CHAPTER XXII.

A Branched Fitting Commonly Known as "Breeches."

In some branches of sheet metal work, there is a constant demand for the branched fitting. As an introductory problem to satisfy this demand, we shall here

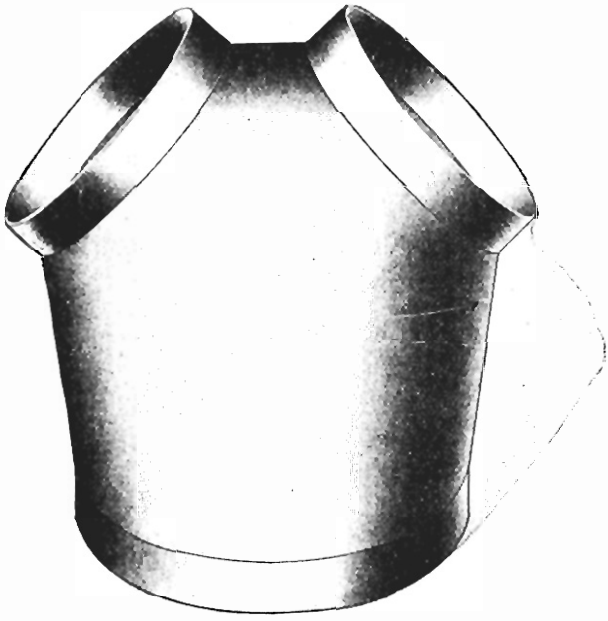

Fig. 92. Photographic View of the Fitting.

presume that the pattern is required for a fitting as shown in a pictorial way at Fig. 92. Said fitting is designed to make connection between a trunk line and two smaller branches. The axes of all to be in the same

plane, with the smaller pipes radiating from, or converging to the trunk line at an angle of 45 degrees.

This is a problem wherein the necessary diagrams may be curtailed to a considerable extent in developing the pattern. However, to place before the student the reason for, and the use of these curtailed diagrams, we shall first consider a complete plan and elevation.

A COMPLETE PLAN AND ELEVATION.

Having before us the required measurements, we may first draw a horizontal line as *A B*, Fig. 93, whose length is equal to the diameter of the large pipe. From the center point of this line as at *C*, erect a perpendicular as *C D*. Set off from *C* along line *C D*, a distance equal to the required length of the fitting as at *E*. Through the point *E* draw a horizontal line as *F G*. Upon line *F G*, and at each side of point *E*, set off one-half the required distance between the small collars as at points *F* and *G*. From points *F* and *G* draw lines as *F H* and *G J*, which are at an angle of 45 degrees to line *C D*. Set off distances along said lines equal to the diameter of small collars, as shown at *H* and *J*. Draw lines as *H A* and *J B* to complete a view which is in this instance, looked upon as an elevation, or a section of the fitting taken upon line *K M*.

When said diagram is looked upon as an elevation, a view of the fitting upon the horizontal plane is secured by first drawing a circle whose diameter is equal to the length of line *A B*, and in a position as shown, i.e., its center is in some point along the line *C D* produced.

Lines as *H F* and *G J* are looked upon as the edge view of circles whose diameters are equal to the diameter of the small pipes. As will be noted, said circles are per-

pendicular to the vertical plane, and at an angle to the horizontal, thus the representations of said circles upon the horizontal plane will be elliptical. To draw these forms in their correct relative positions, we draw semi-circles as shown, which are in reality semi-profiles of the round collars. Divide said semi-profiles into a convenient number of parts as shown, and project these points of division to lines *H F* and *G J*, as also shown. From points thus located along lines *H F* and *G J*, we drop vertical projectors to the horizontal plane.

From any convenient point along line *N M*, Fig. 93, we may draw a semi-circle whose diameter is equal to the diameters of the round collars, and divide said semi-circle into the same number of equal parts as the semi-profiles have been divided into. From said points of division we draw lines parallel to line *I L* as shown. Then will points secured in the intersections of these lines with the vertical projectors, be points in the plans of the openings to which the round collars are to be connected. As for example, if we look upon point *a* in the elevation as the end of a line which is perpendicular to the vertical plane, and whose length is equal to the length of line *b b* shown in the semi-circle *M*, the broken line *d d* in plan becomes a plan of that line. Since the positions of all other points which must be located in plan are secured by similar work and reasoning, the student should have little difficulty in comprehending, or drawing diagrams as shown at Fig. 93.

With the plan as shown at Fig. 93 before us, we note that said diagram is capable of being divided into four equal parts, i.e., by lines *K M* and *C N* produced. Thus we conclude that diagrams may be drawn to represent one-quarter, and measurements thus obtained duplicated for the three remaining parts.

