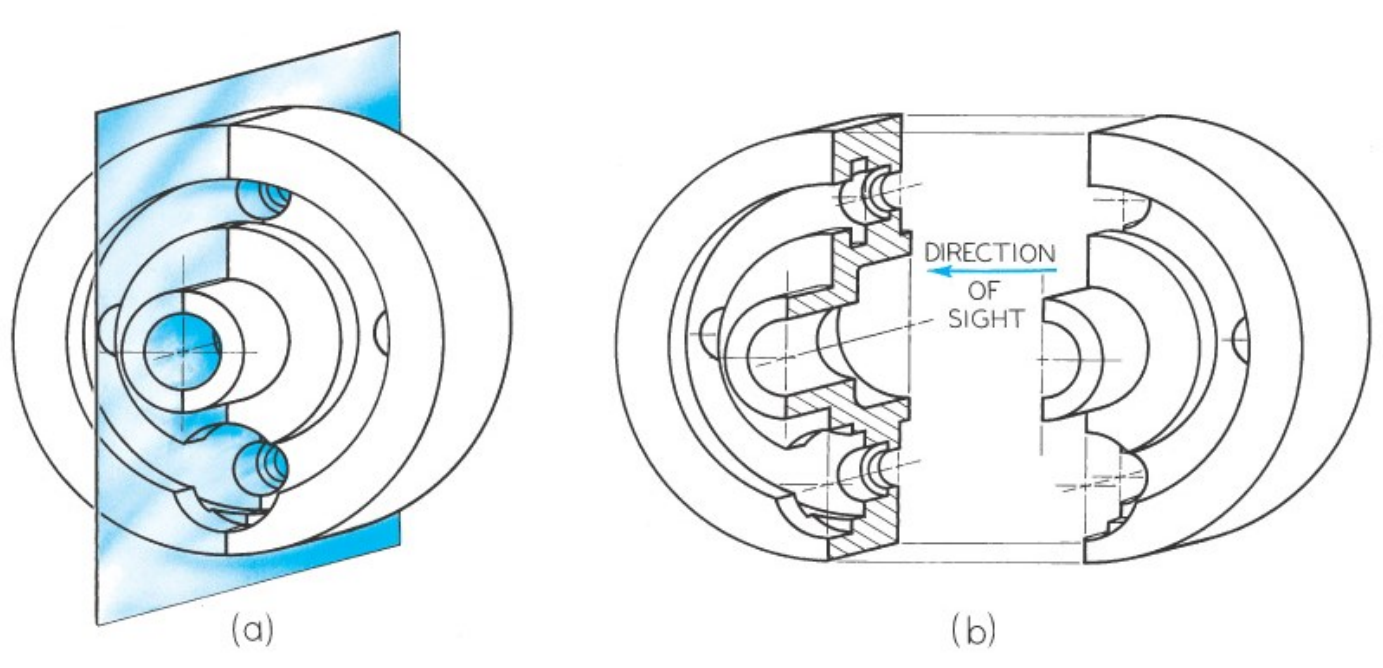
CHAPTER 7 SECTIONAL VIEWS

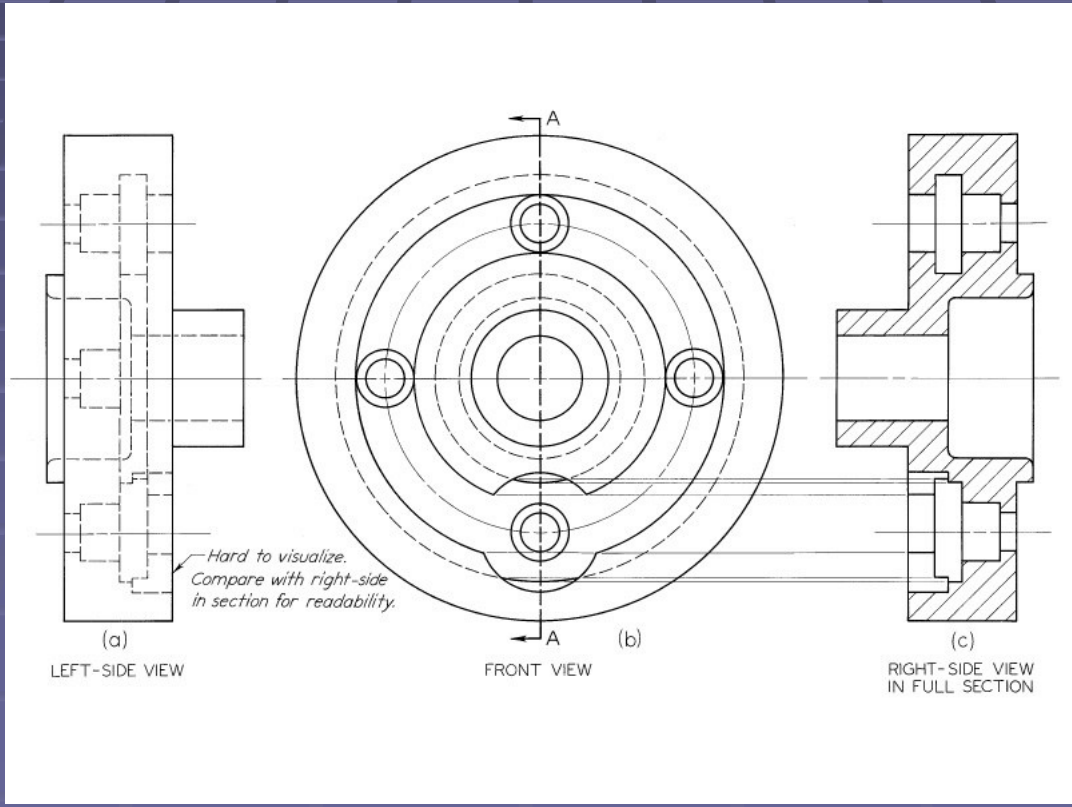
7-1 Sectioning

To produce a sectional view, a cutting plane is imagined cutting through the part, as shown in fig. (a). Picture the two halves of the object pulled apart, exposing the interior construction, as shown in fig. (b). In this case, we will look toward the left half of the object in the section view. This sectional view replaces the right side view.



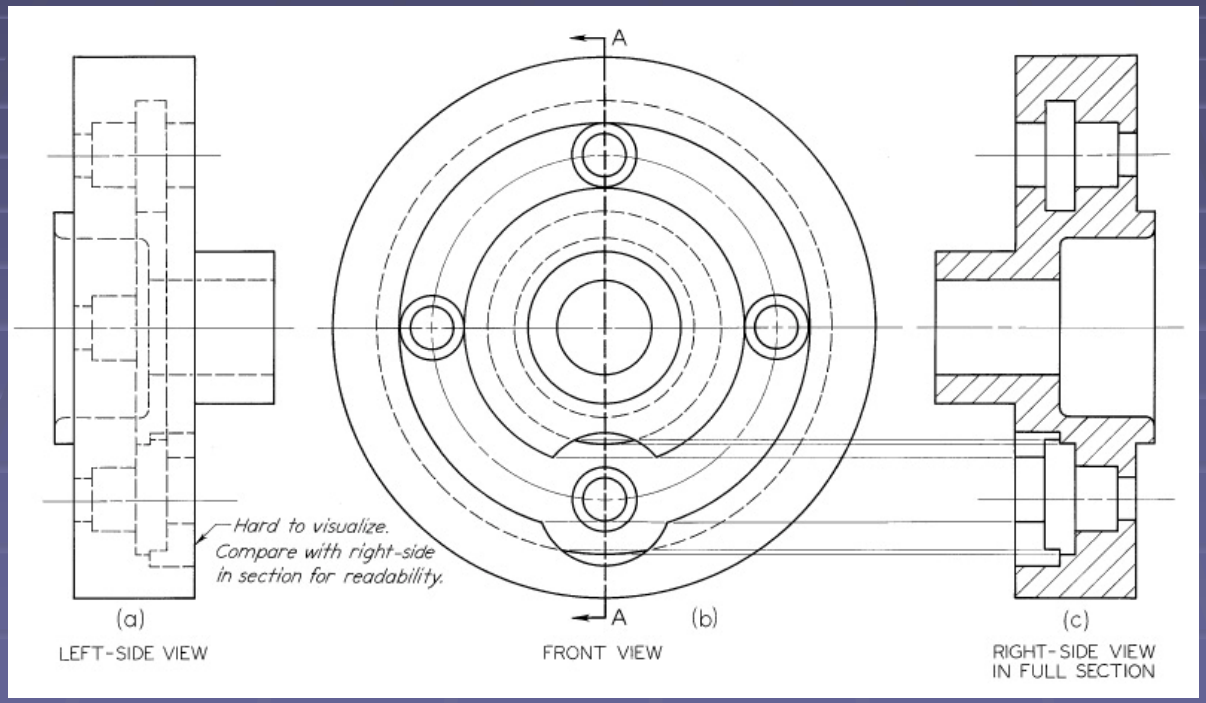
7-2 Full Sections

The section produced by cutting through the entire object is called a full section, as shown in fig. (c) below.



7-3 The Cutting Plane

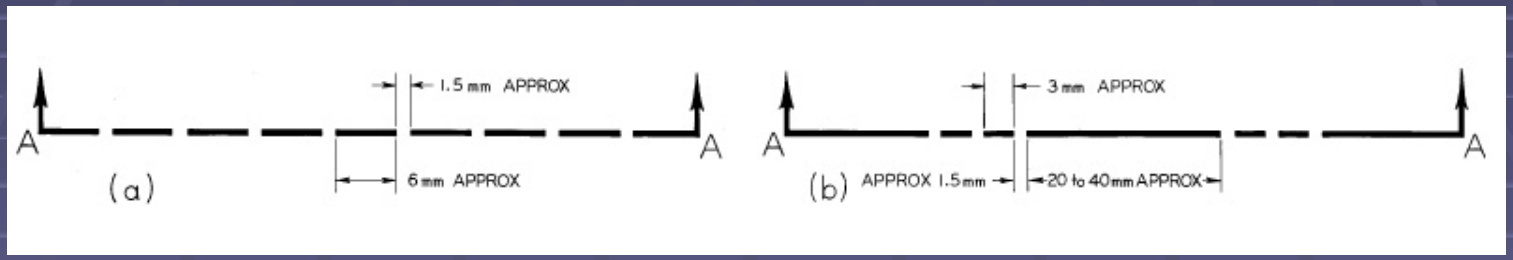
The cutting-plane line is shown as a special pattern. The arrows at the ends of the cutting plane line indicate the direction of sight for the section view. We can think the cutting-plane line as showing the edge view of the cutting plane.



When a cutting-plane line coincides with a centerline, the cutting-plane line takes precedence.

