Three Types of Surfaces

There are three basic types of flat surfaces in an orthographic projection. A ***normal surface*** is parallel to one of the three projection planes and, therefore, perpendicular to the other two. For example, each surface of a cube is normal and the top flat surface of a cylinder is normal. If normal surfaces are examined with respect to the three principles:

- A normal surface appears true size and shape in only one view.
- The normal surface appears as a line in two of the three regular views.

Think about this for a while. Very often, when you look at a line in a multiview drawing, you are looking at the edge view of a surface. When you look at the front view of a cube, you see the top and right side surfaces as lines. Study Figure 5-8A. With respect to the top surface of the cube in the front view, if you only "see" the front edge along the front surface, you are still thinking in two dimensions. As your visualization ability increases, you will see these lines as surfaces that extend back.

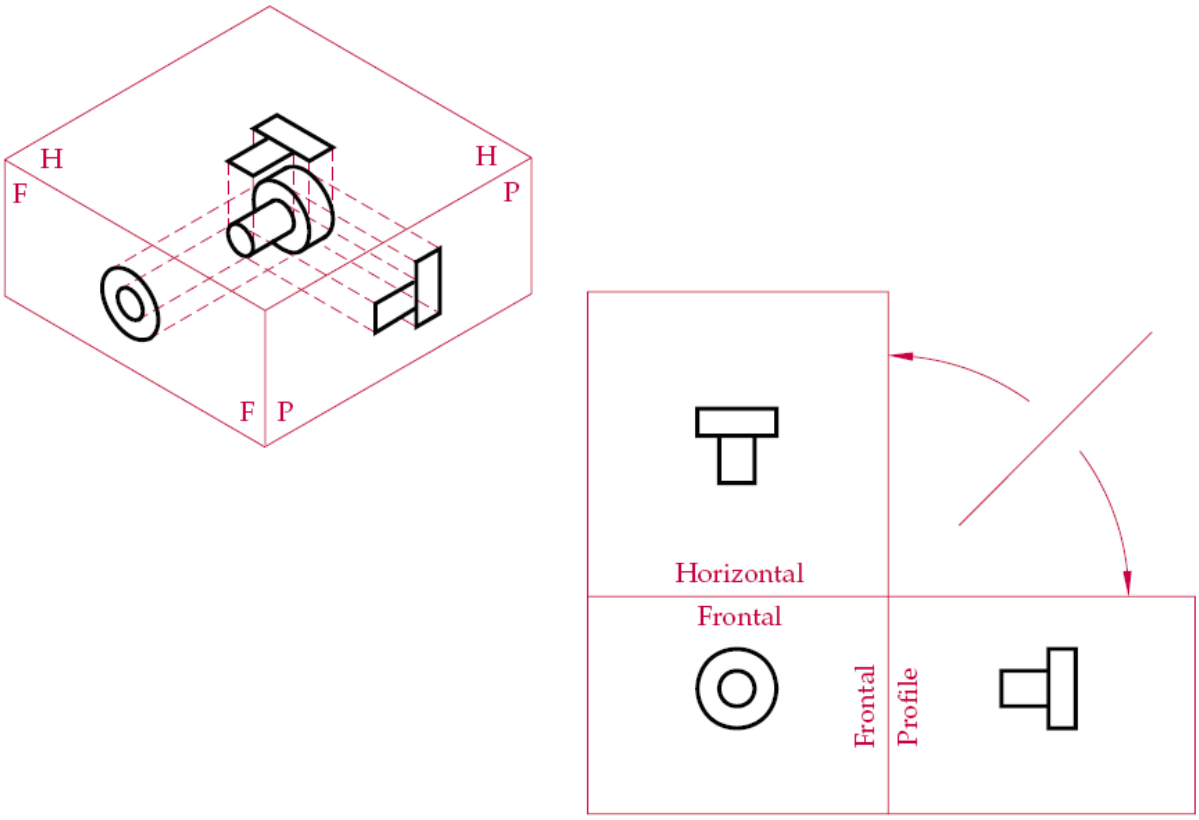

Figure 5-5.
Three basic projection planes are used to explain multiview drawings.

