CHAPTER XXIV.

A Two Pronged Fitting Whose Prongs Are Unequal.

The chief difficulty which is usually encountered when an attempt is made to develop the pattern for an unequal branched fitting as illustrated at Fig. 101 is to establish

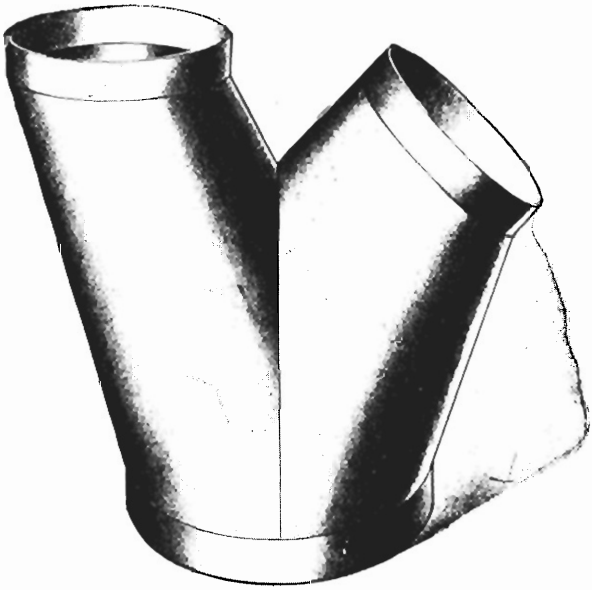

Fig. 101. *Photographic View of the Fitting.*

a suitable form at the junction of its prongs. Therefore our first work will be to discuss methods which may be pursued to establish that form.

Upon comparing Fig. 97 in Chapter 23 and 101, it will be noted that one prong of Fig. 101 is a duplicate of

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the left hand prong of Fig. 97: thus if we can determine the true form of a fitting as shown at Fig. 97 at the junction of its prongs, we have established a form for that part of the fitting as shown at Fig. 101.

To Establish the Form of the Fitting at the Junction of Its Prongs.

When following a course as here suggested, we presume one prong of the fitting to be a portion of the frustum of an oblique cone, and determine the true form upon the line which represents the junction of the prongs in elevation, which may be accomplished as shown at Fig. 102.

Upon examination of Fig. 102, it will be noted that there is shown the plan and elevation of the frustum of an oblique cone, a portion of which will supply one prong of the required fitting. Fig. 102 also shows a number of lines which connect points of the top and base. The elevations of said lines are located by projecting the points of division of the circles to lines parallel to *I L* which represent the top and base of the object in elevation.

The line *5 13* in plan Fig. 102, is a plan of a plane which cuts away a suitable portion of the conical form, since it passes through the center of the large circle, and as said line is perpendicular to *I L,* the line *5 D* is an elevation of said plane. This plane thus cuts the conical elements or lines which connect points of the top and base in points *E F G H J K* and *L,* and intersects elements at the base of the fitting in points *5* and *13.* The distance above the base of the object at which said plane intersects or cuts these elements is shown at points *A B C* and *D* of the elevation.

Thus we have definitely located in plan and elevation

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a number of points upon the surface of the conical form which were created by the plane in penetrating that form. Since the position of a point in space may always be determined from its plan and elevation, we may pro-

