5. Creating Sectional Views

Quite often an outside view of an object does not adequately describe it, as no internal features are shown. In order to show the internal features without excessive use of hidden-detail lines, the object is imagined to be cut along a plane called a *cutting plane.* The cut portion nearer to the observer is removed and the remaining part is shown as a sectional view. The surfaces in section can be imagined to be cut along the cutting plane with an imaginary tool and imaginary cutting marks are represented by thin equidistant hatching lines as shown in Figure 5.1. Sometimes hatching may be omitted, if the clarity of drawing is not reduced by doing so.
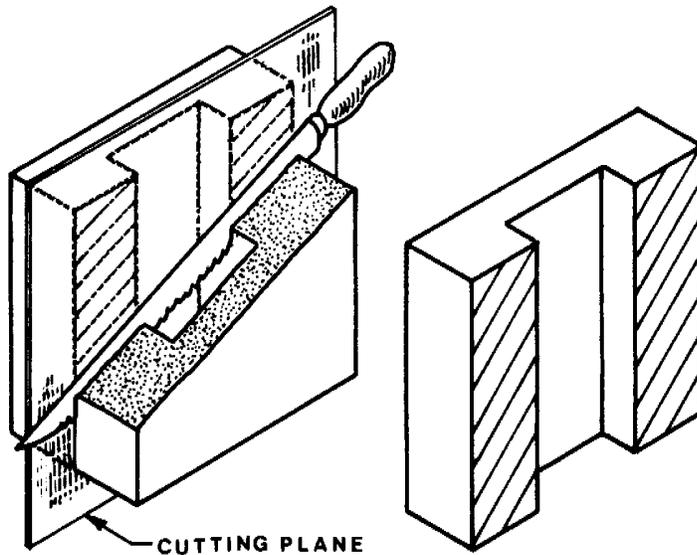

Figure 5.1 Cutting plane

    Sectional views are usually produced
(a) to clarify details of the object,
(b) to illustrate internal features clearly,
(c) to reduce the number of hidden-detail lines,
(d) to facilitate the dimensioning of internal features,
(e) to show the shape of the cross-section,
(f) to show clearly the relative positions of parts forming an assembly.

5.1. CUTTIG PLANE

Another important line type associated with a section view is the cutting plane line (Figure 5.1). Gritting plane lines typically lay in a view adjacent to the section view and represent the cutting path of the cross section (a removed section is an example of a view where the cutting plane line does not lie in a view adjacent to its section view). Arrowheads terminate the ends of a cutting plane line and point in the viewing direction of the section. The cutting plane line definig the cross section cut is located in this view.
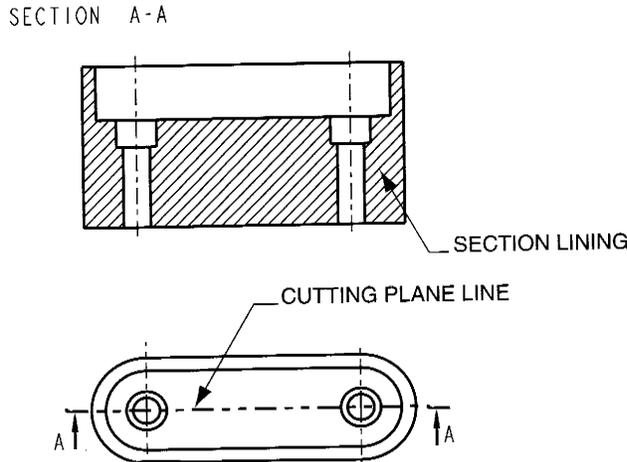
Figure 5.1 Cutting plane

Cutting planes are represented on drawings by long thin chain lines thickened at each change of direction and at both ends. The direction of viewing is shown by arrows resting on thick lines at both ends. Cutting planes should be designated by capital letters. The surfaces shown in section are usually hatched at or at some well defined angle which avoids clashing with visible outlines, as in Figure 5.2. Spacing between hatching lines should be equidistant and not less than 4 mm.
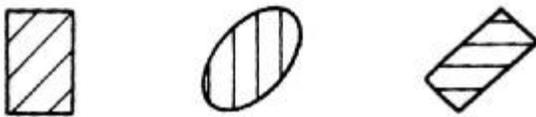

Figure 5.2 Hatching

5.2. SECTION VIEW TYPES

The most common section view used is the full section. Other types of section views are available to serve of variety of documentation needs.