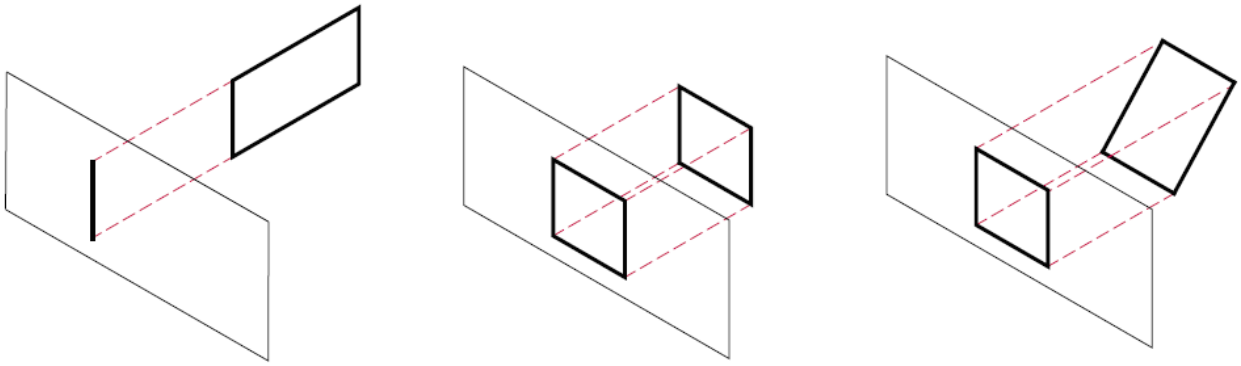

Figure 5-6.
A flat surface is oriented perpendicular, parallel, or inclined to a plane of projection.

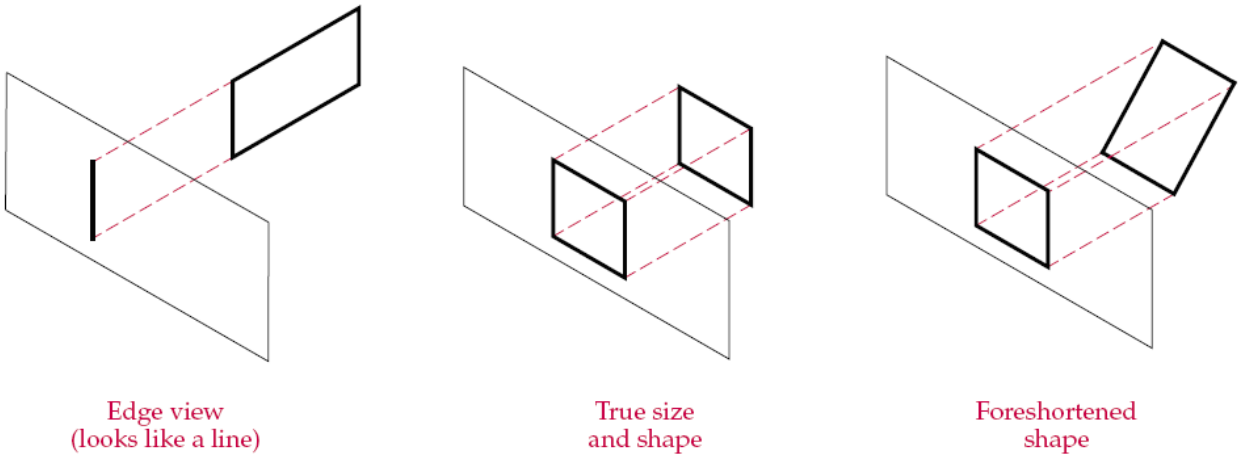

Figure 5-7.
A flat surface can appear in a projection as an edge, in true size and shape, or foreshortened.

