CHAPTER XIII.

A Transitional Elbow from Round to Rectangular

The fitting illustrated at Fig 54, whose most common use is found in furnace work, supplies us with a comparatively simple example in pattern development. A fitting of this class may be modified in many ways and

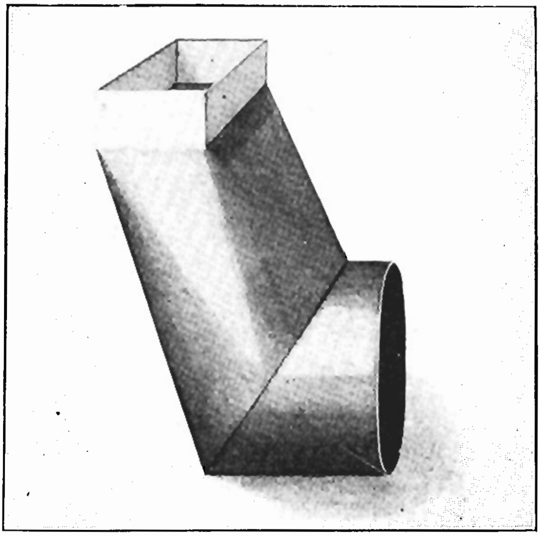

Fig. 54. Photographic View of a Transitional Elbow.

not materially alter the method of securing its pattern. For convenience, we shall presume it to be made to given dimensions, which may be verified by the use of the scale in Fig. 55.

We propose to secure the pattern for a fitting which will make a right angled connection between a round and a rectangular pipe, whose dimensions are as follows: Diameter of round pipe 15 inches, cross sectional dimensions of the rectangular pipe of 6 x 24 inches. Their relative positions are shown in the elevation Fig. 55, since the line *A B* of that view is the edge view of the lower extremity of the rectangular pipe, and that portion included within the lines *1 9, 9 a, a b,* and *b 1* represents one extremity of the round pipe. It will be noted that the round pipe is here shown to be cut oblique to its axis, and to this the irregular portion of the fitting is connected.

The Irregular Portion.

The irregular portion, with which we are chiefly concerned, becomes a form making a transition from elliptical to rectangular, the ends of which are not parallel. This presents a problem which is not unlike some previously explained; however, if we attempt to follow those methods it will be difficult to determine the exact form and size of the elliptical end. This can be accomplished theoretically, but in practice it is somewhat difficult to work with the accuracy demanded when the irregular portion is to be seamed to the round collar. Other methods than those previously shown will give more accurate results in practice, and are illustrated and explained in this demonstration.

Plan and Elevation.

The most simple diagram which will represent the object shown at Fig. 54 is a section, and shown as an elevation in Fig. 55. At least two views are necessary to enable us to secure the true lengths of lines presumed to be upon the surface of the object, therefore the next work will be to draw the second view, which is a semi-plan. Since the object is composed of two equal but opposite halves, it is only necessary to represent one-half in plan.

To secure this semi-plan, we let fall perpendicular lines from points *A* and *B* of the elevation, and make them 12 inches in length from *I L,* as shown at *X A* and *Y B.* Upon drawing the line *A B* as shown, the semi-plan of the rectangular pipe in its assumed position is completed.

That portion of the elevation included within the lines *9 1, 1 b, b a,* and *a 9* represents a round collar which has been cut obliquely, and to secure a plan of this it will be most convenient to locate a number of elements upon its surface. Therefore in any suitable position to the right of line *G L,* draw a semi-circle whose diameter is 15 inches. This constitutes a profile, or an end view of the round collar upon a profile plane, of which *G L* is the intersecting line between it and the primitive vertical plane.

Divide the semi-circle into a number of equal parts as shown. From said points of division right lines are drawn parallel to line *I L* to intersect the miter line *1 9.* These points of intersection upon the miter line, as at *1, 2, 3, 4,* etc., are now looked upon as the end elevations of lines which are perpendicular to the vertical plane of projection; therefore their plans will be found in lines let fall from said points at right angles to *I L,* as shown. The lengths of these lines are found in the distances similarly numbered points of the semi-circle are from the line *G L.* These lengths are set off from the line *I L* in plan, as also shown. This, as will be noted, locates points through which the curved line is traced to complete a semi-plan of the oblique end of the round collar.

