

CHAPTER XIV

ELBOWS

An illustration of a four-piece 90° elbow, which is used universally in heating and ventilating work, is shown in Figure 126. Elbows of this form, having a small radius in the inner curve or throat, are commonly made use of in stovepipe work, furnace work, and in duct work where

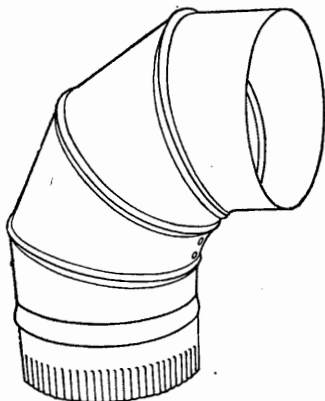


Figure 126.—Four-piece 90° Elbow.

a blast is not used. Elbows having a large radius in the throat are generally used for making turns in grain conveyers, exhaust and blow-piping work. In projects of this kind an elbow having a short radius should never be used if it can be avoided.

The drawings shown in Figure 127 contain all the necessary details for development of the patterns for elbows at any angle, having any number of pieces. The work-

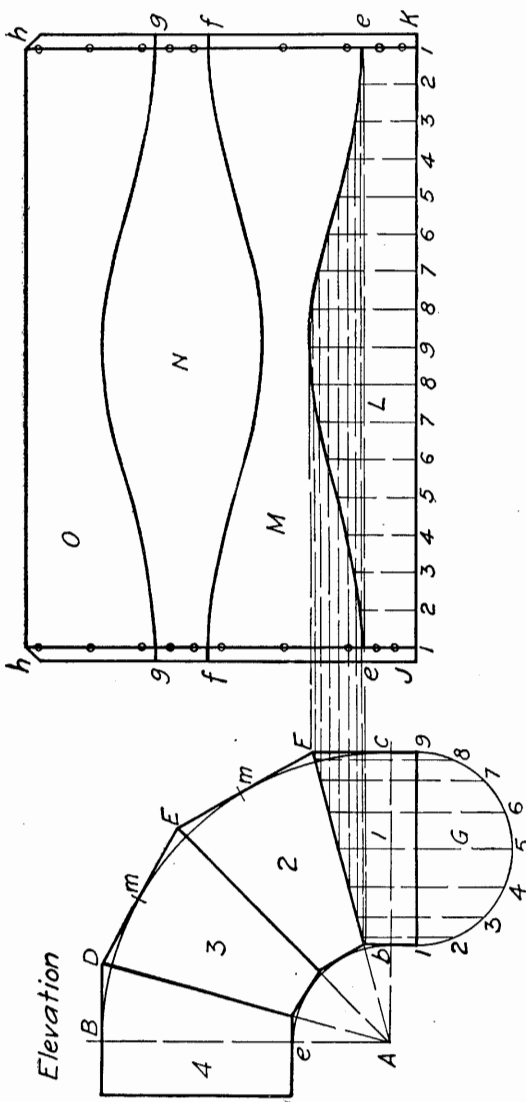


Figure 127.—Patterns for Four-piece 90° Elbow of 5 Inches Diameter.

man should follow the instructions carefully, and memorize the construction of the problem.

Four-Piece 90° Elbow.—Figure 127 shows the method of obtaining the patterns for a four-piece 90° elbow having a diameter of 5 inches; the length of the radius for the inner curve of the elbow being 3 inches. First draw the right angle shown by the dotted line BAC . Next, on the line AC lay off a distance of 3 inches from A to B . With A as center and Ab as radius, describe the quarter circle be , which gives the required curve for the throat. Make bC equal 5 inches, the diameter of the elbow, and with AC as the radius and A as center describe the outer arc BC .

The joint lines of the elbow, shown by DEF , are found by dividing the outer arc BC into equal parts one less in number than the pieces required in the elbow; in this case into three spaces, shown by Bm , mm , and mC . Each of these spaces is bisected, and lines drawn from these points to the apex A will represent the joint or miter lines of the elbow. The outline of the different pieces of the elbow is now completed by drawing lines tangent to the arcs eb and BC , as shown in the drawing.

The above method can be used in obtaining the miter line for an elbow of any angle or of any desired number of pieces. After the elevation has been completed, draw the half section G , and divide it into a number of equal spaces, as shown by the figures 1 to 9. From these points draw vertical lines intersecting the miter line AF in the elevation.