5.2.1. Full Section

The full section view is the traditional type of section view used on most engineering drawings. A full section is available for general. projection. and auxiliary views. Full section view s cut completely through an object and show the entire mdoel. Cross section used to construct a full section are created along a planar surface.

The whole object is shown in the upper left portion of the figure, and the sectioned object is shown with a portion removed just below it (Figure 5.2). The right side of the figure shows a top view of the object with the cutting plane displayed. Imagine that the material on the side of the cutting plane in the direction the arrows are pointing is retained, and the material behind the arrows is removed. Then the projection of the retained portion appears as SECTION B-B when viewed in the direction of the arrows.
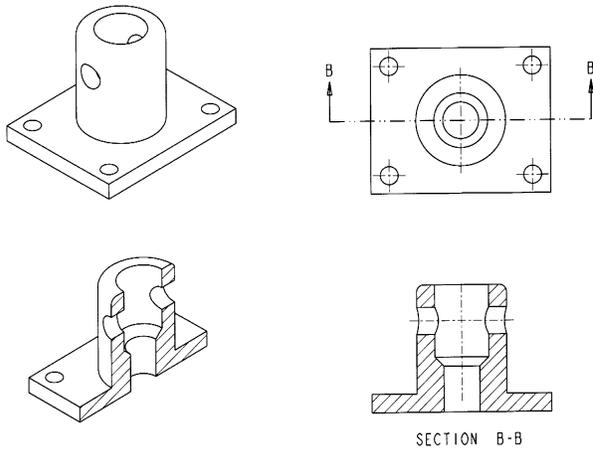
2

Figure 5.2. Full section view

5.2.2. Half Section

The half section view is similar to the full section, except only half of the view is sectioned. For a symmetrical model, half sections provide the advantage of a section on half the view, while also presenting the other aple half with traditional projection. A half section is avai lable for general, projection. and auxiliary views. It is not available with the half, broken, and partial view cut. types. Section views are used to improve the clarity of an engineering design by providing an avenue where the interior details of a model can be viewed. Often, it is not necessary to create a full section (Figure 5.3).
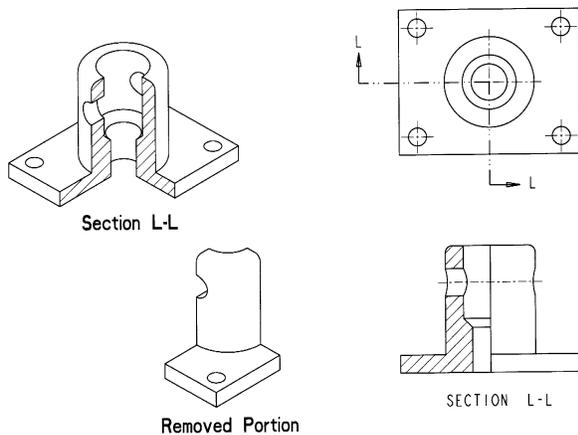

Figure 5.3. Half section view

5.2.3. Offset Section

Most section views are situated along straight cutting plane. Often, features cannot be fully d escribed through a straight cut. Drafting standards allow for an cutting plane. Figure 5.4 shows an example of an offset section view with its corresponding offset cutting plane. With an offset section, the cutting plane is offset by the use of 90º bends that allow the cuttiing plane to pass through features that require sectioning.
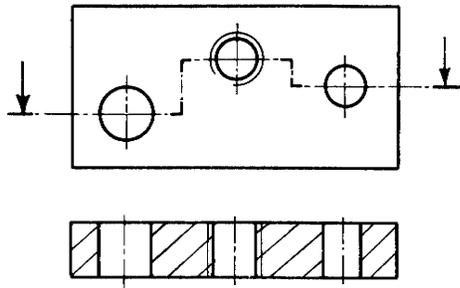
Figure 5.4. Offset sectional view

The cutting plane for offset sections is bent at 90° angles to pass through important features. Note that the change of plane that occurs at the 90° bends is not represented xvith lines on the section view.

