CHAPTER III.

TEE-PIECES FOR ROUND PIPES.

Square Tee-Piece.

It is sometimes necessary for sheet and plate metal workers to make what is known as tee-pipes or elbows; the patterns, therefore, of a few examples in round pipes of this kind of work will be given. The pattern for a right-angle tee-piece, both pipes being of the same diameter, is shown set out in Fig. 8. An end elevation of the top pipe is drawn first, and the quarter-circle divided into three equal parts. Lines are now drawn through each point parallel to the centre line and down to the base line. The girth of pipe is set along 0 0, lines run up and cut off equal in length to the lines in elevation drawn from base line to corresponding number. The hole is marked out by making line 33 equal to half-

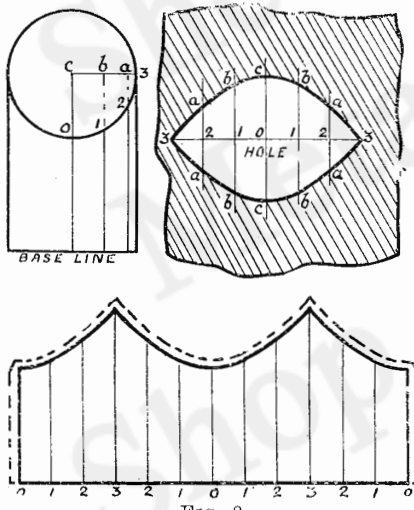


FIG. 8.

circumference of pipe, lines being drawn across through each of the five intermediate points, and cut off equal in length to the lines with the same number and letter in elevation. Thus *a* 2 in pattern will be the same length as line *a* 2 in quarter-circle. Care must be taken that the hole is marked in its proper position on the sheet or plate for top pipe. The line *c c* should be on the longitudinal centre line of plate.

The construction lines for obtaining the pattern by a more practically useful method are set out in Fig. 9. This is a most important case, and on account of the peculiar results obtained should be carefully studied. No elevation is needed, the view shown simply being drawn to exhibit the shape of the tee-pipe. A quarter-circle of same radius as pipes is set out first, and then divided into three equal parts in the same manner as before-mentioned. Line 0 0 is drawn equal in length to the girth of the pipe, divided into twelve equal parts, and then numbered as on pattern. Through each point perpendicular lines are run up, and these are cut off the proper length by drawing lines through 1, 2, and 3 on quarter-circle parallel to line 0 0. Thus the

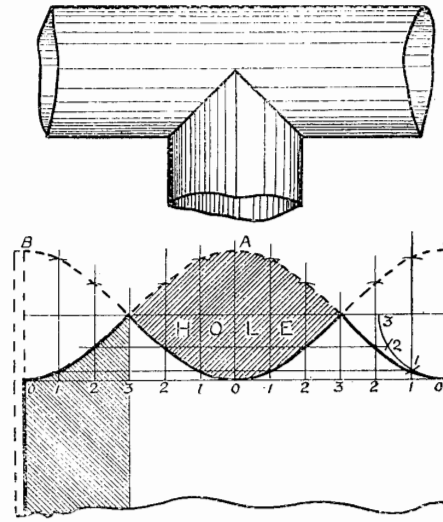


FIG. 9.

point of intersection of line through 1 on quarter-circle with the line drawn up from 1 on girth line will be a point on curve of pattern. In the same way the other points will be obtained.

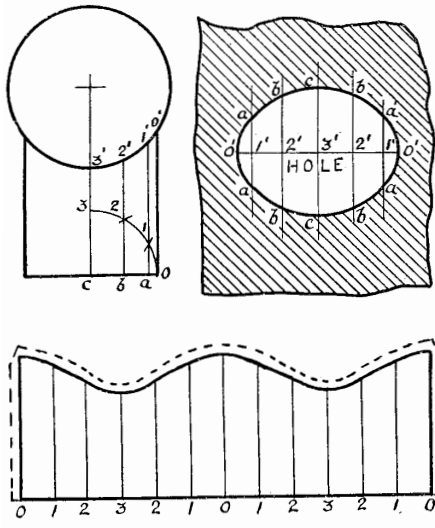


FIG. 10.