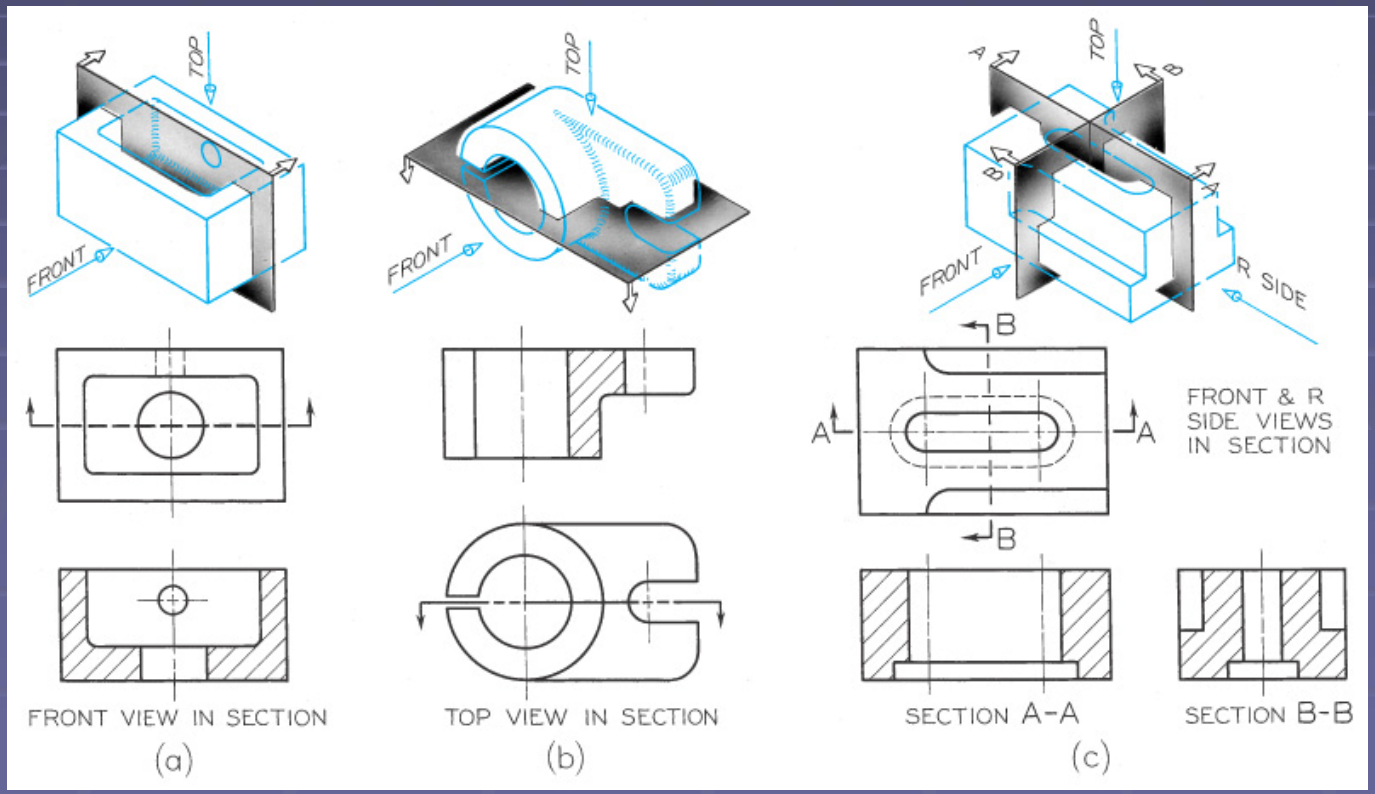
7-4 Cutting-Plane Line Patterns

Figures below show two line patterns used to show the cutting-plane line. Arrowheads indicate the direction in which the cut object is viewed.



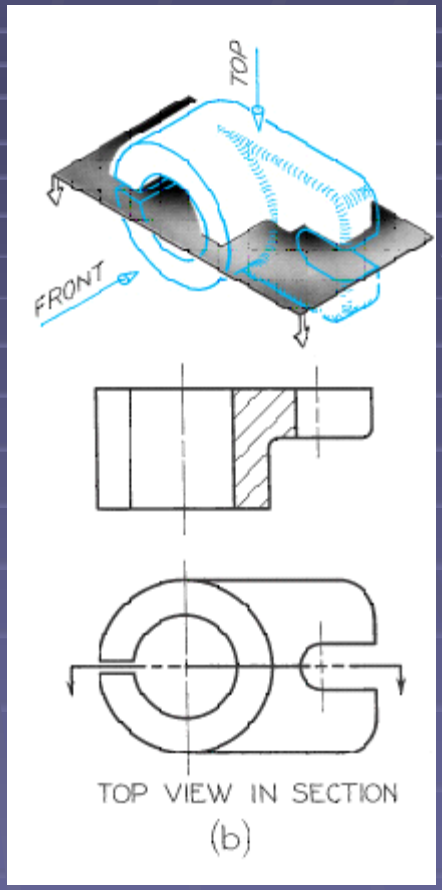
7-4 Interpreting Cutting Planes and Sections

Sectional views often replace standard views. As figures shown, the cutting plane is a frontal plane and appears as a line in the top view. The arrows at the ends of cutting-plane line point in the direction of sight for front section. The result is called a front section, or front view in section, since it replaces the front view in the drawing.



(cont)

As shown in figures, the cutting plane is a horizontal plane, appearing as a line in the front view. The arrows point toward the lower half in the same direction of sight as for a top view. This result is top view in section.



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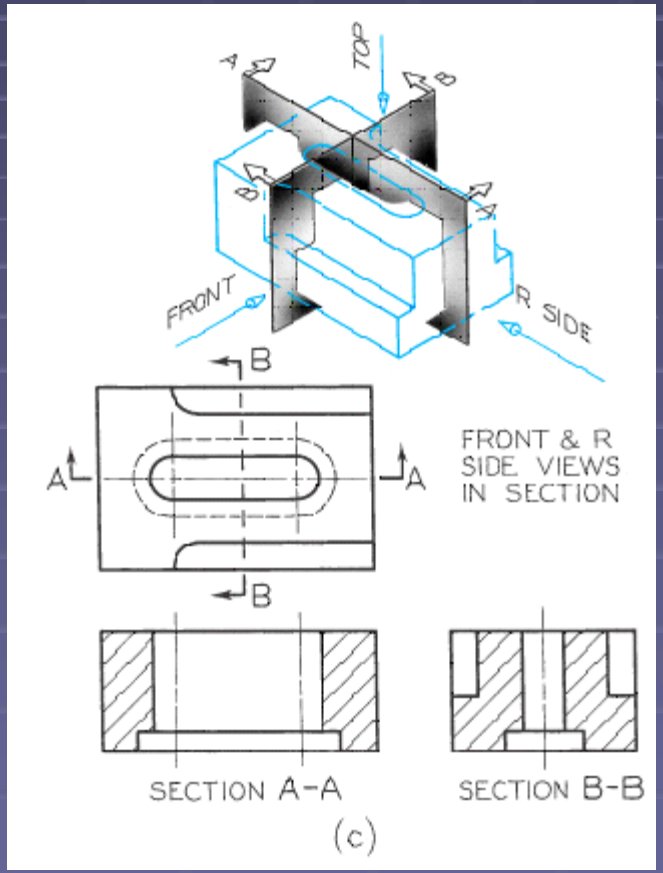
Figures below show two cutting planes - one a frontal plane, the other a profile plane - and both appear on edge in the top view. Each section is completely independent of the other and drawn as if the other were not present.



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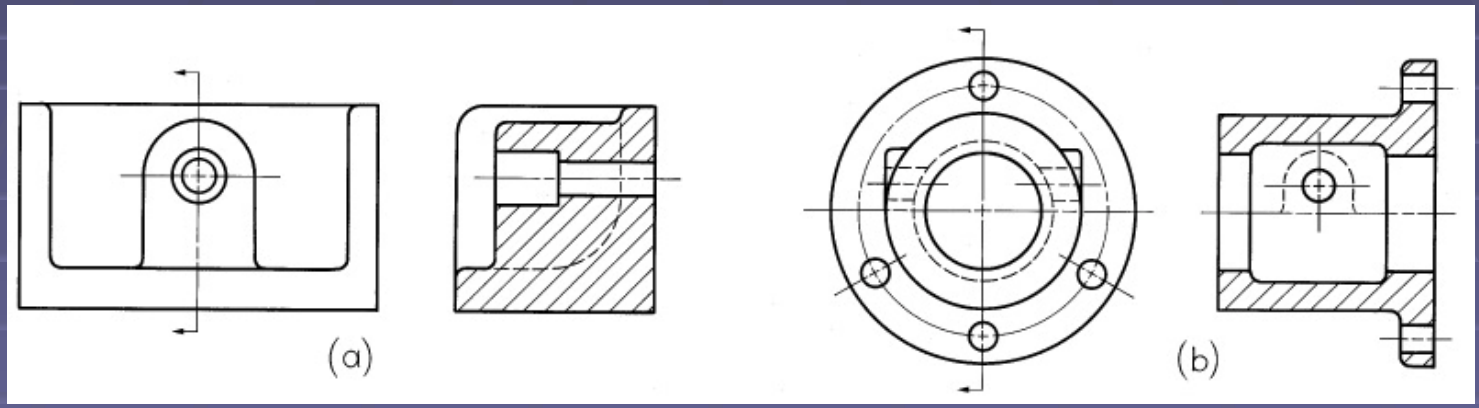
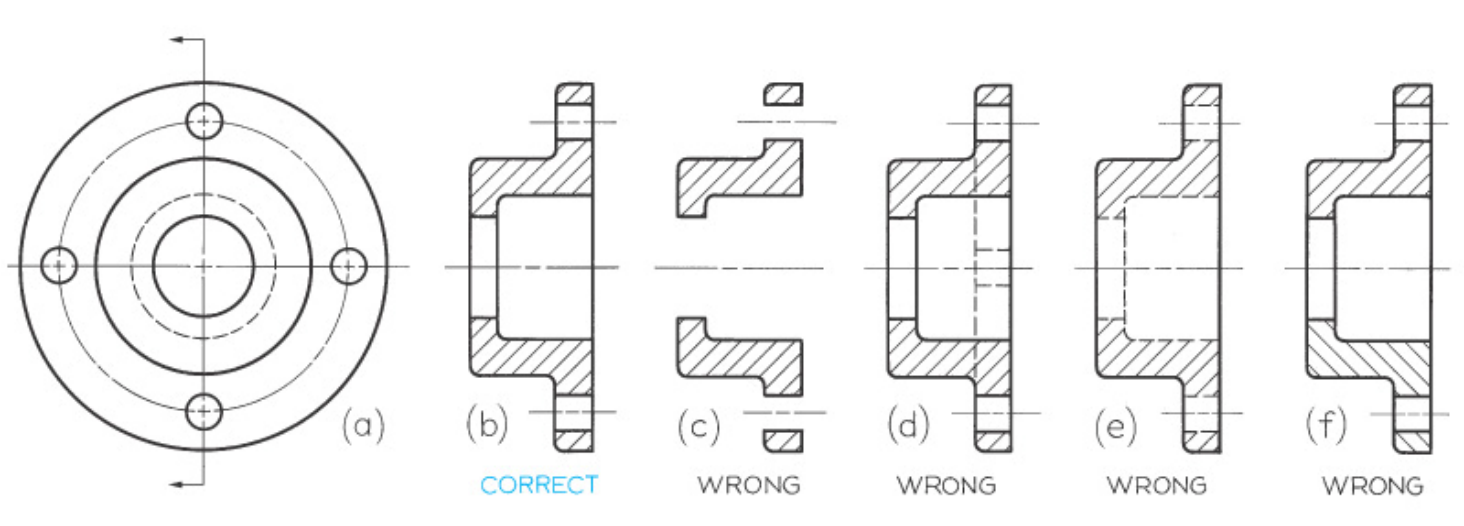
Keep the following things in mind when drawing sectional views. Visible edges and contours behind the cutting plane should be shown, as below in fig. (a). Hidden lines should be omitted in section views unless they are necessary, as in fig. (b).