5.2.4. Alligned section views

Multiview projection does not always prenset the best display of a design. Figure shows a design displayed using normal lines of projection. Normal lines of projection for a multiview drawing project at a 90° angle. With the drawing shown in Figure, the part does not form a 90° angle. This presents a projection problem. Clarity for this design can be improved with the us of an aligned view (Figure 5.5).
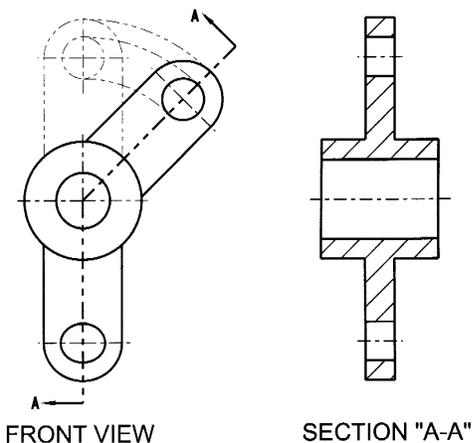

FRONT VIEW   SECTION "A-A"

Figure 5.5. Alligned section

5.2.5. Local (Detail) Section

The local section option is used to create a broken-out section view (Figure 5.6). A local section creates a section in a specific, user-defined area. Local sections are available for general, projection, and auxiliary views. Is is not available with the half and broken view types. A local (part) section may be drawn to avoid the need for a separate sectional view. The local break is shown by a continuous thin irregular freehand line.
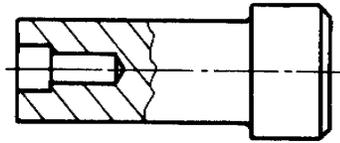
4

Figure 5.6. Local sectional view

5.2.6. Revolved Section

Revolved sections are used to show the cross section of a spoke, rail, or rib type feature. Additionally, it is used with features that are extruded, such as wide flange beams. Revolved sections are useful for representing the cross section of a feature without having to create section 90º (Figure 5.7).
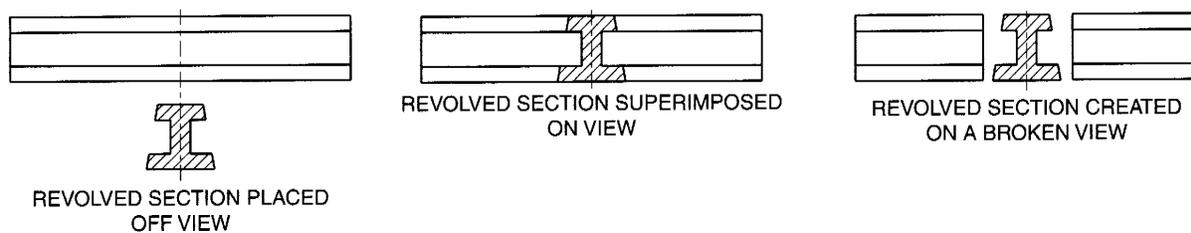

Figure 5.7. Revolved section views

5.3. ASSEMBLY SECTIONS

Assembly sections are typically orthographic, pictorial, full or half section views of parts as assembled. Section assembly drawings follow special conventions. Standard parts, such as fasteners, dowels, pins, washers, springs, bearings, and gears, and nonstandard parts, such as shafts, are *not* sectioned; instead, they are drawn showing all of their exterior features. For example, in Figure 3.17, fasteners would be cut in half by the cutting plane, yet they are not cross-hatched with section lines.

Adjacent parts in assembly sections are cross-hatche at different angles so that they are more easily identified. Different material symbols can also be use for this purpose. Also, if a part in an assembly section i separated by some distance, the section lines are sti] drawn in the same direction.