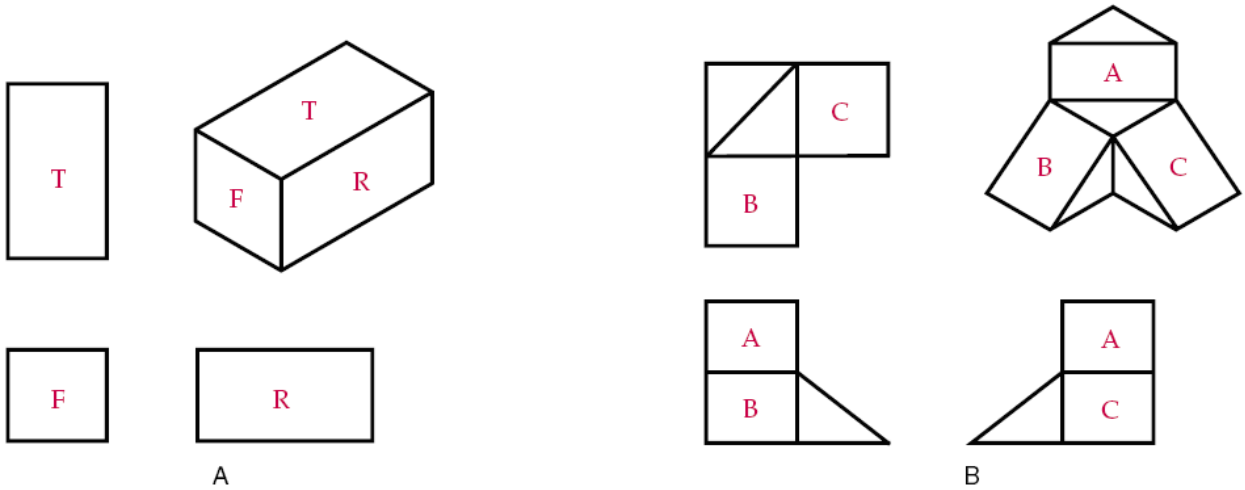

Figure 5-8.
A—This object has normal surfaces. B—This object has normal and inclined surfaces.

A second type of flat surface is the inclined surface. An ***inclined surface*** is perpendicular to one plane of projection, but inclined to the other two planes of projection. If inclined surfaces are examined with respect to the three principles:

- An inclined surface appears as a line in only one of the three regular views.
- An inclined surface appears as a foreshortened shape in two of the three regular views.

Study Figure 5-8B. Surface C is perpendicular to the frontal plane, so it appears as a line in the front view. However, it is inclined to the horizontal and profile planes, so it appears as a foreshortened shape in those two views. Analyze surfaces A and B in the same way. In summary, the shape of an inclined surface appears twice in three regular views, but a normal surface shape only appears once! The normal surface is true size and shape, but the inclined surface is never true size and shape in a regular view.

A third type of planar surface is the oblique surface. An ***oblique surface*** is not only inclined, but rotated. Therefore, it is inclined to all three planes of projection. It is not true shape and size in any view. In fact, it may appear a little distorted due to the projection angle it forms with the projection plane. It also does not appear as a line in any view. See Figure 5-9.

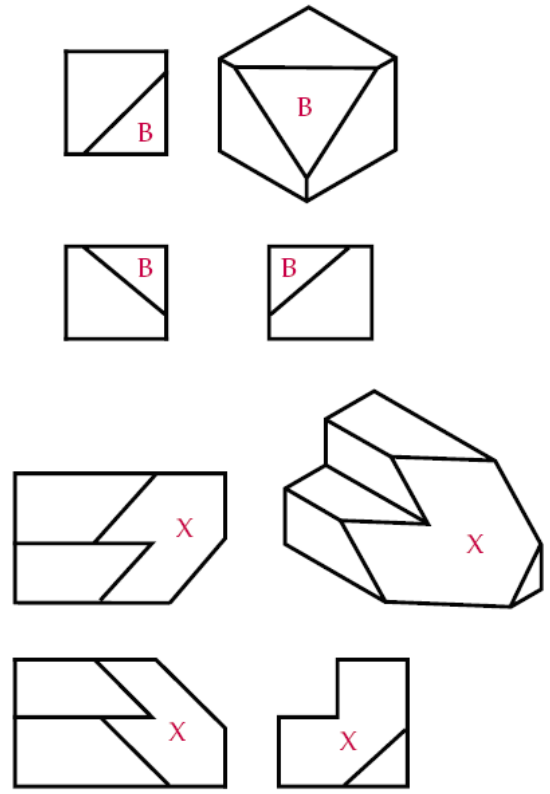

Figure 5-9.
An oblique surface is not only inclined, but rotated. Surfaces B and X are oblique surfaces.

Cylindrical and Curved Surfaces

Cylindrical surfaces present another set of visual challenges to the print reader. Technically, cylindrical surfaces are made of thousands of "elements" that form a curved surface about an axis, Figure 5-10. The designer has often planned it so that a flat surface is tangent to a curved surface, thus making a smooth transition between the curve and the flat. See objects B and D in Figure 5-10. In these cases, no lines are shown at the element of tangency. Be aware, however, some CAD programs that automatically generate the views from the model show these elements of tangency. Also, when flat surfaces form intersections and cutouts with cylindrical surfaces, the projections can be tricky. Study Figure 5-11 to help you visualize how cylindrical surfaces are projected in multiview drawings.