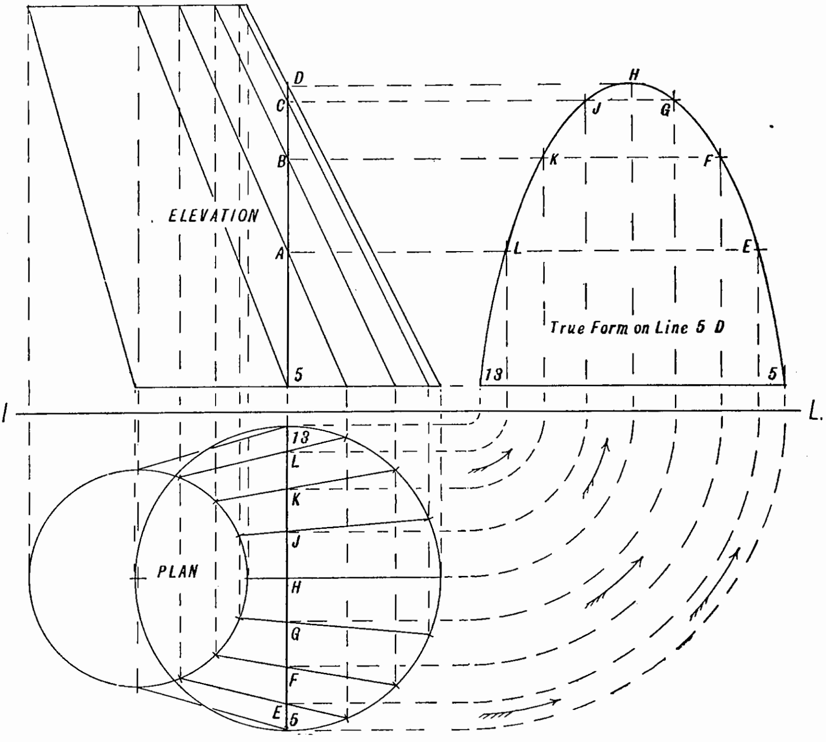

Fig. 102. *Plan, Elevation, and True Form of Section.*

ceed to locate those points in their correct relative positions by erecting perpendicular lines at distances from each other as found between points along the line *5 13* of the plan as shown at the true form. Said lines are now intersected by lines projected from points *D C B* and *A,* thereby locating points as shown at *5 E F G H J K L* and *13* of the true form on line *D5*. A line traced

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through said points will then supply the form of the fitting at the junction of its prongs.

Other lines of reasoning may of course be applied to this operation to secure identical results, as for example, the point *B* in elevation may be looked upon as the end elevation of a line which is perpendicular to the vertical plane, the length of which is the distance between points *F* and *K* of the plan, and so on for all lines shown.

Having established the form of the fitting at the junction of its prongs, we may proceed to develop the pattern for the right hand prong as shown at Fig. 103. Here as will be noted, an elevation may be drawn to satisfy the demand. In this instance it has been presumed that the lines *A 5, 5 1, 1 1* and *1 9* supply an elevation for a suitable form. With the elevation drawn in outline, our next work is to secure a plan of the object, together with lines presumed to be upon its surface.

It will be noted that Fig. 103 shows a semi-plan of the frustum of an oblique cone, which was used as one prong of the fitting discussed in the last chapter. In this manner the lower extremities of lines presumed to be upon the surface of the right hand prong may be conveniently located as shown. As the length of line *1 9* represents the diameter of the small collar, we draw a semi-circle as at *E,* which then becomes a profile of that portion of the object. Thus we have a semi-circle which is perpendicular to the vertical plane and at an angle to the horizontal, a plan of which will be semi-elliptical as shown. To secure this semi-ellipse divide the semi-circle *E* into the same number of equal parts as was the semi-circle which represents the base of the conical form. Said points of division of the semi-circle *E* are projected to the line *1 9* as shown in points *2 3 4,* etc. From these

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points of intersection along the line *1 9* vertical lines are dropped to the horizontal plane and made of a length below the line *I L* as found in the semi-circle *E*. In this manner points are located in plan as *2 3 4,* etc. A line traced through said points then supplies the semi-ellipse which is a plan of the semi-circle whose edge elevation is the line *1 9.*

The construction lines shown in plan and elevation Fig. 103 clearly show the method employed to locate lines which we shall place upon the plane of development in their true lengths and positions to secure points through which the outline of the pattern is drawn. As for example, those lines whose upper extremities are in points *6 7 8* and *9,* connect points as *A B C* and *D,* which are the lower extremities of elements of the conical form when said form has been cut away, and are in reality points *A B C* and *D* of the true form on line *A 5.* The true form on line *A 5,* as shown at Fig 103, has been established in the same manner as shown in Fig. 102; however, in this instance, only one-half is shown, or that portion represented in plan, since the fitting is that commonly known as "on center." Those lines whose upper extremities are in points *1 2 3 4* and *5* connect points in the lines which were originally presumed to be in the base of the conical form. Broken or dotted lines must be employed as in practically all examples of triangulation.

TRIANGLES.