Points located as above described may now be connected by lines to points *A* and *B* as shown, to supply

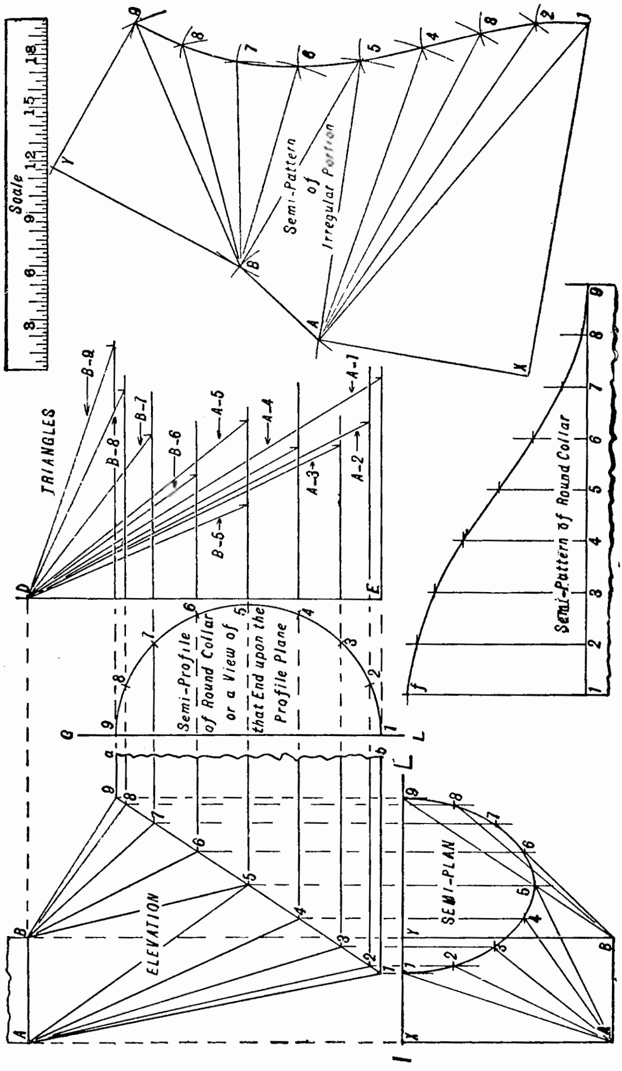

Fig. 55. *Plan, Elevation and Semi-pattern for a Transition Elbow.*

the plans of lines presumed to be upon the surface of the object, and utilized as measuring lines to be transferred to the plane of development, although their true lengths must yet be determined. The elevations of lines whose plans are shown at *A 1, A 2, A 3, A 4, A 5, B 5, B 6, B 7, B 8* and *B 9* of the semi-plan, Fig. 55, are secured by drawing lines from points *2* to *5* inclusive to *A,* and from *5* to *8* inclusive to *B,* as shown in the elevation.

TRUE LENGTHS OF LINES.

The true lengths of these lines are secured by the use of the right angled triangle, as shown in the diagram of triangles, where the line *D E* is used as the perpendicular for all, with a common vertex at *D*. The horizontal lines of the elevation, as *1 1, 2 2, 3 3,* etc., represent the hight of the lower extremities of these lines—i. e., the lower extremity of line *A 2* is at point *2* of the elevation, and so on for all lines shown.

The vertical distance from those lines to line *B D* is the perpendicular hight of each triangle, and the lengths of these lines in plan is the base of each triangle, as will be clearly shown if the reader, by the use of his compasses, will compare measurements.

Having determined the true lengths of lines shown in plan and elevation, we may proceed to transfer these lengths to the plane of development in the process of securing the pattern.

TO DEVELOP THE PATTERN.

There is shown in plan at *A X 1* a triangular surface whose edge elevation is the line *A 1* of that view. Since the line *X 1* is parallel to *I L,* its true length is *A 1* of the elevation, and this length is transferred to line *X 1* of the semi-pattern. From point *X* of the semi-pattern draw a line perpendicular to *X 1,* and set off a distance from *X* equal to the length of line *A X* of the semi-plan, as shown at *A* of the semi-pattern. Upon drawing the line *A 1,* the true form of the triangular surface has been placed upon the plane of development.

It may be well to here explain that where right triangular surfaces are shown in plan, those triangles will be right angled in their true form; therefore we may transfer them to the plane of development in the manner as above explained, or employ our compasses to transfer the length of each of the lines of which the triangle is composed. The author has made a practice of employing his compasses to transfer the lengths of lines. If the resulting triangle is right angled, a portion of his work is proven.

Upon examination we find five lines radiating from point *A* of the plan or elevation, Fig. 55, whose true lengths are shown in the diagram of triangles. Therefore we may use these lengths as radii, and with point *A* of the pattern as center to describe small arcs as shown at *2, 3, 4* and *5* of the semi-pattern of the irregular portion. Since the distances between the lower extremities of these lines are not shown in plan and elevation, they must be determined. As has been previously stated, this can be done approximately by securing the true form of the oblique section of the round pipe, and will be explained below. For the present we shall pursue the more accurate and simple method of first developing the pattern for the round collar. As this may be looked upon as the pattern for one section of an elbow in round pipe, the miter line of which has been located, it is not an example in triangulation.