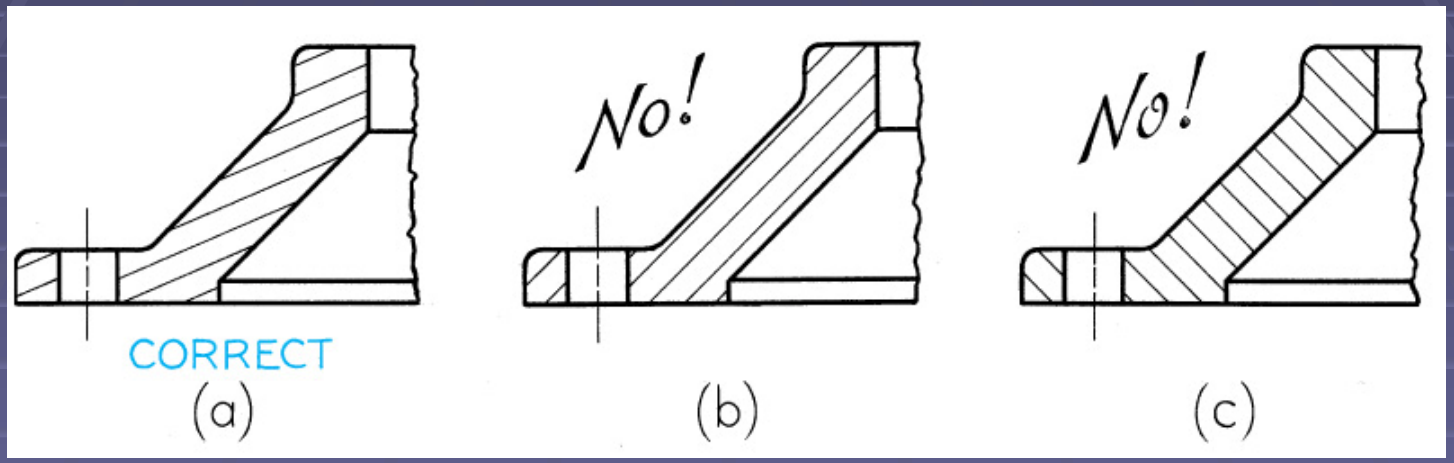
A section-lined area is always completely bounded by a visible outline – never by a hidden line. The cross hatching in all hatched areas must be parallel in a sectional view of a single object, along or in assembly.

Hands on 7.1 Find the errors in section views



7-6 Cross-Hatching

Cross-hatching patterns, shown in Fig. 7.6 are used to present general material types. Make hatching lines at 45 degrees with horizontal, unless they look better at a different angle.

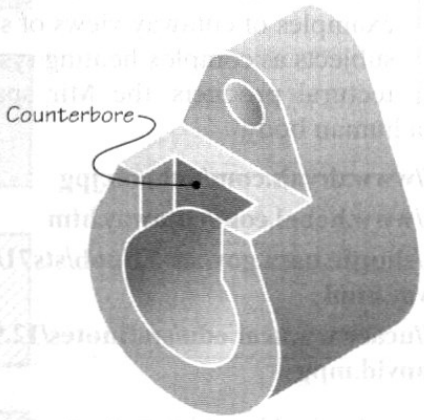


In figures above, cross-hatching at 45 degrees with horizontal would be nearly parallel or nearly perpendicular to a prominent feature. In this case, the hatching appears better drawn at 30 degrees, 60 degrees, or some other angle.

Step by Step 7.1 Visualizing a full section

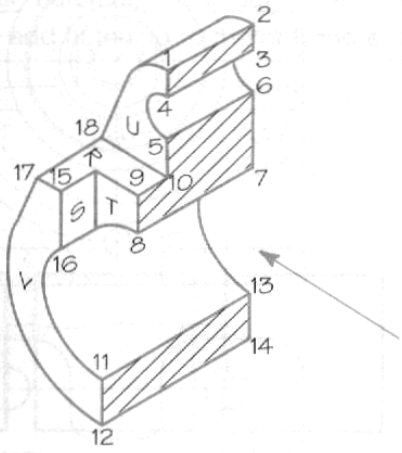
STEP 1: CHOOSE A CUTTING PLANE

The illustration below shows two views of a collar to be sectioned. It has a drilled and counterbored hole. To produce a clear section showing both the counterbored hole and the smaller hole near the top of the object, choose the cutting plane to pass through the vertical center line in the front view and imagine the right half of the object removed.



STEP 2: IDENTIFY THE SURFACES

Below is a pictorial drawing of the remaining half. The first step in projecting the section view is making sure that you interpret the object correctly. Identifying the surfaces on the object can help. Surfaces R, S, T, U and V have been labeled on the given views and the pictorial view. Which surface is R in the front view? Which surface is U in the top view? Are they normal, inclined, or oblique surfaces. Can you identify the counterbore in each view?



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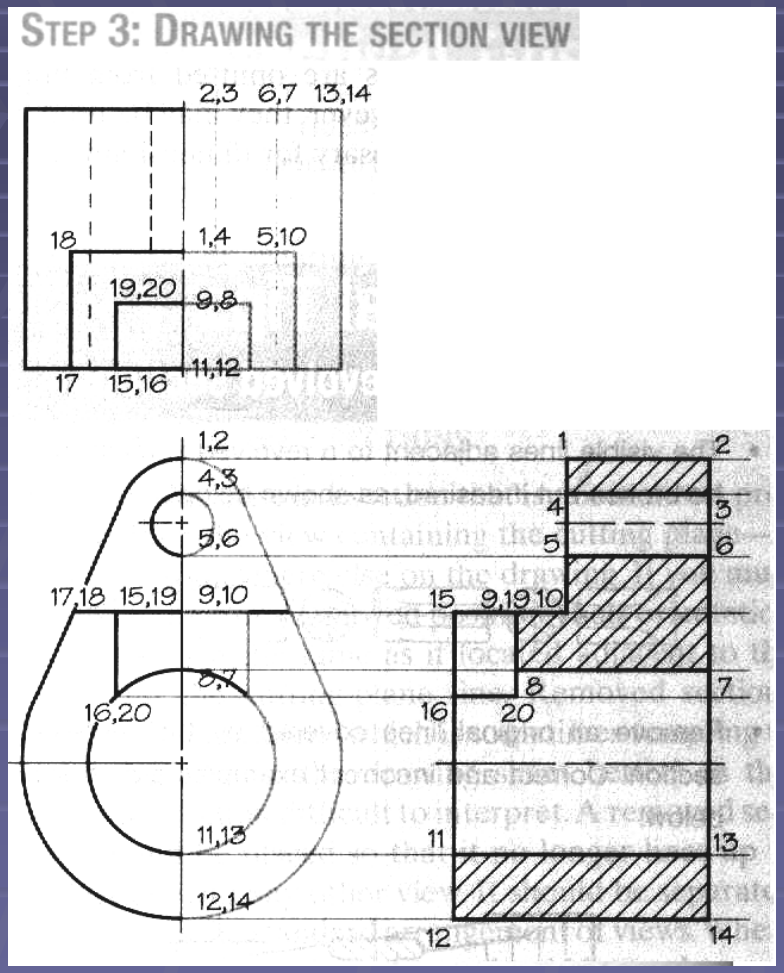
STEP 3: DRAWING THE SECTION VIEW
2,3 6,7 13,14
18
1,4 5,10
19,20
9,8
11,12
17
15,16
1,2
4,3
5,6
17,18 15,19 9,10
16,20
8,7
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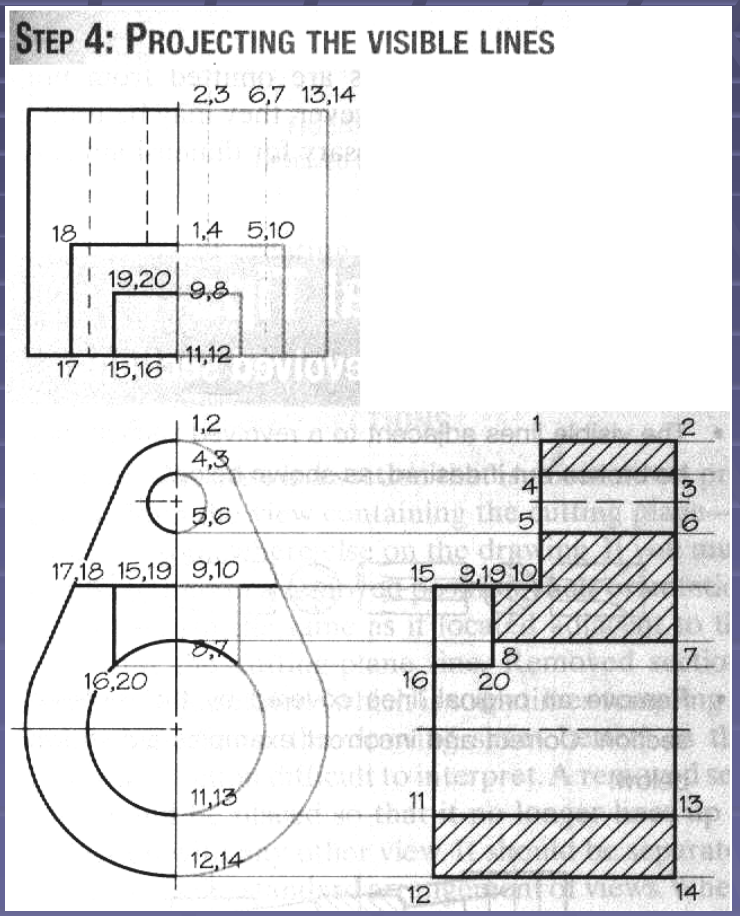
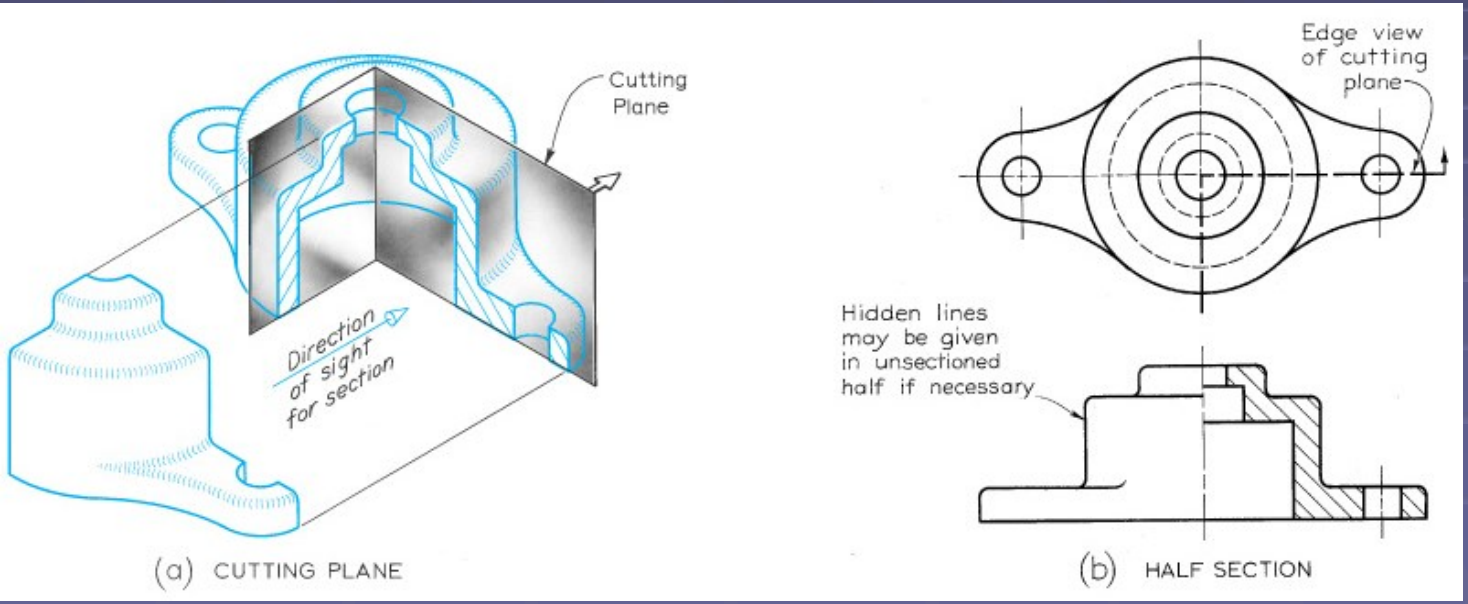