It will be noticed that the cut on pattern to form the joint is made up of four equal curves: hence in workshop practice all that is necessary to mark out is a template containing one of the curves, such as the shaded part shown at the left of pattern. This simple template can be used in a variety of ways. The pattern for the pipe can be set out by using it four times, marking the curve, and then reversing. The hole on top pipe can be drawn out in a similar manner, as will be seen by the four curves that form the hole at top of pattern. The template can also be used for setting out the patterns for a square elbow, the curve B 0 B showing the pattern for seam at back, and the curve 0 A 0 for seam at throat. Laps can be added on to the net patterns according to the method of joining adopted.

Tee-Piece with Unequal Pipes.

In the development of the patterns for tee-piece in which the branch pipe is smaller than the main (Fig. 10), the

method pursued is the same as with Fig. 8. It will be observed that this pattern is also formed of four equal curves, and consequently in large work the setting-out of

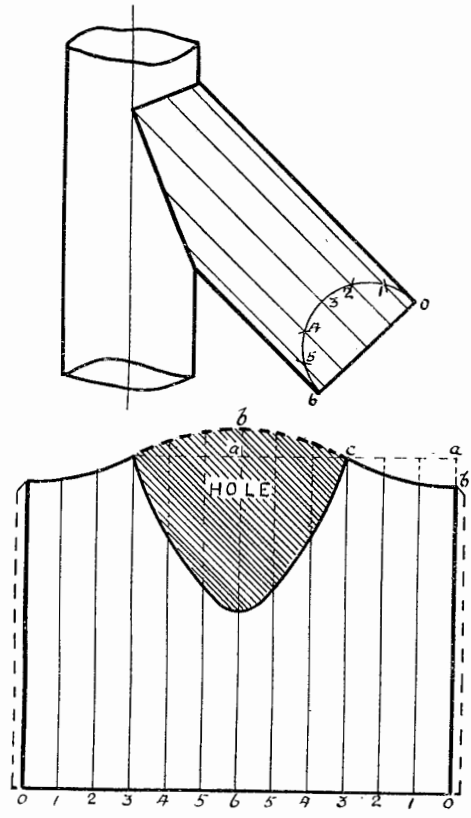


FIG. 11.

one-quarter of the pattern will be sufficient for practical purposes. In marking out the hole the lengths 0 1, etc.,

are taken from the corresponding lengths around the main pipe, and the widths at the same points from the quarter-circle on branch pipe. A test as to the accuracy of working can be applied when it is remembered that the girth around the hole should be the same as the length of curve on pattern.

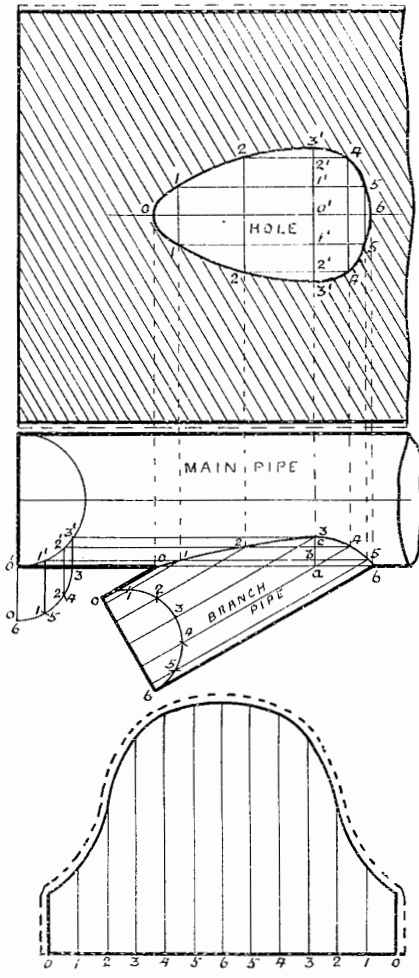


FIG. 12.

Oblique Tee-Pipe.

For an oblique tee-pipe (Fig. 11), in which both pipes are the same diameter, the elevation of the two pipes is set out to the required angle, and the pattern marked out in the usual manner. The shape of the hole can be obtained as in Fig. 8, or scribed directly from the pattern, the curve at top of hole being the same as the curve from *b* to *c* on pattern, and the

heights a b being equal. The two halves of pattern are exactly the same, and after what has been said with regard to Fig. 9, the mechanic with an ingenious turn of mind will probably be able to see how the two curves on half of pattern can be used to set out an obtuse elbow and an acute elbow at the same angles at which the centre lines of the two pipes meet.