To determine the true length of lines presumed to be upon the surface of the object and now located in plan and elevation, triangles are constructed in the usual manner. The length of base for each triangle is found in the plan, and the perpendiculars are secured from the

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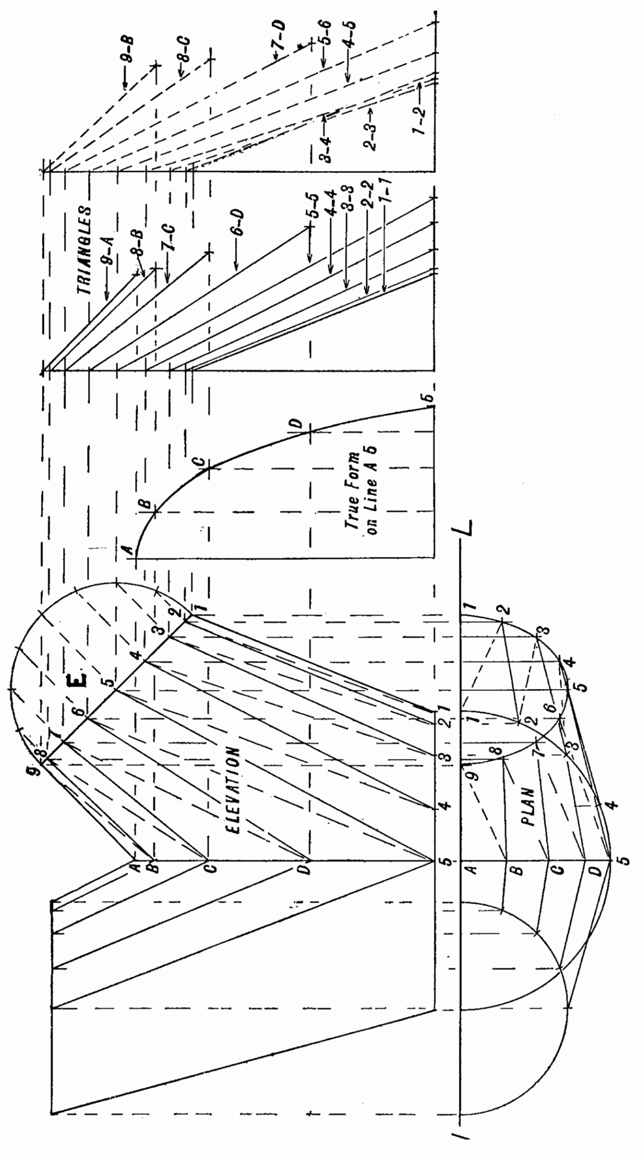

Fig. 103. *Semi-Plan, Elevation, and Diagram of Triangles.*

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elevation, as is clearly shown by the horizontal projectors.

The Pattern.

Having before us in the diagram of triangles Fig. 103, the true lengths of lines which are presumed to be upon the surface of the object, and previously located in plan and elevation, we may proceed to develop the pattern

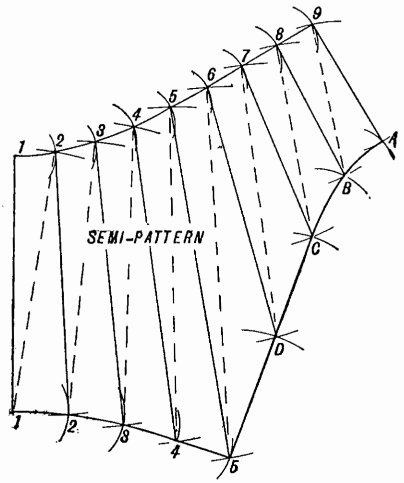

Fig. 104. *Semi-Pattern for One Prong of a Fitting as Shown at Fig.* 101.

somewhat as follows: In any convenient position upon the plane of development we draw a line whose length is equal to the length of line *1 1* of the elevation, or as found in the diagram of triangles and shown at *1 1* of the semi-pattern, Fig. 104. The distance between lines *1 1* and *2 2* at their extremities is the distance between points *1* and *2* of the large circle in plan for their lower extremities, and one space of the semi-circle *E* at their upper extremities. Therefore we set our compasses to a

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span equal to the distance from *1* to *2* of the large circle in plan, and from the lower extremity of line *1 1* of the pattern, describe a small arc as shown at *2*. With compasses set to a span equal to one space of the semi-circle *E*, place one point at the upper extremity of line *1 1* of the pattern and describe an arc as also shown. The upper and lower extremities of line *2 2* must then lie in some points of these arcs.

We note that the broken line *1 2* shown in plan and elevation connects point *1* at the base with point *2* at the top, and point *2* at the top is in some point of the small arc just drawn. Therefore we set our compasses to a span equal to the true length of line *1 2* found in the diagram of triangles, and describe a second small arc whose center is point *1* at the base of the pattern. In this manner we definitely locate the upper extremity of not only line *1 2*, but line *2 2* as well. The lower extremity of line *2 2* is in the small arc at the base of the pattern, therefore we draw a second arc whose radius is equal to the true length of line *2 2*, and whose center is point *2* at the top of the pattern. The point of intersection between those arcs as at point *2* at the base of the pattern must then be the lower extremity of line *2 2*.