STEP 4: PROJECTING THE VISIBLE LINES
2,3 6,7 13,14
18
1,4 5,10
19,20
9,8
11,12
17
15,16
1,2
4,3
5,6
17,18 15,19 9,10
16,20
8,7
11,13
12,14
1
2
4
3
5
6
15 9,19 10
8
7
16
20
11
13
12
14

7-8 Half Sections

Symmetrical objects can be sectioned using a cutting plane passing halfway through an object, resulting in a half section. A half section exposes the interior of one half of the object and still shows the exterior of the other half. Half sections are very useful in undimensioned assembly drawing since they show both internal and external construction on the same view.

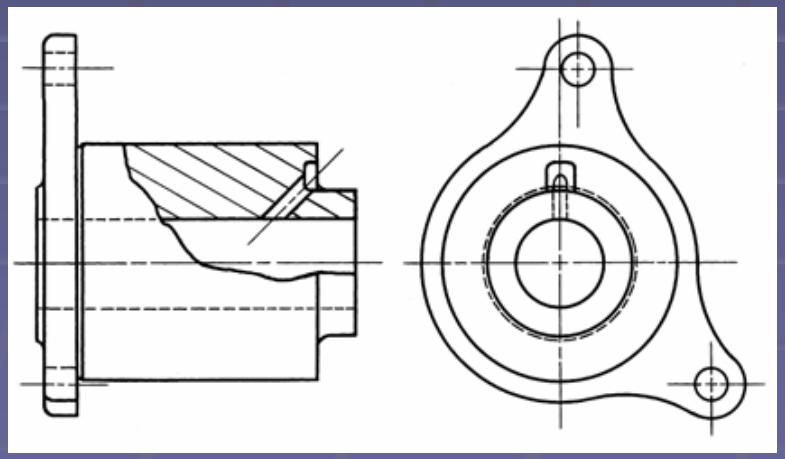


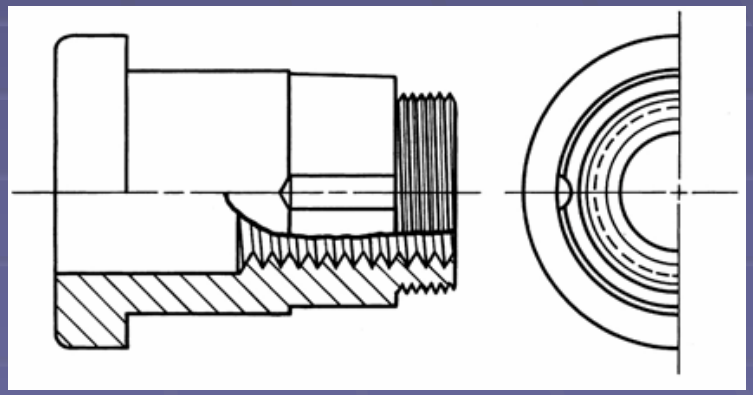
In general, hidden lines are omitted from both halves of a half section. However, they may be used in the unsectioned half if necessary for dimensioning.

7-9 Broken-Out Sections

Often, only a partial section of a view is needed to expose interior shapes. Such a section, limited by a break line, is called a broken-out section. In the first figure, a full of half section is not necessary. A broken-out section is sufficient to explain the construction.

In the second figure, a half section would have caused the removal of half the keyway. The keyway is preserved by breaking out around it. In this case, the section is limited partly by a break line and partly by a centerline (i.e., break-around keyway).



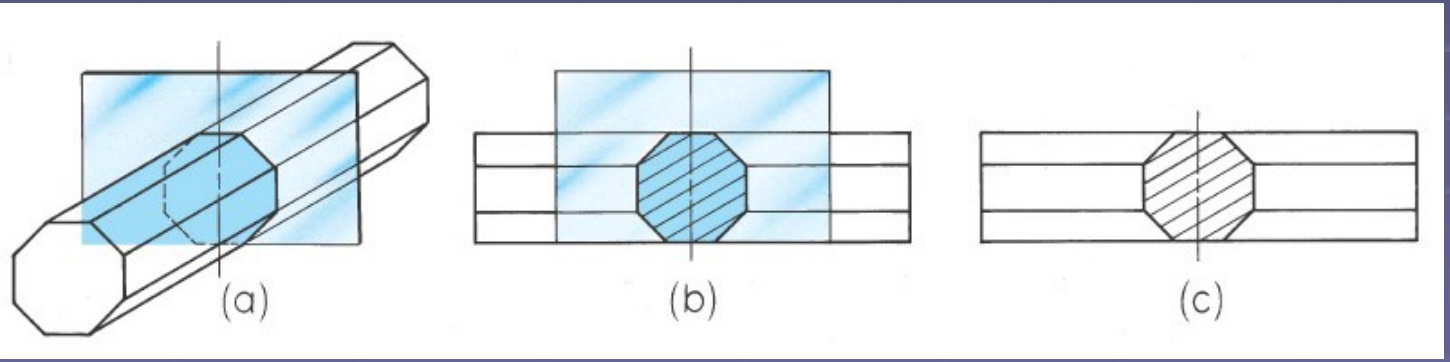


7-10 Revolved Sections

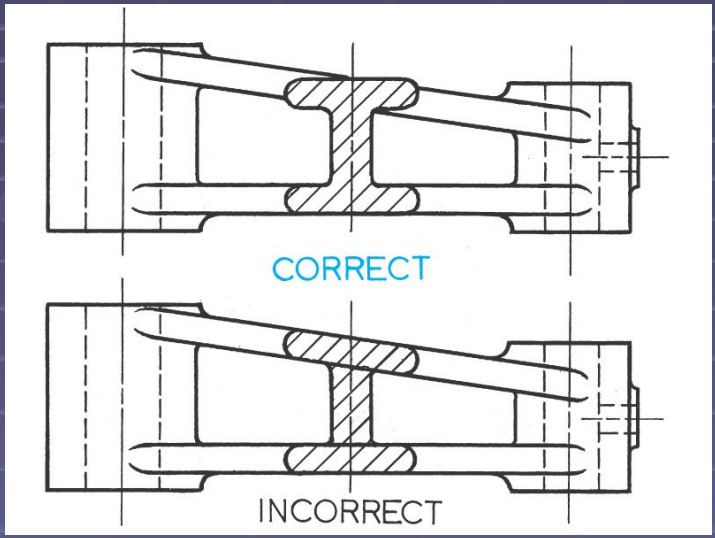
The shape of the cross-section of a bar, arm, spoke, or other elongated object may be shown by means of a revolved section.

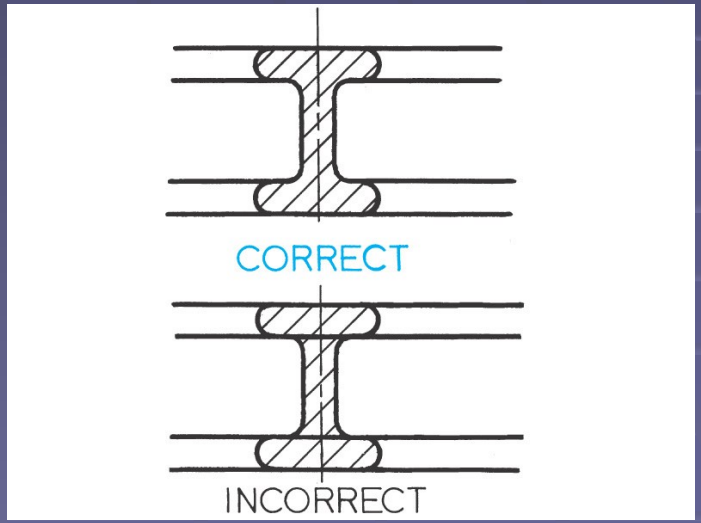
Revolved sections are made by assuming a plane perpendicular to the centerline or axis of the bar or other object, and then revolving the plane through 90 degrees about a centerline at right angles to the axis.

Figure below depicts the process of creating a revolved section.



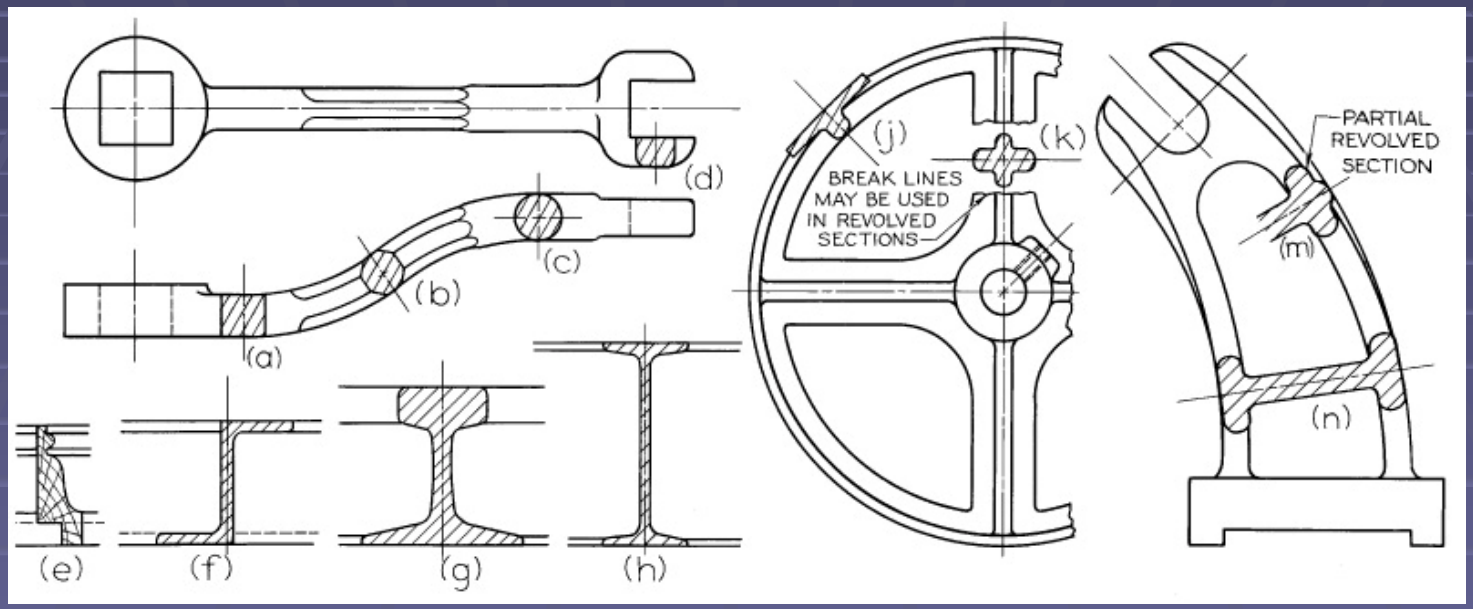
Practical Tips: Sketching Revolved Sections





(cont)

A number of examples of revolved sections are shown below.