The pattern for the first section of the elbow is developed by drawing the horizontal line JK , upon which place the stretch-out of twice the number of spaces contained in the half section G . From these points on the stretch-out line draw vertical lines, which intersect lines drawn from similar numbered points on the miter line AF in the elevation. Through the points thus obtained, the irregu-

lar curve of the pattern may be traced, as shown by *eLe*, which completes the pattern for piece No. 1 of the elbow. This irregular curve is the only one needed, and is used in laying out the patterns for the entire elbow.

The patterns for the sections numbered 2, 3 and 4 are

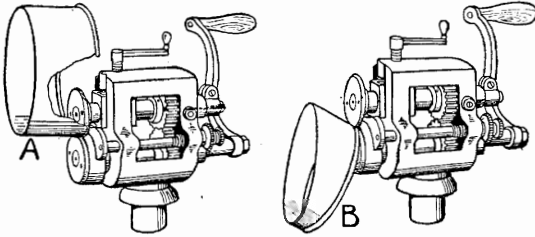


Figure 128.—Bench Elbow Edging Machine.

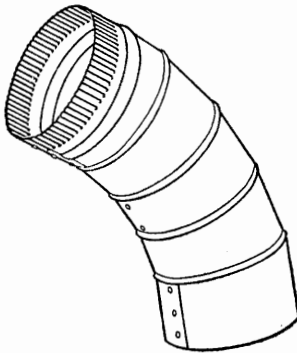


Figure 129.—Five-piece 60° Elbow.

usually laid out directly on the metal, in the following manner: A piece of metal equal in length to the stretch-out of the pattern is provided, and pattern *L* is transferred to the metal by the usual method of pricking, as described in Chapter I. Next, take the length of the wide side of section 2, as shown by *EF* in the elevation,

and mark this dimension on each end of the metal, as shown by *ef*. Then take the throat width or short side of piece No. 3, and place it as shown by *fg*. The length of the long side or top of piece No. 4 is placed on the metal, as shown by *gh*.

Pattern *L* is now cut from the metal, after which the metal pattern is turned over and the curved edge placed on the points *ff*. The irregular curve of the pattern is scribed on the metal by means of the scratch awl, which completes the pattern for piece No. 2, shown at *M*.

The patterns for pieces Nos. 3 and 4 are completed by placing the curved edge of pattern *L* on the points *gg*; then scribe the irregular curve on the metal, and connect the points *hh* with a straight line, completing the patterns *N* and *O*.

This method of grouping the patterns places the seams opposite each other, and allows the patterns to be cut from a rectangular piece of metal without waste of material.

The patterns are now cut from the sheet, corners notched, rivet holes punched, formed in the forming machine (Figures 24, 25) and riveted on the mandrel stake; after which the edges for seaming the pieces together are turned on the elbow edging machine (Figure 128).

Five-Piece 60° Elbow.—Figure 129 shows a finished five-piece elbow with an angle of 60°, such as would be used in ventilating and blow-pipe work, where it is desired to reduce the friction to the lowest possible amount by constructing an elbow having a long length of throat.

In Figure 130 is shown the elevation of a 5-piece 60° elbow, the inner curve or throat being described with an 8-inch radius. This problem is introduced in order to give practice in developing the patterns for elbows at other than a right angle.

First, draw the required angle *BAC*. Next, on the line *AC*, measure off a distance of 8 inches from *A* to *D*, which

is the required radius for the throat curve of the elbow. With A as center, describe the arc DE . Make DC equal 5 inches, and with AC as radius describe the outer arc CB ,