From an analysis of the fitting derived from its plan and elevation, Fig. 93, we also conclude that there are two portions which closely resemble the conical form, and between these there are two flat triangular surfaces.

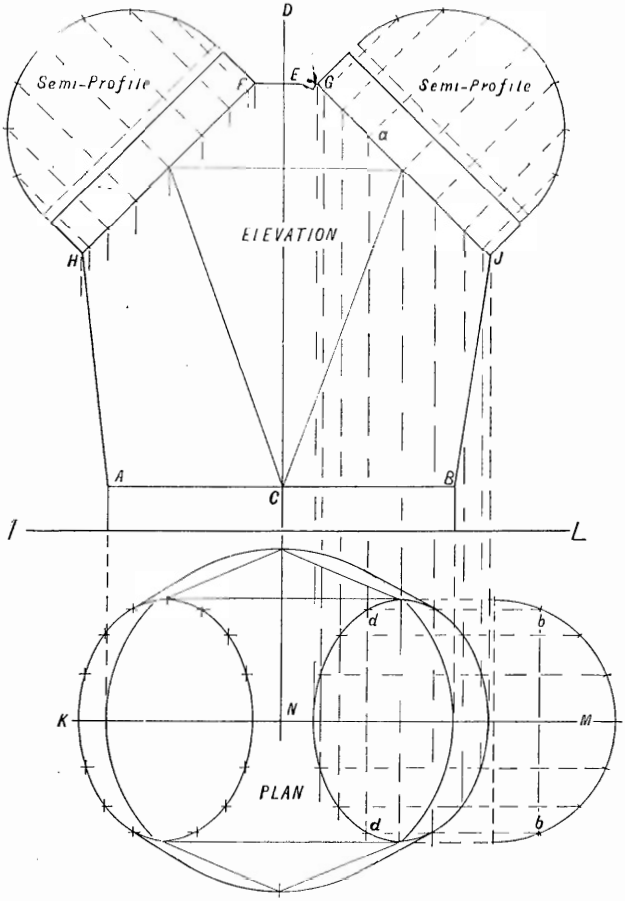

Fig. 93. The Branched Fitting Represented in Plan and Elevation.

The upper portion, or that to which the upper half of each collar is to be connected, is a form which when cut at the required angle, supplies a semi-circle as its section.

Since the lengths of lines presumed to be upon one-quarter of the fitting may be duplicated for the remaining three-quarters, we may, when the pattern is developed, curtail our diagrams as is shown in Fig. 94, i.e., it is only necessary to represent but one-quarter of the object in plan and elevation.

A Curtailed Plan and Elevation.

To draw a plan and elevation as shown at Fig. 94, we first draw the quarter circle in plan, to a diameter equal to the required diameter of the large collar. Through the point from which the quarter circle was drawn as at *X*, we draw a perpendicular line, and set off a length equal to the required length of the fitting, as *1 a*. From point *a*, draw the horizontal line *a c*, locating point *c* at a distance from *a* equal to one-half the required distance between the round collars. From a point *c*, draw a line at the required angle to *1 a*, as *c 5*. Locate the point *5* at a distance from *c* equal to the required diameter of the small collar. From the center point of line *c 5*, draw a semi-circle whose diameter is equal to the length of line *c 5* as shown. Divide said semi-circle into a number of equal parts, and project said points of division to the line *c 5*, as also shown at *2 3 4* and *b c d*.

From some point along the line *5 X*, draw a quarter circle whose diameter is equal to the required diameter of the small collars as at *Y*, and divide this arc into the same number of parts as was a similar arc shown in the semi-profile, as at points *2 3* and *4*. Draw indefinite horizontal lines through these points to intersect lines dropped from points *1 2 3 4* and *5* on the line *5 c*, then will these intersections be points in the line which is a plan of the fitting on line *1 5* of the elevation.

Divide the quarter circle in plan into the same number of parts as the arc *1 5* of the semi-profile has been divided into. Project said points of division to a horizontal line drawn through the lower extremity of line *A 1*, thus locating points as *1 2 3 4* and *5* at the base of the fitting in elevation. As will be noted, we have thus