7-11 Removed Sections

A removed section is a section that is not direct projection from the view containing the cutting plane – it is located somewhere else in the drawing.

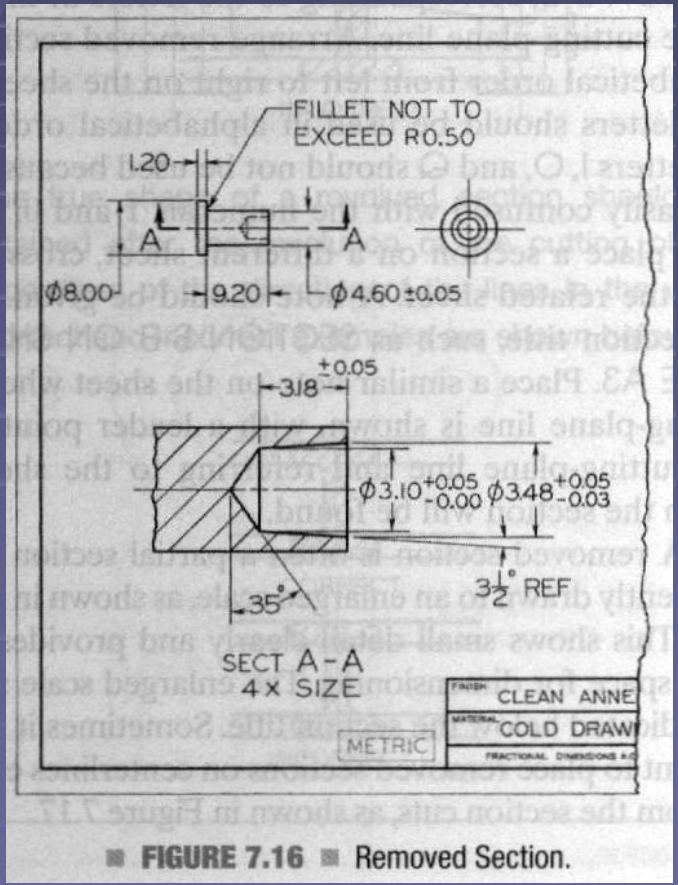


FIGURE 7.16 Removed Section.

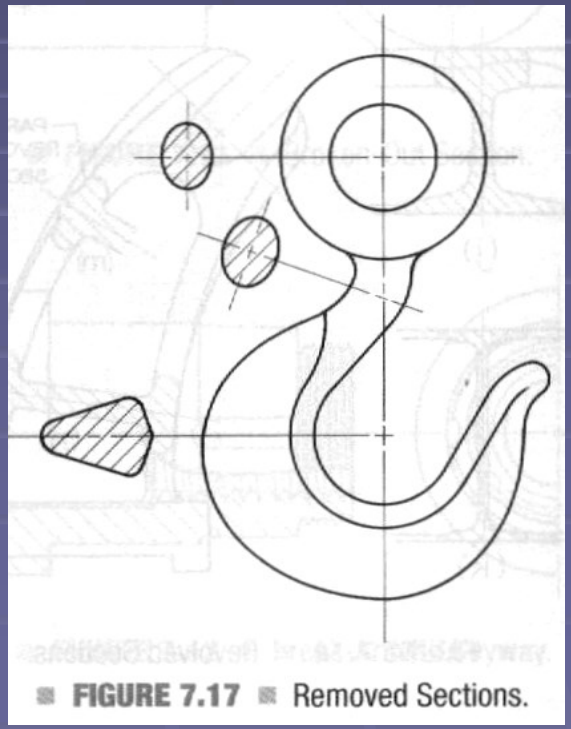
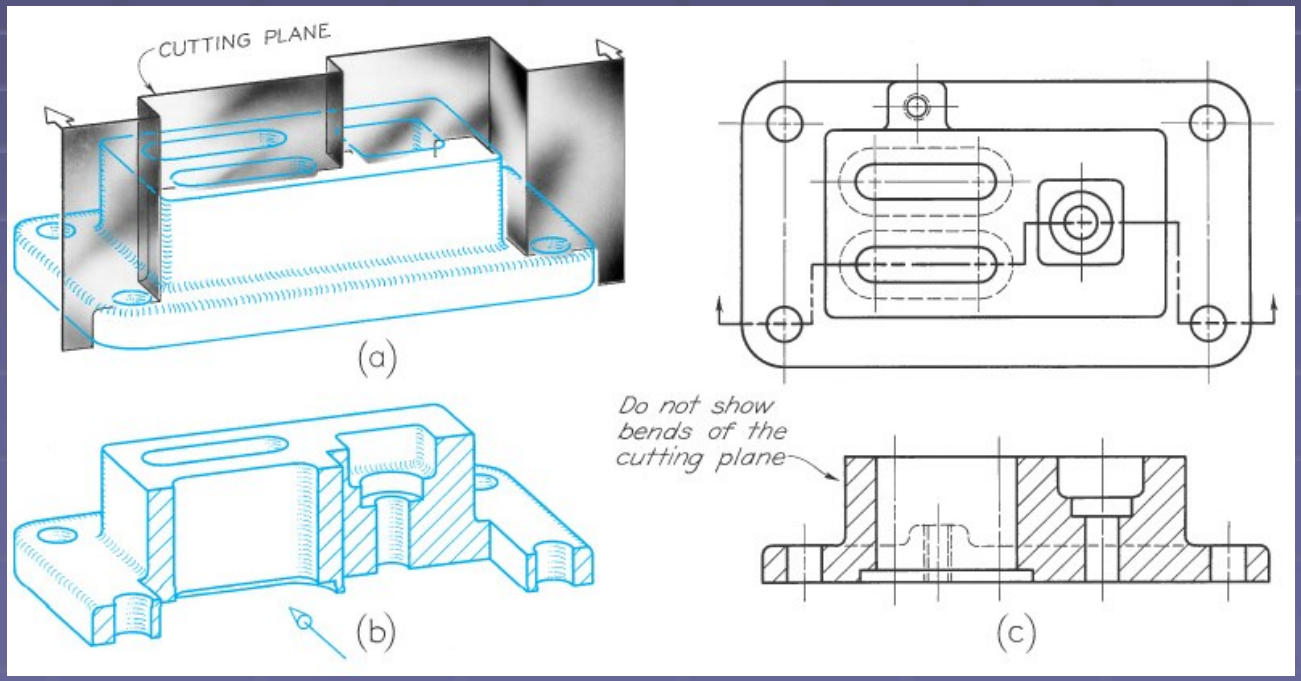


FIGURE 7.17 Removed Sections.

7-12 Offset Sections

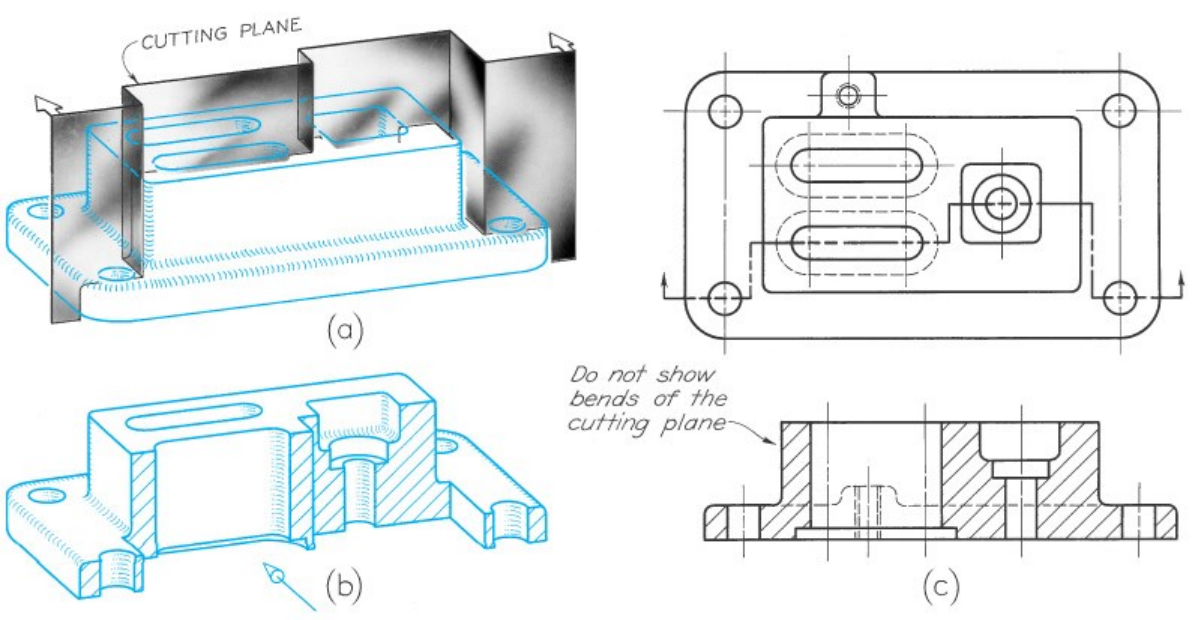
In sectioning irregular objects, we may show features that do not lie in a straight line by offsetting, or bending the cutting plane. Such a section is called an offset section.

In figure (a) the cutting plane is offset in several places to include the hole at the left end, one of the parallel slots, the rectangular recess, and one of the holes at the right end.