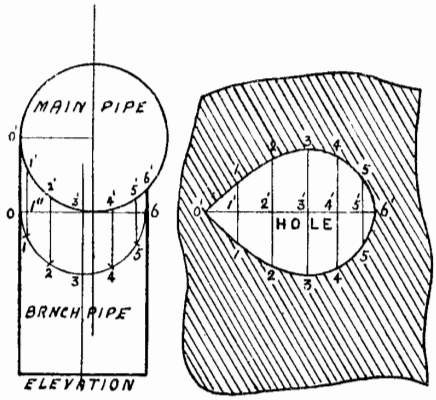
Oblique Tee-Piece for Unequal Pipes.

Where a junction of two pipes of unequal diameter is formed, as in Fig. 12, it will be necessary first of all to obtain an elevation of the joint line, or of points upon the same. This can be done by drawing a semicircle on the main pipe and on the bottom line of this pipe a quarter-circle of radius, equal to half the diameter of branch pipe. The quarter-circle is divided into three equal parts, and lines drawn up to cut the semicircle in $0'$, $1'$, $2'$, and $3'$. Lines are drawn up through these points parallel to the centre line of the top pipe, and where they intersect with the lines drawn through the corresponding points on the semicircle on branch pipe will give points on the joint curve. Great care should be exercised to obtain these points correctly, as the accuracy of the patterns depend upon the lines on the branch pipe being cut off to their proper lengths. In setting out the pattern for branch pipe the girth is, as usual, measured along 0 0, lines drawn up from all the points, and distances marked up these lines equal in length to the line with the same number on branch pipe in elevation.

To mark out the shape of the hole is somewhat more difficult than in the previous cases. Drop a perpendicular line from 3 on joint line to the bottom line of pipe. This in elevation is denoted by $3\ a$. To obtain points on curve of hole draw any line down the paper, and mark a point on it $0'$. Set above and below this point the distance $0'\ 1'$, obtained by measuring along between $0'\ 1'$ on the semicircle on main pipe in elevation. In the same way set along the

lengths 1′ 2′ and 2′ 3′. Lines at right angles to the line 3′ 3′ are now drawn through these points, and the corresponding lengths measured on each side of 3 *a* in the elevation marked along. Thus 0′ 0 will equal *a* 0 and 0′ 6 equal *a* 6, 1′ 1 will be the same as *b* 1 and 1′ 5 as *b* 5. In the same way, 2′ 2 and 2′ 4 will respectively equal *c* 2 and *c* 4. The points found will, of course, now be joined up with an even-flowing curve, and the shape of the hole is completed.

Facility in marking out the shapes of holes should be acquired by every sheet and plate metal worker, as it will save endless cutting, chiselling, and filing after the plate or sheet is bent into shape.



Nothing has been said so far as to any allowance that should be made for the thickness of sheet or plate; but this will be dealt with in later chapters.

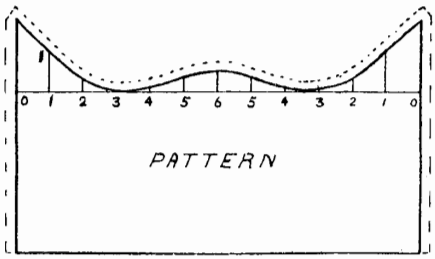


FIG. 13.

Offside Tee-Piece.

When a branch pipe which is smaller than, and square to, a main pipe, and is also required to fit flush on the back of the main pipe (say, to lie against a wall), then its pattern will be obtained as shown in Fig. 13.

The necessary lines for the hole and pattern are obtained by marking out an end elevation of the two pipes, as seen on Fig. 13. A line 0 6 to touch the main pipe is now drawn, and upon it a semicircle described, this latter being divided into six equal parts, and perpendiculars run up through the division points to meet the main pipe. The girth line 0 0 of the pattern is made equal in length to the circumference of the branch pipe, divided into twelve equal parts, and lines square to it run up through each division point. These perpendicular lines are now cut off equal to the same numbered line measured from the line 0 6 up to the main pipe circle in the elevation. Thus, for instance, the line 1, 1, on the pattern will be the same length as 1″ to 1′ in the elevation, and so with all the other heights.