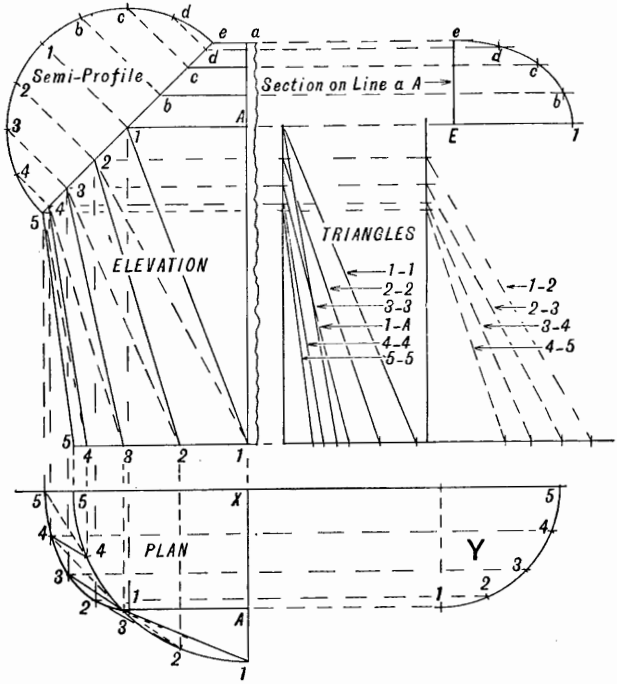

Fig. 94. Diagrams from Which the Pattern May Be Secured.

located lines in plan and elevation which may be presumed to be upon the surface of the fitting, and which we shall use to develop the pattern.

The plan and elevation before us supply the distances said lines are from each other; however, their lengths must be determined, therefore we construct a diagram of triangles as shown.

The method of constructing the diagram of triangles is substantially the same as with all examples in this branch of pattern development, and to those who have followed this work, it is but a simple operation. As a matter of fact it is folly for one to attempt the solution of a problem of this nature without having first acquired some understanding of the more simple examples.

As will be noted upon examination of Fig. 94, the elevation supplies the perpendicular hight for all triangles. For example, the triangle which must be constructed to secure the length of line *1 A* on line *1 A X* of the plan, has a base equal to the length of line *1 A* on the line *1 A X*, and a perpendicular equal to the length of the vertical line *A 1* of the elevation.

The base of a triangle from which we may secure the true length of line *1 1* shown in plan and elevation, is equal to the length of line *1 1* of the plan, with a perpendicular equal to the vertical distance between the extremities of that line shown in elevation, and so on for all lines presumed to be upon the surface of the fitting.

It must be remembered that the rectilinear elements as *1 1, 2 2, 3 3,* etc., are not sufficient to develop the pattern, therefore additional lines must be introduced, as shown in broken lines *1 2, 2 3, 3 4,* and *4 5,* and whose true lengths are also shown in the diagram of triangles.

To Develop the Pattern for the Irregular Portion

Having determined the true lengths of lines presumed to be upon the irregular portion of the fitting, and shown in plan and elevation, we may proceed to develop the semi-pattern for that part, when our line of reasoning may run somewhat as follows: Since we are to develop

a half pattern from the diagrams before us, we must duplicate practically all measurements found in those diagrams. Therefore we draw in any convenient position, a line, some portion of which is the line *1 A*, as shown at the vertical line *1 A*, Fig. 95. Having located a point as *1* at the base of the pattern to our satisfaction, we set off along that line a distance equal to the

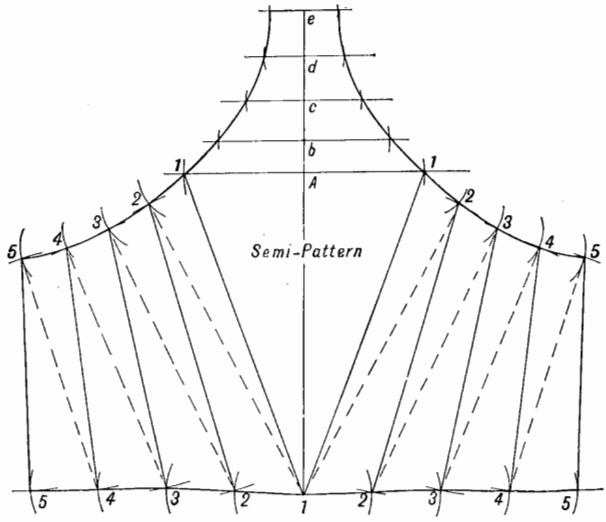

Fig. 95. Semi-Pattern for the Branched Fitting Shown at Fig. 92.

true length of line *1 A* found in the diagram of triangles, as shown at *A* of the pattern. This is a line which divides the flat triangular surface of the fitting into two equal parts.

Through point *A* of the pattern, we draw a line perpendicular to the first, making it of a length each side of *A* equal to the length of the horizontal line *1 A* of the elevation, as shown at *1 A 1* of the pattern, Fig. 95. To complete the boundaries of the flat triangular surface, we draw the lines *1 1* as shown.