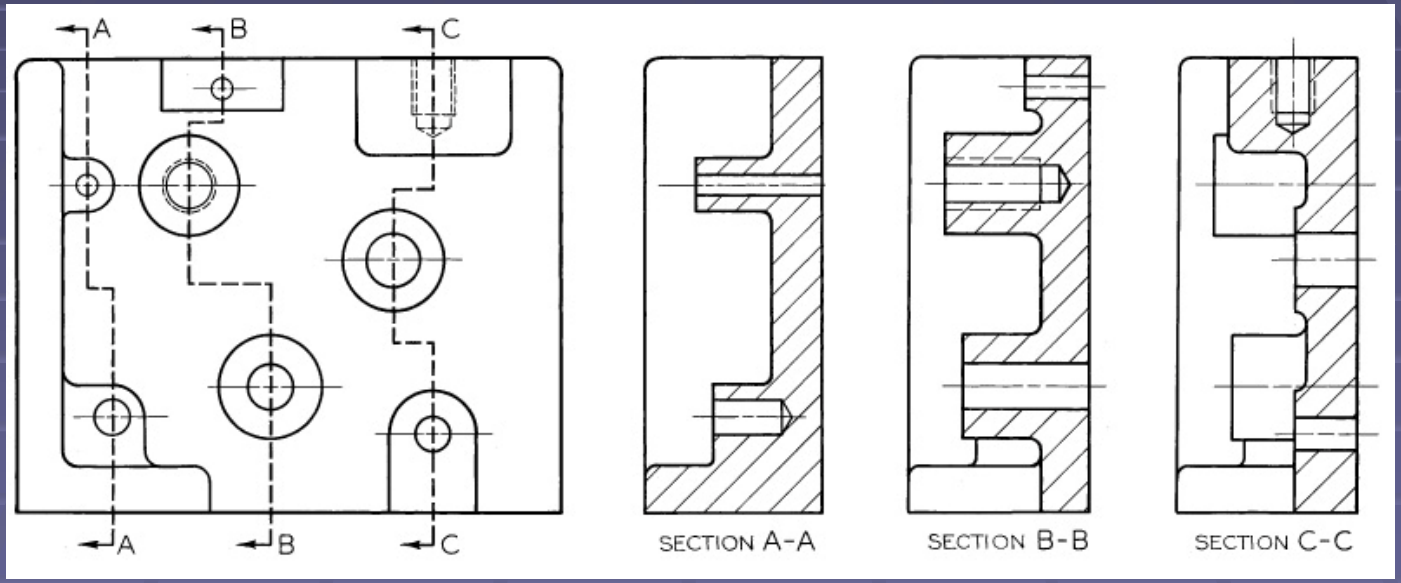
(cont)

The front portion of the object is then imagined to be removed, as shown in fig. (b). The path of the cutting plane is shown by the cutting-plane line in the top view of fig. (c), and the resulting offset section is shown in the front view. The offsets or bends in the cutting plane are all 90 degrees. Figure (c) also illustrates how hidden lines in a section eliminate the need for an additional view. If the hidden lines were not shown, an extra view would be needed to show the small boss on the back.



(cont)

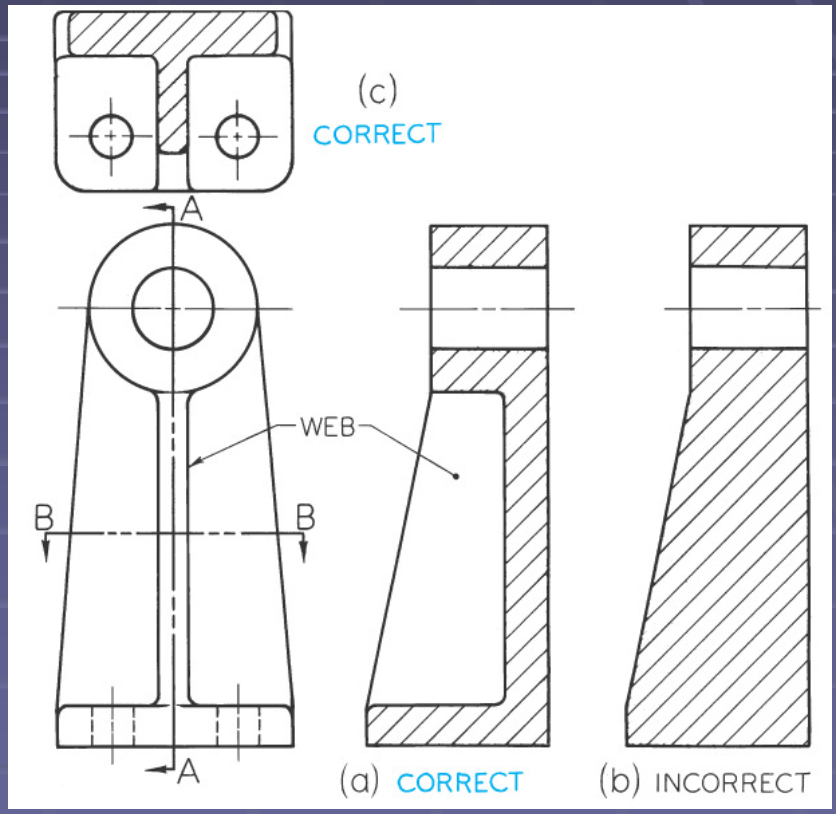
Figure below shows an example of multiple offset sections. Notice that the visible background shapes without hidden lines, appear in each sectional view.



7-13 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.

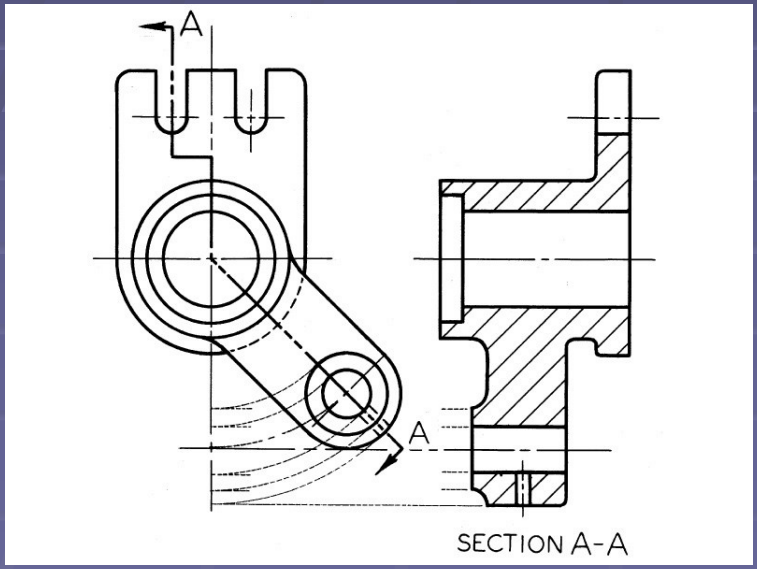
For example, in figure at right the cutting plane A-A passes through the long dimension of the vertical web, or rib, but as figure a shows, the web is not section lines. Such thin features should not be section lined, even though the cutting plane passes through them. Figure b shows an incorrect drawing.



7-14 Aligned Sections

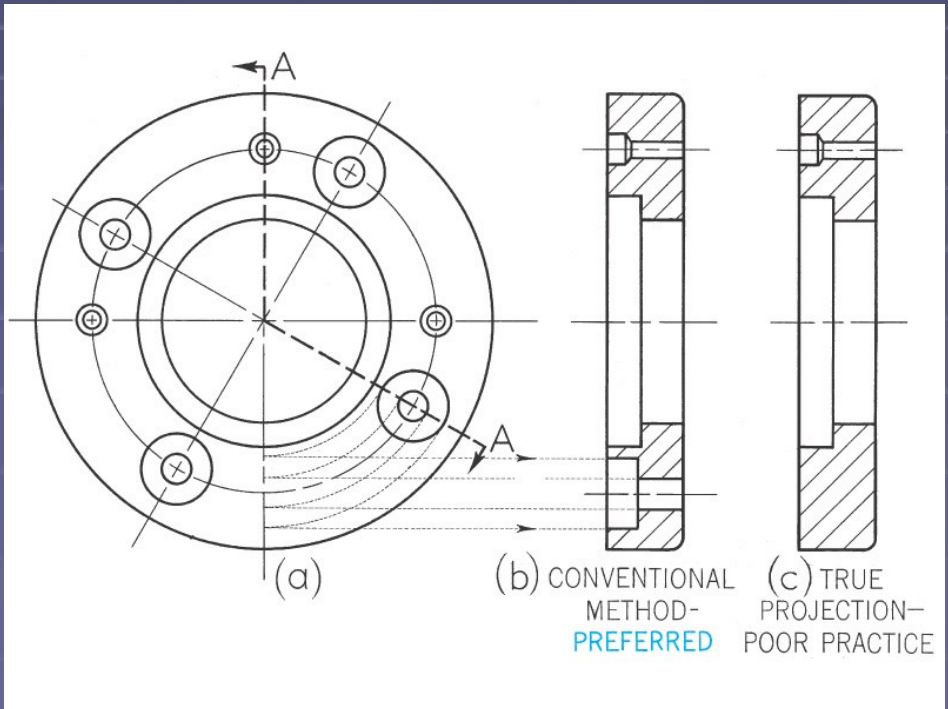
To include in a section certain angled features, the cutting plane may be bent to pass through those features. The plane and features are then imagined to revolved into the original plane.

For example, in figure below the cutting plane bends to pass through the angled arm and then is aligned to a vertical position, where it is projected to the sectional view.



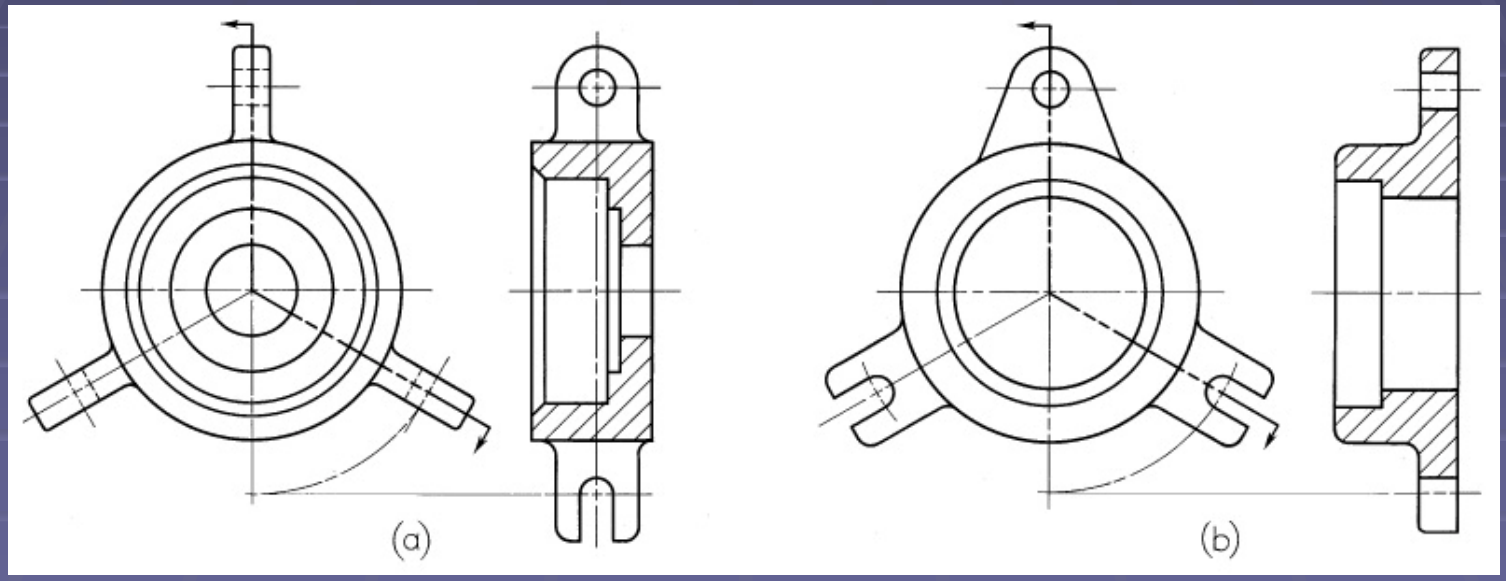
(cont)

In the figure below, the cutting plane is bent so that both a drilled and a counterbored hole will be included in the sectional view. The correct sectional view, shown in fig. (b), is clearer and more complete than a full section, shown in fig. (c). The angle of revolution should always be less than 90 degree.