The same elements are employed to secure this pattern as are shown in elevation, therefore the lower extremities of lines whose true lengths are shown in the diagram of triangles must intersect these elements of the cylinder at the miter cut. This being understood, the reader will realize that the distance between lines as *A 1, A 2, A 3,* etc., at the lower extremity of the irregular portion, must be the same as shown between similarly designated elements upon the miter cut of the round collar. Therefore

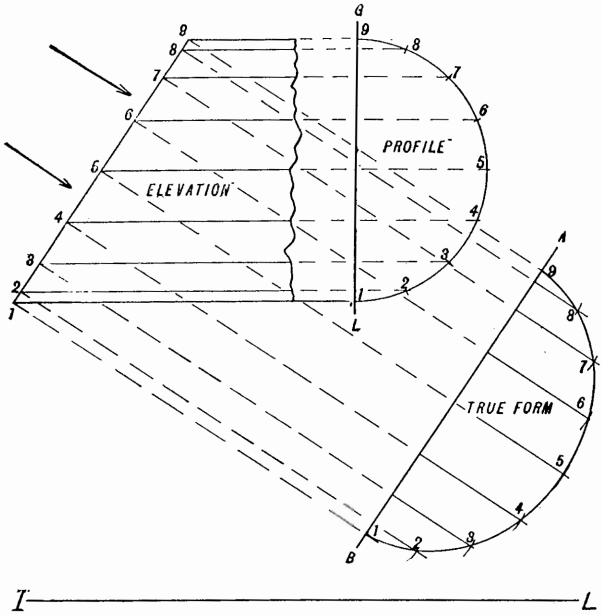

Fig. 56. *Diagram Employed to Secure the True Form of the Oblique Section of a Cylinder.*

we use these distances in rotation, beginning at *f* to describe additional small arcs, as shown at *2, 3, 4* and *5* of the pattern for the irregular portion. Having located points *A* and *5*, or line *A 5* of the pattern, we may add the triangular surface shown in plan and elevation at *A 5 B.*

The line *A B* is in its true length in either plan or elevation; therefore we may set our compasses to a span equal to the length of line *A B* of the elevation, and placing one point at *A* of the pattern, describe the small arc shown at *B*. From the diagram of triangles we secure the true length of line *5 B*, which we use as radius, with point *5* of the pattern as center, to draw the second small arc as also shown at *B*.

There are five lines radiating from point *B* in elevation, whose positions may be located upon the plane of development in the same general manner as was explained for those radiating from point *A*. Presuming the extremities of line *B 9* to have been located, the remaining triangular surface, *B Y 9* may be added, since from the plan we secure the true length of line *B Y*, and in the elevation the true length of line *Y 9* is found in line *B 9*.

It is by no means necessary that the semi-circle or profile shall be divided into the number of parts shown in this demonstration. Divide the profile into any equal number of parts desired. More parts will increase the work, and increase the accuracy to some extent.

Form of the Round Collar at the Mitered End.

The true form of the oblique section of a cylinder is an ellipse,* the minor diameter of which is equal to the diameter of the cylinder. The major diameter is dependent upon the length of the miter line, when it can be looked upon as the edge view of a plane which has cut said cylinder. Therefore, in this instance, the true form of the round collar at the miter cut is an ellipse whose

* No part of a true ellipse is a part of a circle, therefore any method which involves arcs drawn from centers will not produce a true ellipse. Approximate ellipses drawn in this manner are sometimes known as false ellipses, and in some instances are found to be sufficiently accurate.

minor diameter is 15 inches, and whose major diameter is approximately 18 inches, and can be drawn by any method which secures a true ellipse.

Perhaps the most desirable course to pursue is to secure this ellipse by projection as follows: Draw the side elevation of the cylinder as shown in Fig. 56. Draw a semi-circle whose diameter is equal to that of the cylinder as shown in the profile. Draw a line as *A B*, parallel to the miter line.

We now have what may be looked upon as the side elevation of one half of the cylinder, showing the miter line, and drawn upon the primitive vertical plane. To the right of the elevation is the profile plane, with the line *G L* as the intersecting line between this and the primitive vertical plane. To the right and below, the true form is shown upon an oblique supplementary plane, which is also perpendicular to the primitive vertical plane. This is a projection of that portion of the cylinder represented in elevation by line *1 9* upon a plane parallel to it, when viewed as indicated by arrows.

The semi-circle shown as a profile is divided into a number of equal parts, and from these points of division lines are drawn parallel to *I L* to intersect the miter line. From points thus secured as *1, 2, 3,* etc., upon the miter line, project lines perpendicular to *A B* as shown. From the intersections of these lines with *A B,* set off distances as found from line *G L* to similarly numbered points of the semi-circle, thereby securing points through which the curve of the ellipse may be traced.

The distances between points of the ellipse are substantially the same as found by the more simple method of first determining said distances by developing the pattern for the round collar. We can, if we choose, use that form for the base, and develop the pattern in the same general manner as was explained in Chapter XI. However, this process will be found to be more complicated, and less accurate in pattern problems of this class.