CHAPTER VI.

THE PATTERN FOR THE FRUSTUM OF AN OBLIQUE CONE.

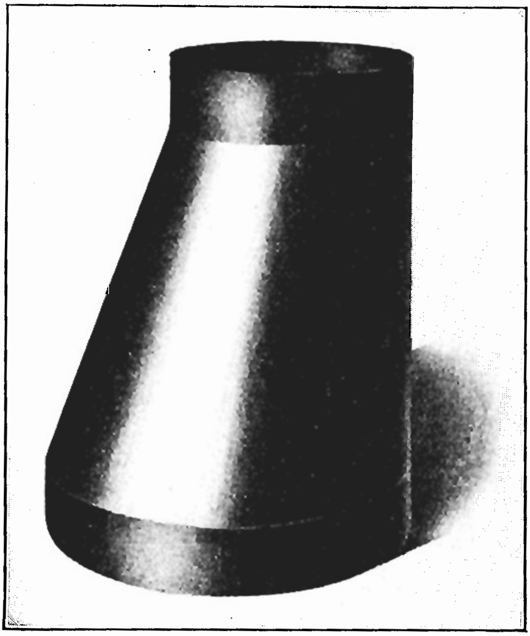

Fig. 29. The Frustum of an Oblique Cone.

As has been explained, the surface of the object for which a pattern is required, may be presumed to be divided into triangles. In foregoing chapters, forms have been selected whose rectilinear elements divide said surfaces into triangles. Attention will now be directed to forms whose rectilinear elements of their surfaces do not divide said surfaces into triangles, therefore additional lines must be introduced.

Elements of a Surface.

It may be here explained, that lines drawn, or presumed to be drawn upon the surface of the cone or cylinder, are termed elements of that surface, and if drawn in positions which admit of their being right lines, they are known as rectilinear elements.

Thus we note upon referring to Fig. 12, Chapter 2, that lines *D 1, D 2, D 3,* etc., are plans of rectilinear

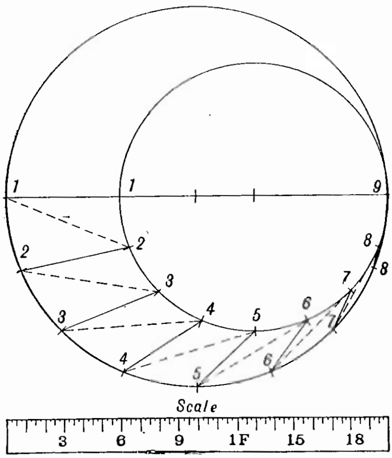

Fig. 30. The Plan of a Fitting Illustrated in Fig. 29.

elements presumed to be upon the surface of the object represented. Similarly, upon referring to Fig. 16, Chapter III, lines as *1 A, 2 A, 3 A,* etc., are plans of rectilinear elements of the conical surface.

Pattern for the Frustum of an Oblique Cone.

Presuming the pattern is required for a fitting as illustrated at Fig. 29, the specification must supply the diameters of the top and base, together with its hight and the relative positions of its ends. In this example, it has been presumed that one side is perpendicular to the plane of its ends, or, what is sometimes termed, straight on one side. This form is the frustum of an oblique cone. The most simple and efficient diagram which will represent the object is a plan as shown at Fig. 30. This assumes the object to occupy a position as shown at Fig. 31.

SCENOGRAPHIC AND ORTHOGRAPHIC PROJECTION COMPARED.

It may be well to here explain that Fig. 31 is a pictorial view of the object, and its plan. This is a scenographic representation and of no particular value beyond its use

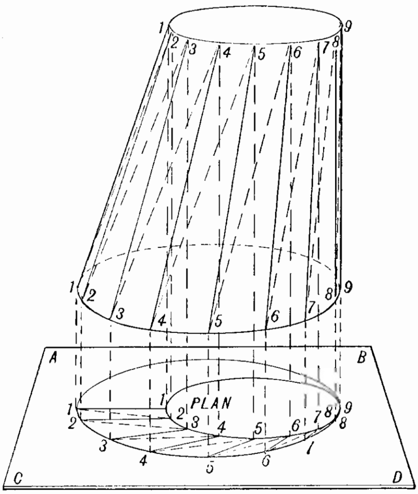

Fig. 31. Pictorial View of the Fitting and Its Plan.

to convey to the reader an understanding of the position the object occupies as regards its plan.

In continuation of the above, it may be stated that in representing objects according to the principles laid down for perspective, the eye is imagined to be stationed in one particular place, called the point of sight, from which all the visible parts of the figure are supposed to be seen. In orthographic projection, with which we are chiefly concerned, the case is very different, inasmuch as the eye is supposed to be in a direct line with every part viewed, or, in other words, to move over the object in such a manner as to be directly opposite to every part represented. The visual rays are therefore parallel, whereas in perspective they converge to a point.