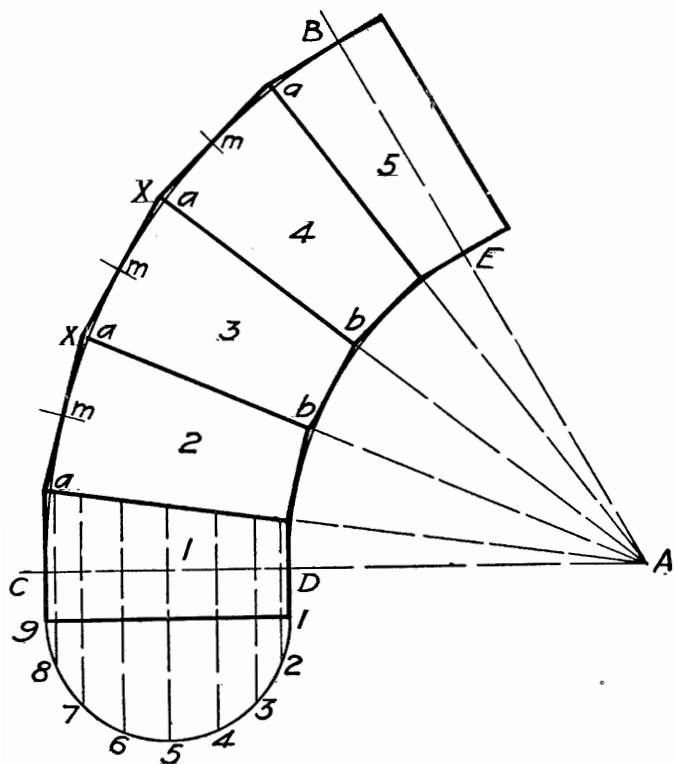


Figure 130.—Elevation of Five-piece 60° Elbow.

which is divided into four equal spaces, one less in number than the pieces in the elbow. These spaces are shown by Bm , mm , and mc in the drawing. Each of these spaces is bisected as shown at a , a , a , a , and lines drawn

from these points to the apex *A* will give the required miter line for each section of the elbow.

Complete the elevation, and develop the pattern for piece No. 1. The development is not shown on the drawing, as the work would be simply a repetition of the operations described in laying out the patterns for the four-piece 90° elbow shown in Figure 127.

The end pieces, Nos. 1 and 5, may be made any length at the pleasure of the workman, but the length of the heel and throat of the middle sections 2, 3, and 4, should be taken from the elevation. These dimensions are shown by *xx* and *bb* in section No. 3, and cannot be changed when once the arc *DE*, representing the inner curve of the elbow, has been described on the drawing.

DUCT ELBOWS

Square or rectangular piping, or duct work, has become a very important part of the sheet metal trade, and is

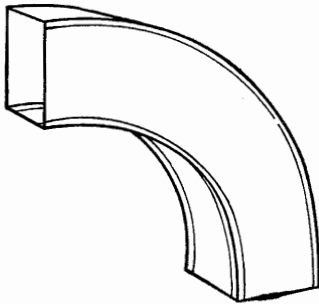


Figure 131.—Rectangular Duct 90° Elbow.

largely used in the installation of heating and ventilating systems. A curved elbow, of the style generally used in this class of work, is shown in Figure 131. These elbows

are made in four pieces, consisting of the two sides, the heel, and the throat. The heel is the outer and the throat the inner curve.

When laying out the patterns for duct elbows of this kind, the radius for describing the inner curve or throat should be equal to the width of the duct. The pieces are usually joined together by riveting or double seaming the corners by means of the double-seaming stakes or "hand dollies."

This problem is presented to give practice in the construction of a duct elbow, and to describe an easy and quick method for seaming the corners of elbows and square or rectangular pipes by the method commonly known in the trade as "the Pittsburgh seam."

Rectangular Duct 90° Elbow.—In Figure 132 is shown the method of laying out the patterns for a 90° rectangular elbow, in which the turn is made on the short side of the pipe. Draw the elevation *A* and profile *B* according to the dimensions given on the drawing. First draw the right angle shown by *1-a-8*. With *a* as center and *a7* as radius, describe the quarter circle *1-7*, which represents the inner curve or throat of the elbow. Next make *7-8* equal the narrow side of the elbow, and with *a* as center and *a8* as radius describe the arc *1-8*. This is the outer curve, or the heel; the straight parts shown by *x1* and *y8* are added to the quadrant to make an easy connection with a straight duct. An allowance of $\frac{1}{4}$ inch, as shown by the dotted lines, is now added to the heel and throat for seaming; then the elevation *A* will also be a pattern for the two sides of the elbow.

The patterns for the heel and throat shown at *C* and *D*, are simply rectangular pieces of metal equal in length to the stretch-outs shown by *xY* in the elevation. The width is equal to the wide side of the elbow, to which 1 inch has been added on each side for seaming, as shown by *abc* in pattern *D*, making *ab* equal $\frac{3}{8}$ inch and *bc* $\frac{5}{8}$ inch.