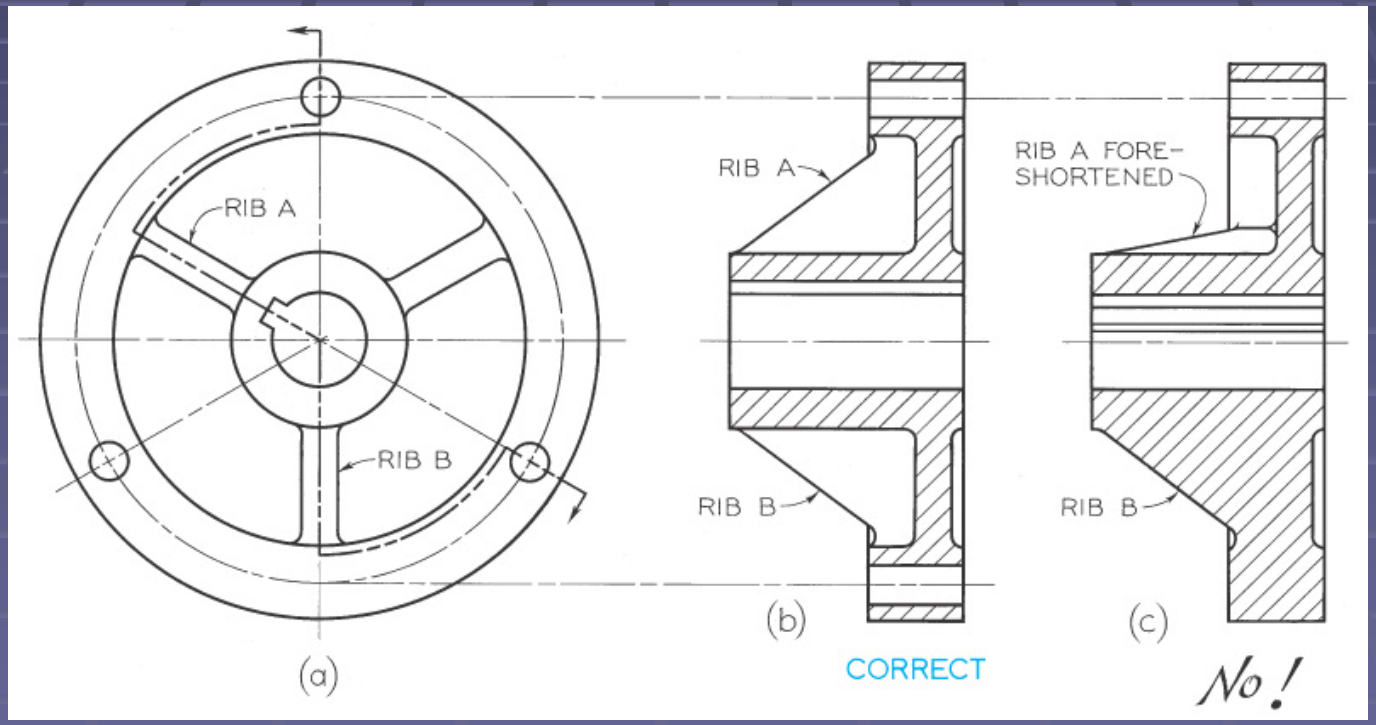
(cont)

In fig. (a) the projecting lugs are not sectioned for the same reason that ribs are not sectioned. In fig. (b) the projecting lugs are located so that the cutting plane passes through them crosswise; therefore, they are sectioned.



(cont)

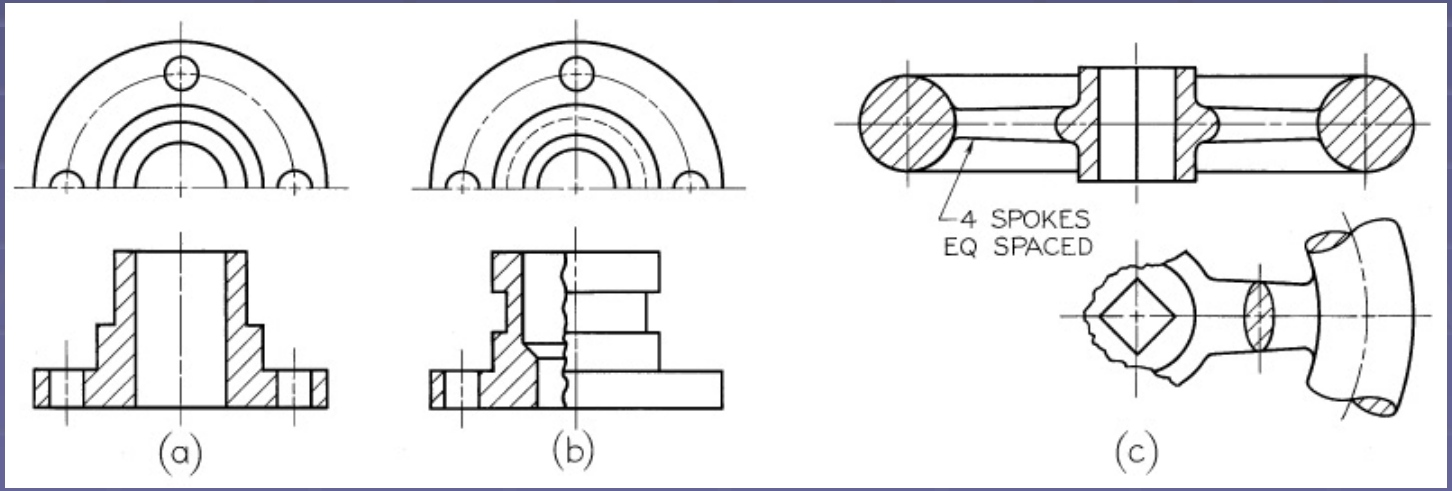
Another example involving rib sections and aligned sectioning is shown below.



7-15 Partial Views

If space is limited on the paper or to save drafting time, partial views may be used in connection with sectioning. Figures (a) and (b) only show half views of the top view. In each case the back half of the object in the circular view is shown to expose the back portion of the object for viewing in section.

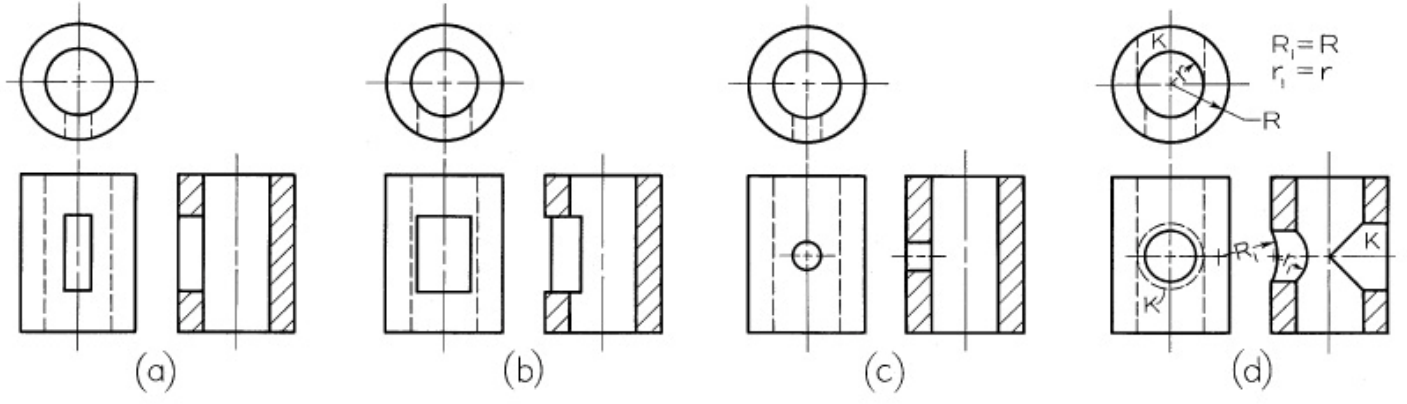
Another method of drawing a partial view is to break out much of the circular view, retaining only those features that are needed for minimum representation, as shown in fig. (c).



7-16 Intersections in Sectioning

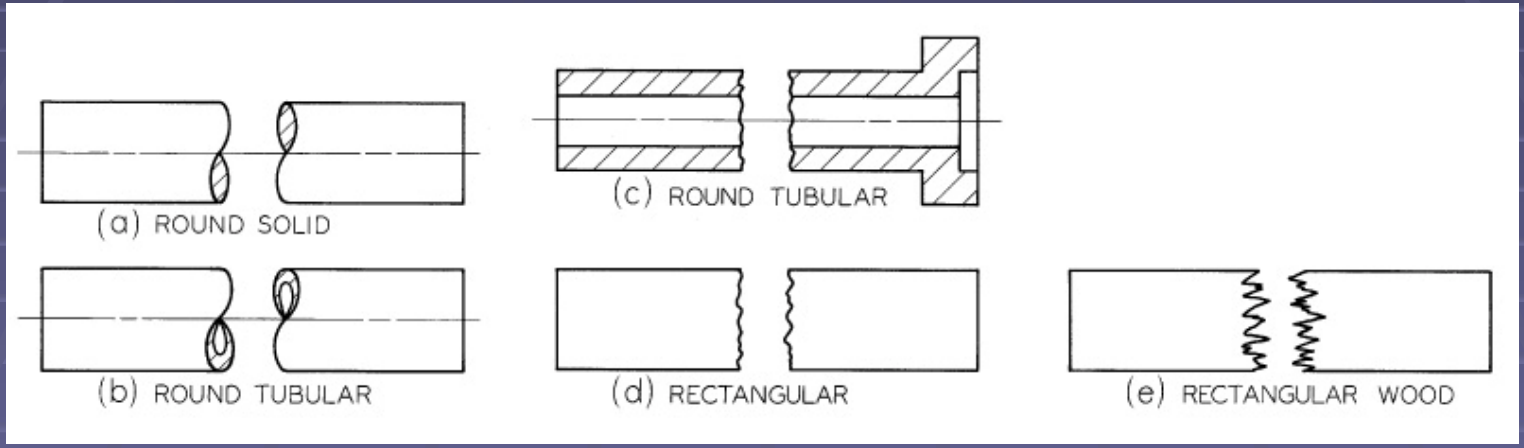
Where an intersection is small or unimportant in a section, it is standard practice to disregard the true projection of the figure of intersection, as shown in a and c. Larger figures of intersection may be projected, as shown in fig. (b), or approximated by circular arcs, as shown for the smaller hole in fig. (d).