A Geometrical Representation, or a Plan.

Fig. 30 is a geometrical representation or a plan of the object, which has been drawn to the scale appended, presuming the dimensions to be as follows: Diameter of base, 20 inches; diameter of top, 14 inches; hight, 21½ inches, with one side perpendicular to the plane of its ends.

The circles have been placed in the same relative position as the ends of the object would appear if viewed from above as in orthographic projection. A line as *1 9,* drawn through the center of each circle, divides the plan into two equal parts, therefore it only becomes necessary to consider one part. As will be noted, one half of each circle has been divided into an equal number of equal parts, as *1, 2, 3,* etc. Lines drawn between points of the same number in each circle as shown, supply plans of lines which are presumed to be upon the surface of the object. The above spoken of lines are clearly shown in perspective at Fig. 31.

As has been previously explained, the development of the pattern rests upon our ability to determine the lengths of these lines and place them upon a flat surface in their correct relative positions. The plan supplies the distances these lines are from each other at their extremities in the points of division of the circle.

THE RIGHT ANGLED TRIANGLE.

By the use of the right angled triangle, we may secure the lengths of these lines as has been explained in foregoing chapters, i. e., draw two indefinite right lines at right angles to each other, as *A B* and *B C,* Fig. 32, and set off from *B* upon the line *A B,* a distance of 21½ inches, as at *A.* Set off from *B* upon the line *B C,* dis-

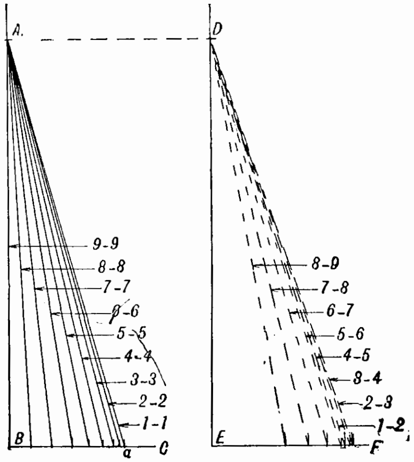

Fig. 32. Diagram of Triangles.

tances equal to lengths of lines *1 1, 2 2, 3 3,* etc., which are shown in plan Fig. 30, as shown upon line *B C,* Fig. 32. Then will the distances from *A* to those points upon line *B C,* supply the true lengths of similarly numbered lines shown in plan at Fig. 30, or in perspective at Fig. 31.

ADDITIONAL LINES MUST BE ASSUMED.

Upon attempting to develop the pattern with the data now before us, we find that these lines cannot be placed in their correct relative positions upon a flat surface.

To enable the reader to realize this, we may attempt to develop the pattern by drawing a line in any convenient position, as *1 1* of the pattern, Fig. 33, whose length is shown in the distance between points *A a,* Fig. 32, which is known to be the true length of line *1 1* upon the surface of the object. With the extremities of this line as centers, draw arcs whose radii are equal to the distances between points *1* and *2* of the large and small circle of the plan, Fig. 30. Since the radii of these arcs are in reality the distances between the extremities of

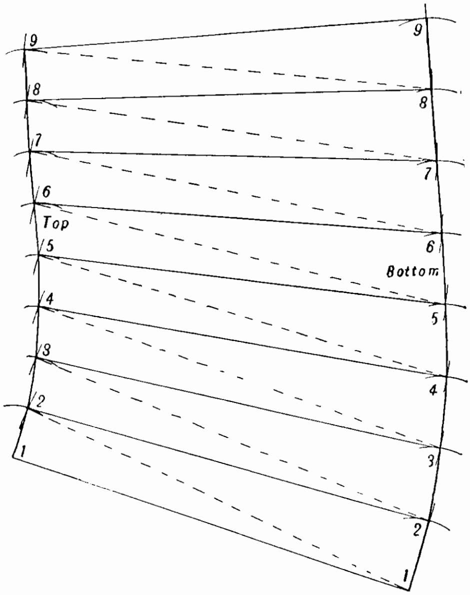

Fig. 33. Semi-pattern.

lines *1 1* and *2 2* upon the surface of the object, the extremities of line *2 2* must lie in points of said arcs. As these arcs may be conceived as being formed of a great number of points, no two of which are in the same position, although at the same distance from their centers, which are the extremities of line *1 1,* it is yet a difficult matter to accurately locate the extremities of line *2 2.*

However points *1* and *1,* Fig. 33, have been located in definite positions. Since points *2* and *2* must lie in arcs which have been drawn with points *1* and *1* as centers, if the true distance between points *1* at the base and *2* at the top of the object was known, we could then locate point *2* upon the pattern. This applies as well to practically all designated points shown in plan.