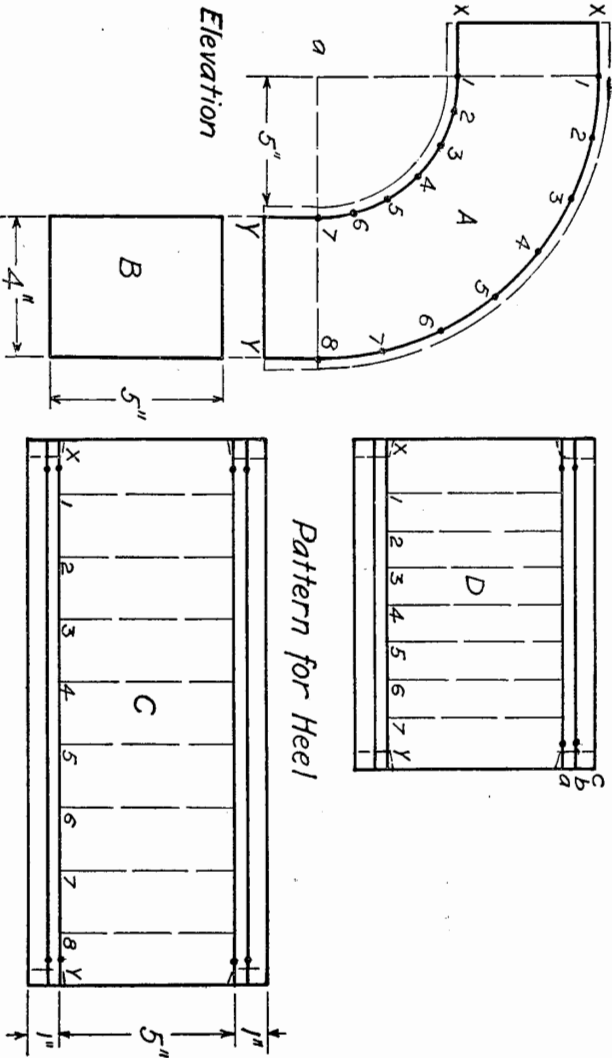


Figure 132.—Layout of Patterns for a 90° Rectangular Elbow.

Prick marks are made at these points for bending purposes, as shown by dots on each end of the patterns.

"*The Pittsburgh Seam.*"—In Figure 133 is shown the method of bending the edges of the patterns for seaming. The operations are performed on the cornice brake and

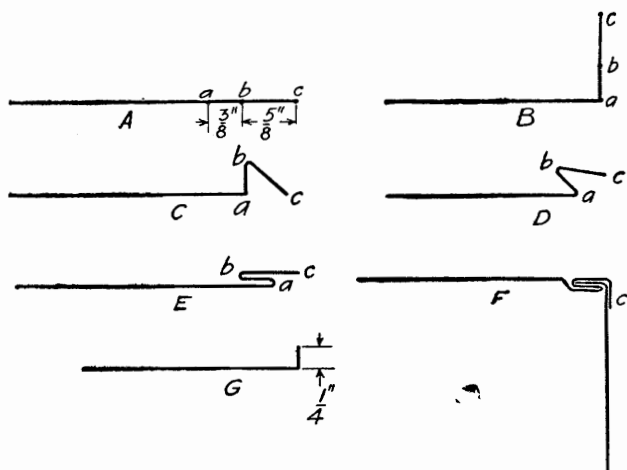


Figure 133.—Progressive Operations of Bending Edges to Form "the Pittsburgh Seam" on the Cornice Brake.

the various bends are shown by the letters *abc*, in the diagram at A.

The first operation is shown at B. Insert the sheet in the brake and bring down the upper clamp on the prick mark shown at *a*, then raise the lower bending leaf, bringing the metal up to a right angle, as shown at B. The sheet is now turned over, the edge placed in the brake, and the upper clamp closed down on the prick mark *b*; raise the bending leaf as far as it will go, which will bend the metal in the position shown at C. Now place the sheet in the brake once more on the point *a*, and bend it

up as far as it will go, as shown at *D*. Place a strip of metal between *a* and *c*, and bring down the upper clamp, pressing the bends together closely. The strip of metal is removed and the edge of the sheet will appear as shown at *E*. The $\frac{1}{4}$ -inch edges are now turned at a right angle on the sides of the elbow, as indicated at *G*.

The patterns for the heel and throat are given the required curve in the forming rolls, and during the operation a strip of metal is again placed between bends *a* and *c*, so that the pressure of the rolls will not close the opening between the bends. The parts are assembled by inserting the $\frac{1}{4}$ -inch edge of the side pattern into the pocket edge of the throat and heel. The projecting edge *c* shown at *E*, is then hammered over, which completes the seam as shown at *F*. This seam, known as "the Pittsburgh seam," is used in the sheet metal trade to good advantage for various purposes. It is easily constructed and makes a tight, rigid joint.