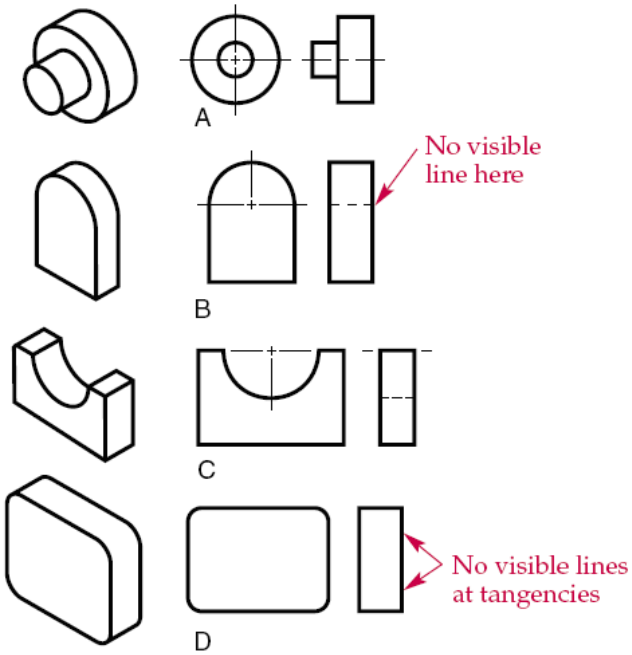

Figure 5-10.
Cylindrical surfaces. A flat surface is often tangent to a curved surface, as shown in B and D.

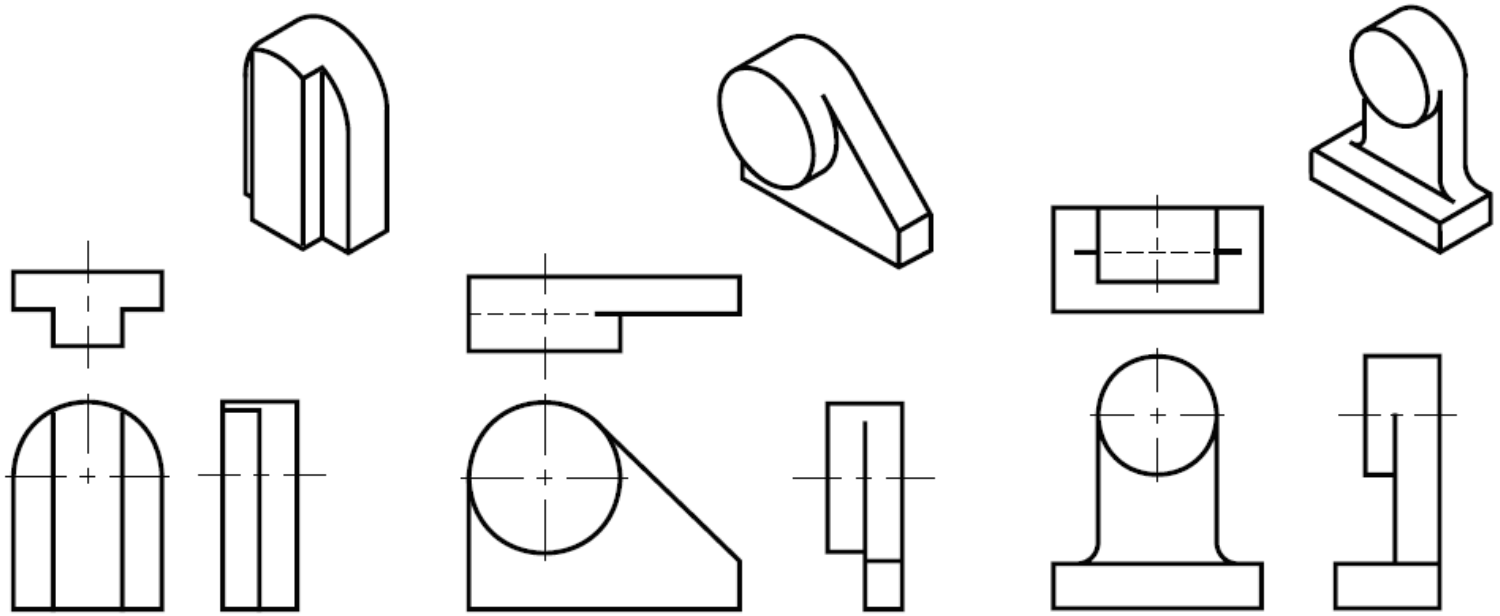

Figure 5-11.
This figure helps illustrate how cylindrical surfaces are projected in multiview drawings.