By similar work and reasoning, we are enabled to locate lines upon the plane of development as shown in Fig. 104. The pattern cutter should not lose sight of the fact that the distances as *5 D*, *D C*, *C B* and *B A* shown at the pattern are in theory at least, secured from the true form on line *A 5*.

In practise a more accurate course to pursue is to secure these measurements from the pattern for the left hand prong, which we may presume to have been first developed. This, as will be noted, not only increases our accuracy, but enables us to develop the pattern for each

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prong without first finding the true form at the junction of the prongs.

It may be here remarked that as has been previously stated, a form could have been established for the junction of the prongs, and the pattern for each prong de-

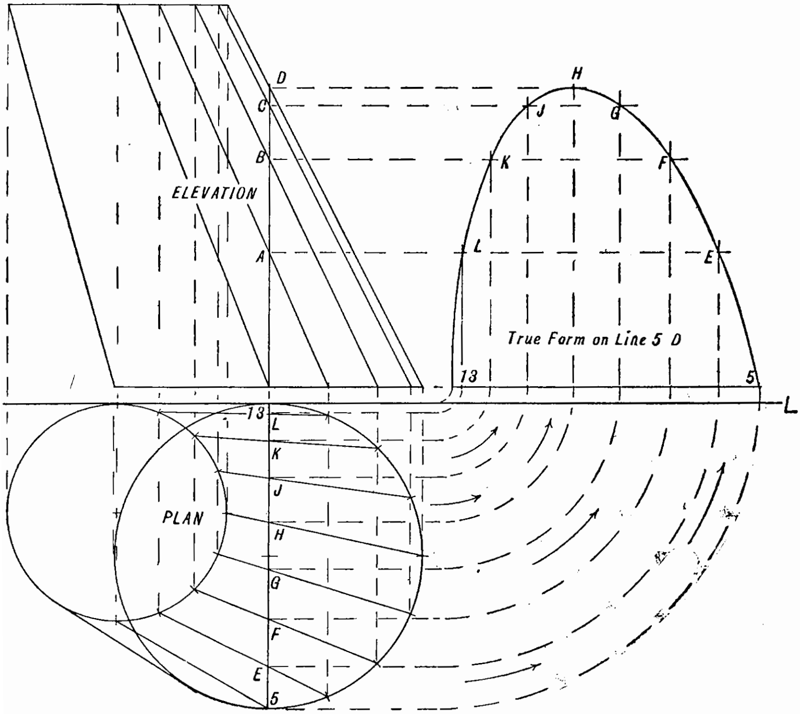

Fig. 105. *Plan, Elevation, and True Form of Section When It is Required That the Fitting Be "Flat on One Side."*

veloped in the same general manner as has been explained for the left hand prong. This is by no means a difficult operation, since the true form in this closely resembles a semi-ellipse whose major diameter is approximately double that of the minor. The author has noted very satisfactory results where this course has been

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pursued, although it is hardly to be recommended in every instance.

When It Is Required That the Fitting Be "Off Center" or "Flat on One Side."

When it is required that the fitting be "off center" or "flat on one side" the work of developing the pattern is increased, since the object can no longer be divided into equal parts, consequently the surface of the whole object must be developed. In this, as with many other examples, the principles involved are precisely the same; however, there is an increased number of lines to be dealt with, as was explained in the twenty-third chapter. The form of section, or the form at the junction of its prongs becomes far more difficult to approximate, and the methods here recommended are very likely to produce more satisfactory results than could be obtained by first establishing an arbitrary form for the junction of the prongs.

Fig. 105 shows the true form of section of the conical form when said form has been presumed to be cut by a plane represented in plan and elevation by line *5 D*. Here, as will be noted, the circles which represent the upper and lower extremities of the conical form in plan have been drawn tangent to the line *I L*, or a line which is parallel to it. This places one side of the fitting tangent to one plane, or "straight on one side."

It may be here remarked that no absolute rule is intended to be laid down for the development of the pattern for the branched fitting. On the other hand, principles and methods are pointed out which have in past years been found to be of service to those whose work is to design and develop the patterns for various forms of branched fittings.

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