Note that the larger hole K is the same diameter as the vertical hole. In such cases the curves of intersection, or ellipses, appear as straight lines, as shown.



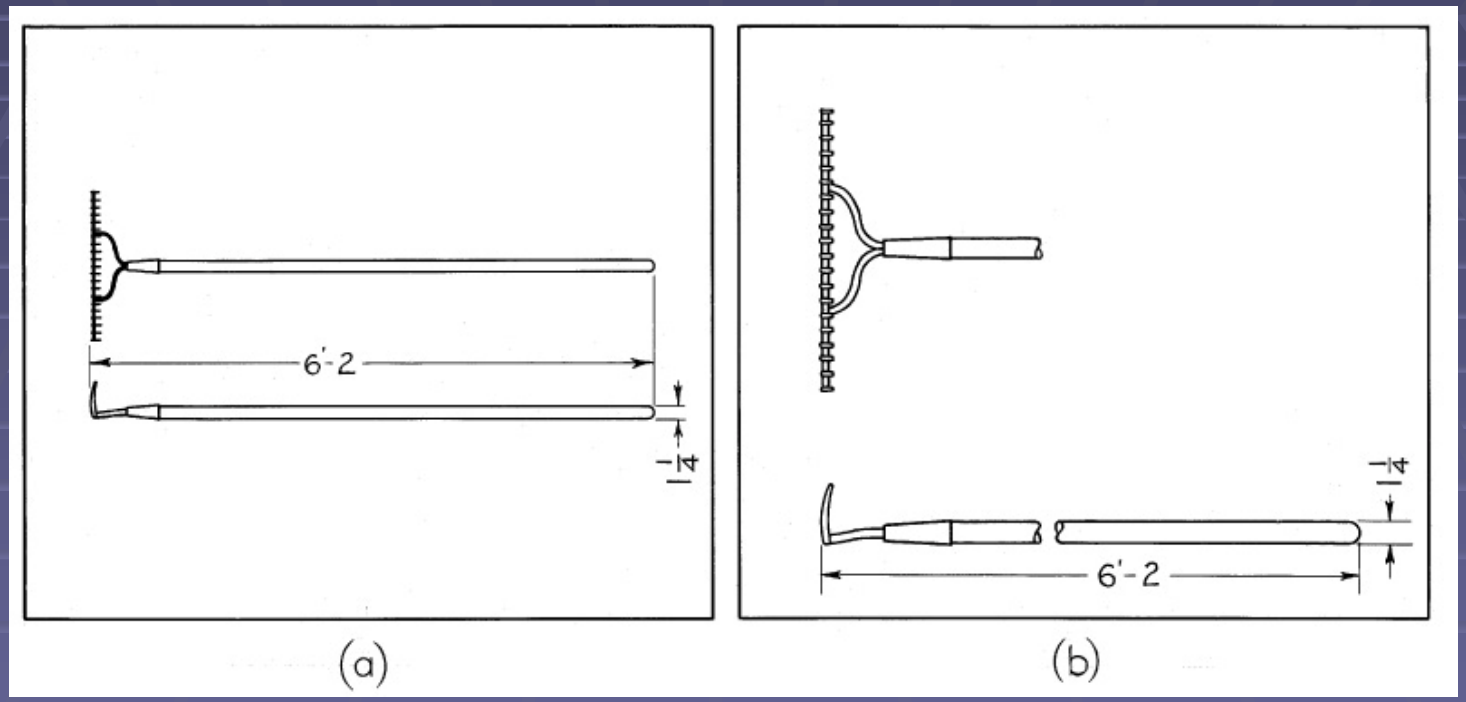
7-17 Conventional Breaks

To shorten a view of an elongated object, whether in section or not, conventional breaks are recommended, as shown below.



(cont)

Another example of conventional breaks is shown below.



7-18 Isometric Sectioning

You can create pictorial sectional views by showing the cut object in an isometric or oblique view and hatching the cut surfaces. An ***isometric full section*** is shown in Figure 7.32. It is usually best to draw the cut surface first and then to draw the portion of the object that lies behind the cutting plane.

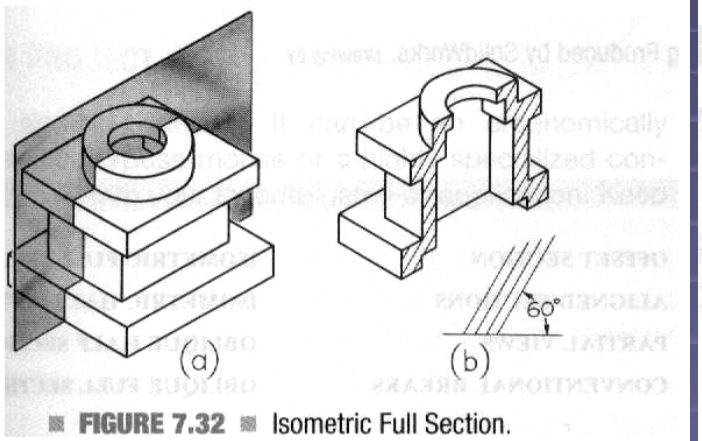


FIGURE 7.32 Isometric Full Section.

An ***isometric half section*** is shown in Figure 7.33. To sketch isometric half-sections, it is usually easiest to first sketch the entire object and then the cut surfaces. Since only a quarter of the object is removed in a half section, the resulting pictorial sketch is more useful than a full section to show both the exterior and interior shapes. Isometric broken-out sections are also sometimes used.

Hatching in an isometric sketch is similar to that in a multiview sketch. Showing it at an angle of 60 degrees with horizontal is recommended, but the direction should be changed if this would be parallel to major visible lines.

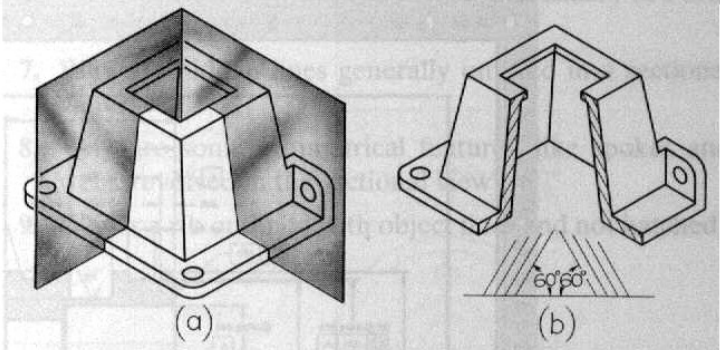


FIGURE 7.33 Isometric Half Section.

7-19 Oblique Sections

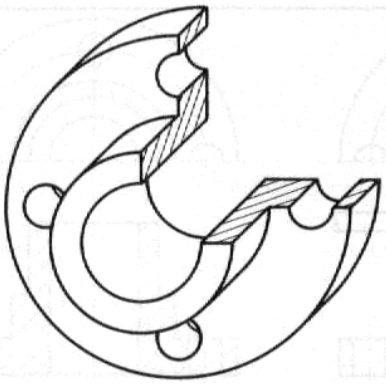


FIGURE 7.34 Oblique Half Section.

You can also show pictorial sections in oblique view, especially to show interior shapes. An ***oblique half section*** is shown in Figure 7.34. ***Oblique full sections*** are seldom used because they do not show enough of the exterior shapes. In general, oblique sections are similar to isometric sections.

(cont)

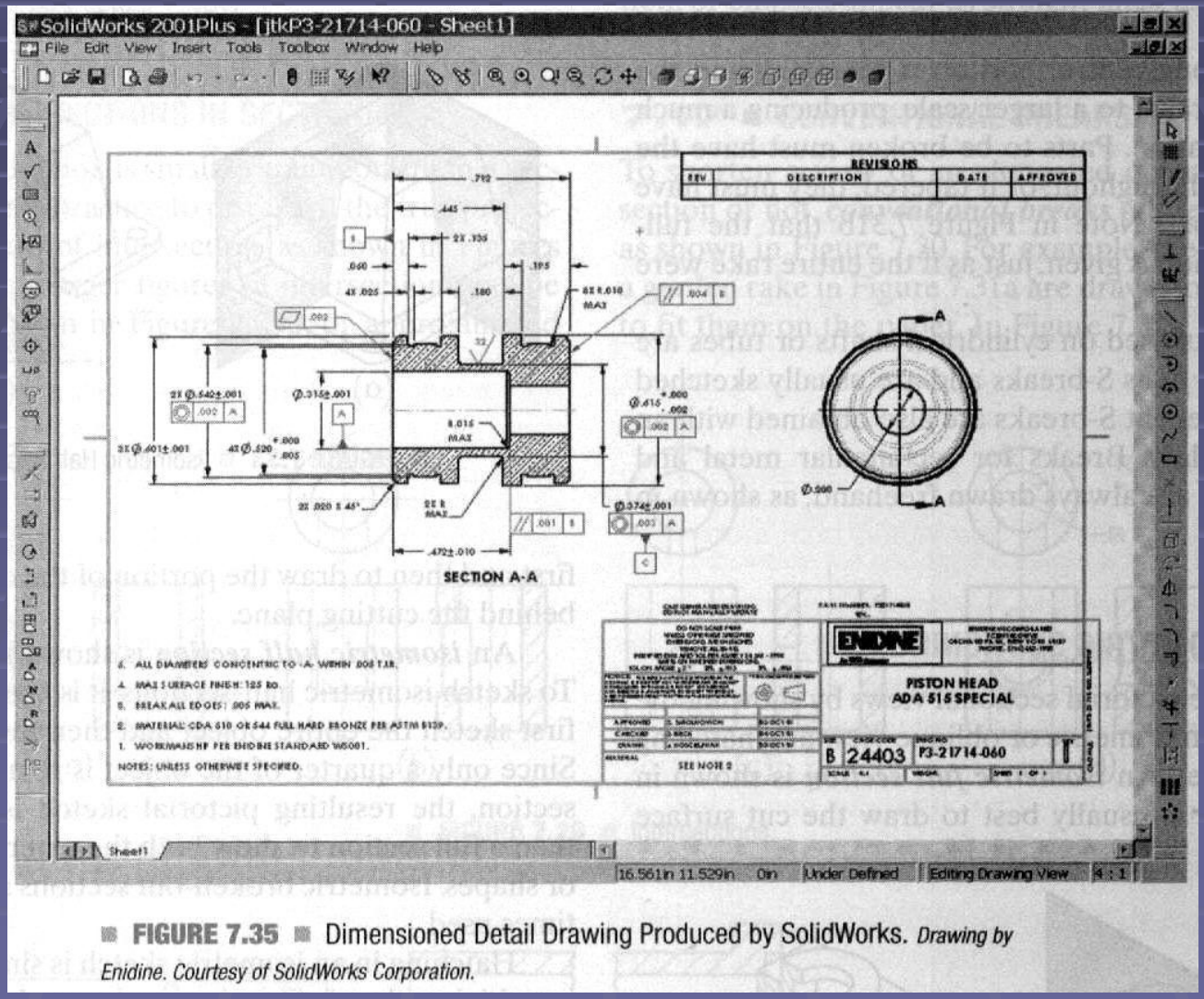


FIGURE 7.35 Dimensioned Detail Drawing Produced by SolidWorks. *Drawing by Enidine. Courtesy of SolidWorks Corporation.*