The distance between lines *1* and *2* at the base of the fitting is found in the first division of the quarter circle in plan. Using this distance as radius, and with the point *1* at the base of the pattern as center, we draw two small arcs as shown. With compasses set to a span equal to the distance between points *1* and *2* of the semi-profile, we use the points *1* at the top of the pattern as centers and draw arcs, as also shown. With the length of line *1 2* found in the diagram of triangles, and with point *1* at the base of the pattern as center, describe small arcs cutting the first at the top of the pattern, as shown in points *2*. Then will point *2* be the upper extremity of the rectilinear element *2 2*. With the point *2* at the top of the pattern as center, and with the length of line *2 2* found in the diagram of triangles as radius, we draw arcs cutting the first at the base of the pattern, thereby locating the lower extremity of the rectilinear element *2 2* in its correct relative position.

To complete the pattern for the irregular or lower portion of the fitting as shown, is but a repetition of the work as explained above, using the length of each line shown in the diagram of triangles in rotation to locate said lines in their correct relative positions, remembering that the true distances between the lower extremities of said lines are secured from distances points of division are from each other in the quarter circle in plan which represents the large collar, and that the true distances between the upper extremities of said lines are secured from the semi-profile.

Fig. 96 will no doubt be of service in securing an understanding of this, since that Fig. shows in a pictorial way the semi-pattern formed to its required shape, with said lines upon its surface.

On the Portion of the Fitting Which May Be Looked Upon as a Parallel Form.

The portion of the fitting shown in Fig. 94 above the horizontal line *1 A*, is a parallel form whose cross-section or profile will show a semi-ellipse, or in this instance, i.e., in Fig. 94, where it is presumed that one-quarter of the fitting only is represented, said section will then be a quarter ellipse as shown at section on line *a A*. Therefore to develop this portion of the pattern, we may

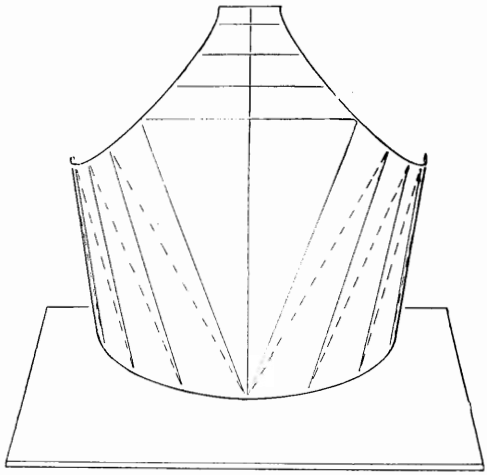

Fig. 96. Pictorial Representation of the Semi-Pattern When Bent to Its Required Form.

look upon the horizontal line *1 A* and lines above it, as *b c d* and *e*, as rectilinear elements of that surface, and in this instance, said elements are in their true lengths. If then we can determine the distance these elements are from each other, the development of that surface is but a simple matter. As will be noted, the section on line *a A* shows in points *1 b c d* and *e*, those distances. This section is drawn by projecting indefinite horizontal lines from points *1 b c d* and *e* as shown, and in any conven-

ient position erecting a perpendicular as *E e*. From the line *E e*, set off distances on the several lines as shown. As for example, the distance from line *E e* to *d* is that found between points *d* and *d* of the semi-profile, and so on for each line represented.

Presuming an understanding of this is secured, we may now complete the semi-pattern. That is, we draw lines parallel to line *1 A 1* of the pattern at a distance from each other equal to those distances found between similarly designated points in the section *a A*, and locate points upon said line each side of line *c A* of the pattern, at distances as found in the elevation, i.e., the length of the horizontal line shown in elevation whose left hand extremity is at point *b*, is set off each side of the pattern on the horizontal line which intersects point *b*.

By applying similar methods to the remaining lines shown in elevation, or those whose left hand extremities are in points *c d* and *e*, we are enabled to complete the semi-pattern as shown.

Some Variation May at Times Be Desirable.

It is by no means necessary that the pattern be developed precisely as here shown. In other words, we may if we wish, select other positions for the seams, or we may introduce more seams. For example, we may make the main body of the fitting in one piece, and that portion between the collars at the top as a separate piece, with seams on each side on a line as *1 A 1* of the pattern, or, we can if we wish, cut the whole from one piece.

Since lines which are presumed to be upon the surface of the fitting, and represented in plan and elevation are presumed to be right lines, we should at all times use care in their location. That is, their positions should be so taken as to allow said lines to be as nearly straight as

possible if placed upon the surface of the object. In this example, slightly more accuracy may be obtained by presuming the broken lines to connect points as *5* of the base to *4* of the top, and so on. However, some slight inaccuracy will usually appear in examples of this nature. On the other hand, we should not be too quick in assuming an error. Be sure your metal has been made to assume its intended form before judgment is passed.