3-D modeling software can create models of eaci part, the individual models can be sectioned, and the section views can be placed together, resulting in a 3-D as assembly section. An alternative involves using a feature that adds translucency to parts to reveal interior assemblies. The models can be used to check for interference of parts or can be analyzed by dynamically showing the parts in action. The models can also be rotated to produce an ortographic assembly section view.

5.4. CREATING SECTION VIEWS IN CADD

In many drafting applications, an area (such as the portion of an object that has been cut to show a section view) is filled with a pattern to make the drawing easier to interpret. The pattern can help differen tiate components of an assembly, or it can indicate the material comprosing the object. You can accomplish this crosshatching or pattern filling by using AutoCAD's Boundary Hatch command.

The Boundary Hatch command fills an area with a pattern. It creates associative hatching, which means that, if the area selected as the hatch boundary is charged, the hatching is automatically updated to fill the new area.
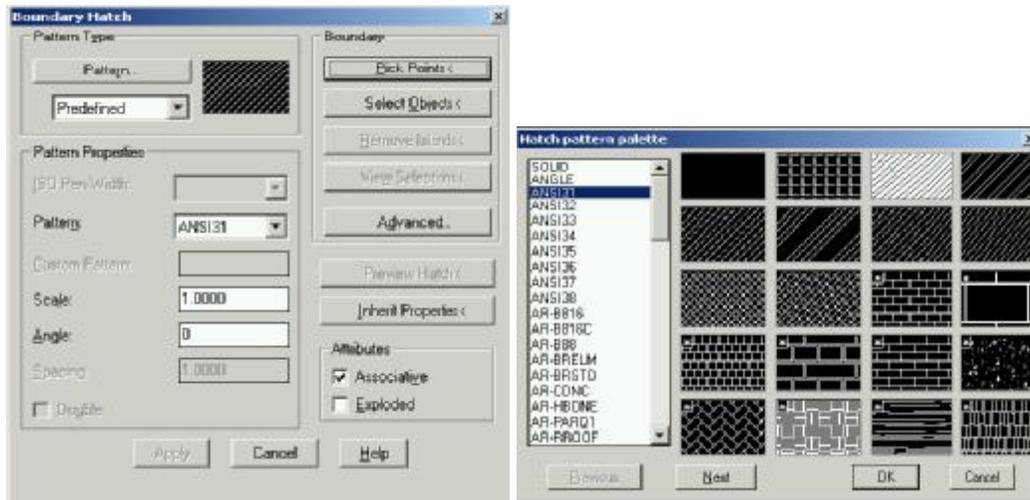

Figure 5.8. Boundary Hatch dialog box

Selecting the Hatch Pattern. You can select predefined hatch patterns by pulling down the list in the Pattern Properties area. It consists of continuous lines angled at 0° spaced about 1 apart, and is typically used to show cast iron materials.

Scaling the Hatch Pattern. You can set the scale for the hatch pattern by using the Boundary Hatch dialog box.

Angling the Hatch Pattern. The Angle area of the Boundary Hatch dialog box allows you to specify a rotation angle for the hatch pattern. The default is 0-degrees, or no rotation of the pattern.

Advaced Option. You can create boundaries for hatching as one of two different types of objects: polylines or regions.

Questions

1. Define section drawings.
2. Describe how 3-D CAD is used to create section views.
3. Describe how cutting plane lines are used.
4. Sketch the two standard types of cutting plane lines.
5. List three applications of section views.
6. What convention is used for hidden lines in a section view?
7. What convention is used for hidden lines on the unsectioned half of a half section view?
8. Define section lines.
9. Sketch the material symbol used to represent steel.
10. Describe how thin parts are represented in a section view.
11. Describe the difference between a revolved and a removed section view.
12. List some of the standard parts that are not sectioned in an assembly section. Explain why.

6

13. What type of line is used to separate the sectioned half from the unsectioned half of a half section view?
14. List some of the future applications of 3-D CAD section views.
15. Discribe different section view types avalible within CADD softwares.
16. What is the purpose of a cutting plane line ?

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