The shape of hole in the main pipe can be marked out by drawing a line, 0′ 6′, made up of the lengths of the arcs 0′ 1′, 1′ 2′, etc., from the main pipe circle, drawing perpendiculars through each point, and cutting these off above and below the line 0′ 6′, equal to the similarly numbered line on the semicircle in the elevation. Thus, to give an example, the line 1′ 1 on the hole will be made the same length as the line 1″ 1 on the semicircle in the elevation, and so on for all the other lines.

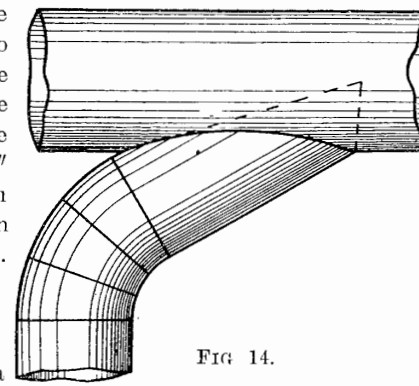


FIG 14.

Offside Oblique Tee-Piece.

That the flow of a fluid from a branch pipe into a main pipe may meet with as little resistance as possible, a branch pipe may be required to join on to a main pipe, as in Fig. 14. Here it will be

seen that the cut on the branch pipe where it joins the main pipe is somewhat peculiar, its shape at the back taking the form shown by the dotted line.

The patterns for the segments of the curved portion of the branch pipe can, of course, be set out, as in the former cases.

The striking out of the pattern for the branch pipe cut, and the hole in the main pipe, is shown in Fig. 15. Before a pattern can be made, an elevation of the intersecting line of branch and main pipes must first be obtained. This is done by describing a semicircle on the branch pipe in the side elevation, dividing into six parts, and running lines up parallel to the centre line as shown. These lines are cut off by drawing lines up from the points on the semicircle in end elevation until they meet the main pipe circle, then running along until they cut the same numbered line on the side view.

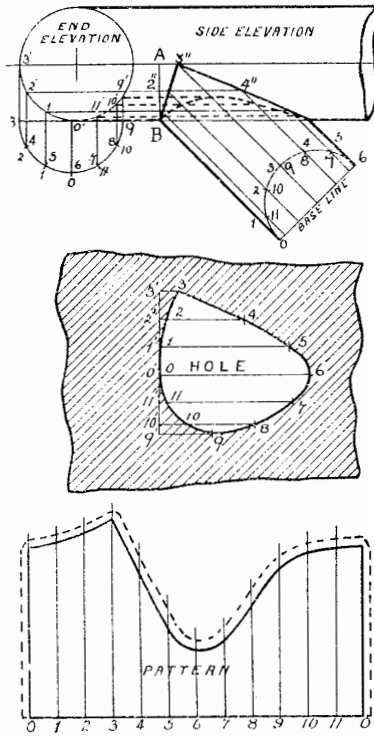


FIG. 15.

Thus, the line through point 10 on the semicircle in the end elevation gives point 10′ on the main pipe circle, the

horizontal dotted line through this point then intersecting with the line drawn through point 10 on the semicircle in the side elevation, and so on for all the other points required for the elevation of the joint line. The pattern for the branch pipe is now marked out in the usual way by measuring lines from the base to the joint line, and setting these lengths up on the correspondingly numbered line on the pattern. It should be noticed that two lengths are measured off each line in this side elevation, except the two outer lines. Thus, to take one case, the height of line for position 8 on the pattern will be measured from the base up to the dotted curve, and that for position 4 up the same line to the point marked $4''$, and so for each pair of lines.

To mark out the hole, a girth line, $3'$ to $9'$, is laid down, the parts of this being equal in length to the length of the correspondingly numbered arc on the main pipe circle. Through each of the division points lines square to the girth line are drawn. Now to get the lengths of these. Draw a line, A B, as shown in the elevation, and, using this as a base to measure from, measure the distance of the different points on the joint curve from this, and set along the corresponding line on the hole. Thus the line $2'$ 4 on the hole will be the same length as $2''$ $4''$ on the elevation, and, again, $3'$ 3 will be equal to A $3''$, and so on for all the other lines. All the points on Fig. 15 have not been numbered, as this would probably have led to confusion; but the reader should find no difficulty in following the construction, as having obtained one set of points and lines, all the rest will follow the same rule.

In bending the plates, care must be taken that they are bent the proper way, so that the pipes will fit together correctly at the joint. This, of course, holds for all cases of tee-pipes in which the branch does not fit on the middle of the main pipe.