To determine those lengths we draw lines as *1 2, 2 3, 3 4,* etc., Fig. 30, thus securing the plans of lines connecting those points. As has been frequently explained, the lengths of those lines will be secured by the use of the right angled triangle as follows: Draw lines *D E* and *E F,* Fig. 32, at right angles to each other. Set off from *E* upon the line *E D,* a distance equal to the vertical hight of the object as at *D.* Set off from *E* along the line *E F,* distances equal to the lengths of lines *1 2, 2 3, 3 4,* etc., Fig. 30. Then will the distances from those points to point *D* represent the true lengths of those lines, i.e., *1 2, 2 3, 3 4,* etc., as shown at Fig. 32, thereby securing the true lengths of all lines necessary to develop the pattern.

As will be noted upon examination of Fig. 33, these lines describe a zigzag path which crosses and recrosses the pattern, turning at the top of same at distances equal to distances between points of division of the small circle in plan, and at the bottom of pattern at distances equal to distances between points of division of the large circle in plan.

Developing the Pattern.

To develop the pattern we may draw in any convenient position, a line whose length is equal to line *1 1,* Fig. 32. From the extremities of this line describe arcs whose radii are equal to the distances between points of division of the large and small circle in plan, Fig. 31. With the compasses set to a distance equal to the length of line *1 2,* Fig. 32, place one point at point *1* of the pattern, (i.e., that end of line *1 1* which may be selected as the bottom of the pattern) and describe the small arc as at *2* at the top, then will the intersection of the small arc locate the upper extremity of line *2 2*. With point *2* at the top of pattern Fig. 33, as center. and with the length

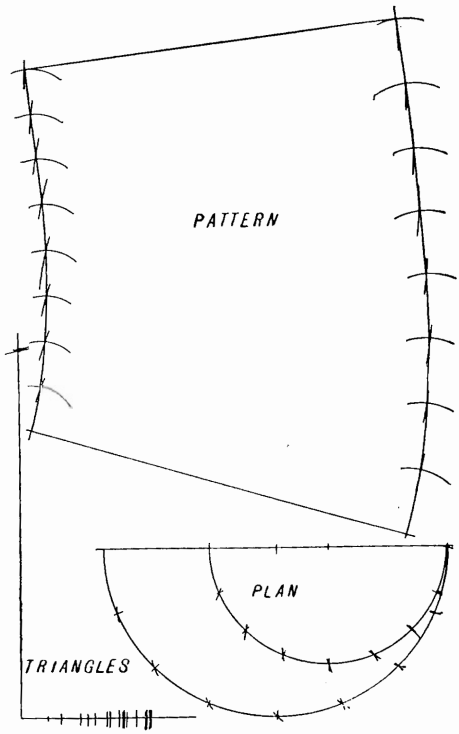

Fig. 34. *Drawing showing how the Pattern may be Secured with the Least Number of Lines.*

of line *2 2* secured from Fig. 32 as radius, describe the small arc as shown at *2* at the bottom of the pattern. This, as will be noted, locates line *2 2* in its correct relative position.

This completes what we may term, one section of a covering for the object. These sections are clearly shown in plan Fig. 30, and in perspective, Fig. 31, therefore the reader should have little difficulty in completing the pattern, since the same operations are involved to secure the true form of all sections shown in Fig. 33, although different lengths of lines must be employed, i. e., we must use the proper length for each line drawn.

Lines drawn to connect points as *1 1, 2 2, 3 3,* etc., have usually been drawn solid, while those drawn between points as *1 2, 2 3, 3 4,* etc., have been drawn dotted, the only purpose of which is to avoid confusion.

Necessity for Lines in Pattern Development.

In a demonstration of pattern development, lines are drawn to illustrate the relation between points presumed to be upon the surface of the object, although the demonstrator subjects himself to considerable criticism from some whose knowledge of pattern development is limited.

The remark is frequently heard: Well, that may be all right, but he makes too many lines. This proves conclusively that the speaker has not stopped to consider. Designated points and lines are as necessary in a geometrical demonstration as the letters of the alphabet are necessary to a printed page.

However, when one becomes familiar with the operations required for the solution of a problem, that problem may be worked out in such a manner as to appear greatly abbreviated as shown at Fig. 34, where the same results are secured as in the demonstration where Figs. 30, 31, 32, and 33 have been shown in an endeavor to illustrate principles involved.