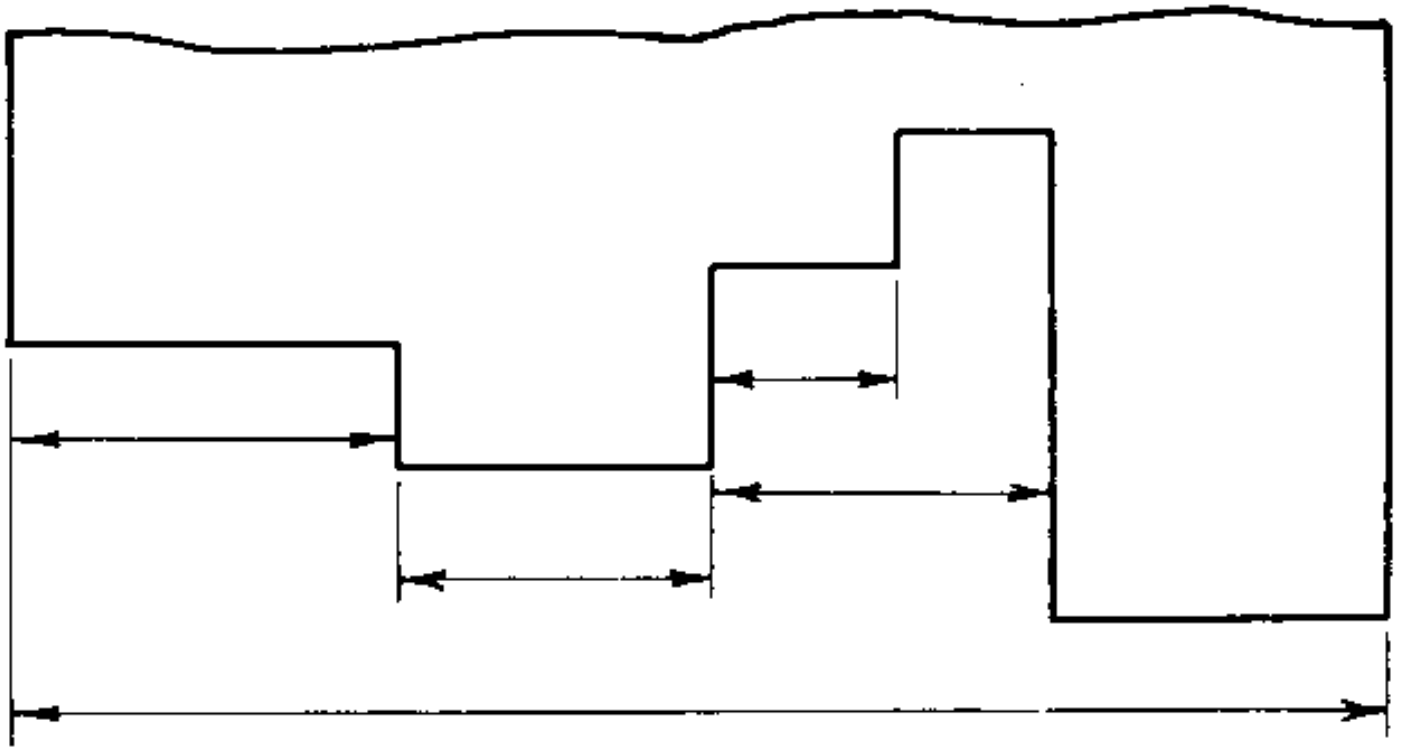


FIG. 37. Dimensions staggered.

Referances

- Öğr. Gör. Yıldıray Angün, Lecture Notes

- MEGEP