CHAPTER V.

TAPERED PIPE ELBOWS AND THREE-WAY PIECES.

In the former chapters we dealt with typical cases of pattern-cutting for cylindrical pipe-elbows, selecting such examples as would serve to illustrate the general principles involved. In conical pipe-work it would not be a difficult matter to pick out scores of apparently different forms of joints, but which, on examination would be found could nearly all be resolved into a few simple types. In this chapter we therefore propose to treat just one or two representative cases of conical pipe-jointing, and these should be sufficient to explain the general method that can be applied to all this class of work. The first example to be dealt with will be that of a

Cylindrical and Conical Pipe Elbow.

The centre lines of the pipes may be arranged to meet at any required angle; but, for the sake of simplification, a square elbow (Fig. 19) will be taken first.

In work of this character the important thing is to accurately set out a side elevation of the elbow, so as to obtain the correct position of the joint line. This is done by first drawing in the centre lines at the required angle, and then from their point of intersection describing a circle (shown dotted in Fig. 19) equal in diameter to the cylindrical pipe. The outside lines of the pipes are afterwards drawn to touch this circle, and where they intersect will give the ends of the joint line. Thus, in Fig. 19, the cone and cylinder intersect re-

spectively in *a* and 6; hence the straight line *a* 6 will be the side elevation of the joint. It will save confusion to remember that this joint line does not pass through the point of intersection of the centre lines. The shape of the section made by the cut to form the junction of the two pipes will, of course, be elliptical, and by careful measurement it will be found that the size of the ellipses on the conical and cylindrical pipes will be exactly the same; hence the two pipes should fit together correctly. A cone base may be taken at any convenient position; but in the case of the square elbow it is, perhaps, best to produce the under side of the conical pipe until it meets the back of the straight pipe, and then use the line 0 6 as the cone-base. A semicircle is described as shown, divided into six equal parts, and lines drawn square to the cone-base, these being then joined up to the cone-apex *c*. From the points where the radial lines intersect the joint *a* 6, lines are run parallel to the cone-base on to the outside line of cone, thus obtaining the points 0′, 1′, 2′, etc. For the pattern, the compasses are first set to the distance *c* 6, and, with C as centre,

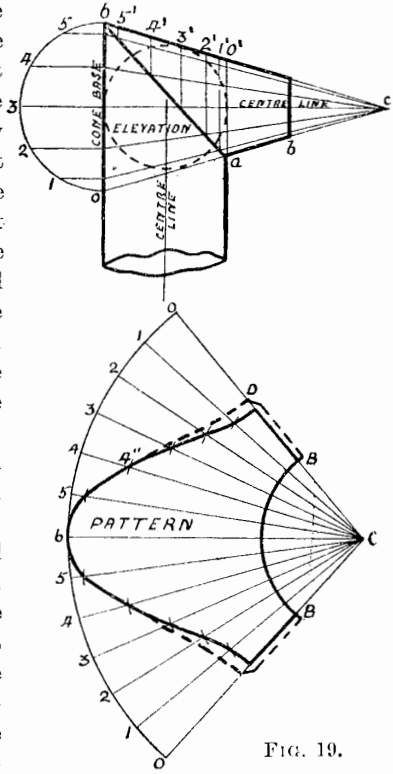

FIG. 19.

the arc 0 0 described, its length being obtained by stepping along the length of one of the arcs from the semicircle twelve times. To obtain points for the pattern curve, the compasses are respectively set to the lengths $c0'$, $c1'$, $c2'$, etc., these being marked from C along the correspondingly numbered lines on the pattern. Thus—to take one case only—the line $C4''$ on the pattern will be the same length as $c4'$ on the elevation. After marking all the points, they are joined up with an even curve. The cut for the other end of pattern is obtained by describing the curve B B from centre C with the radius $c\,b$ from the elevation.

If the elbow is made of galvanised sheet iron, an allowance for jointing can be put on as shown by the dotted line $4''$ D, the width of this depending upon the thickness of sheet metal used.

The cylindrical pipe pattern is not shown, as this will be struck out as before explained; but it should be noted that the allowance for jointing must be added to the back of pattern to correspond to that put on the throat portion of conical pipe.

In plate work more care will have to be taken to allow for thickness of metal in jointing. In setting out the elevation, the middle line of the metal thickness should form the outline of the figure. Suppose it is required to flange the tapered pipe over on to the cylindrical one; then the cone at the dotted circle portion should be made twice the thickness of the metal greater in diameter than the straight pipe. On the other hand, if the cylindrical pipe is to be flanged on to the conical part, then the former should be made two thicknesses in diameter greater.

Before proceeding to lay any lines down for a pattern or template, the arrangement of jointing should first be settled, as by a little forethought any method of connecting can be allowed for, and often much subsequent trouble avoided.

Swan-Neck or Offset.

The complete setting out for a swan-neck bend, made up of three conical pipes, is shown in Fig. 20. The double elbow might have been constructed partly conical and partly cylindrical, as in the last case, the same method for

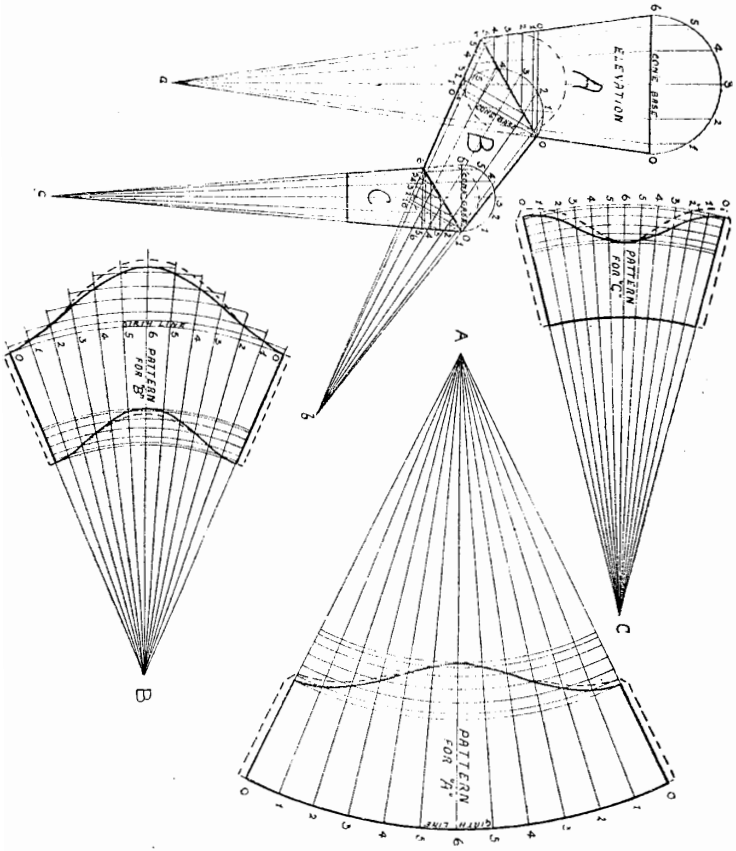

FIG. 20.

obtaining the joint line still holding good. There is no need for very much description in connection with this example after what has been said about the square elbow. The lines that form the cone-bases are indicated in the elevation, those for the parts "A" and "C" being similar to the last case, and that for "B" drawn to the right of the joint, and the radial lines produced through to meet it. It will be noticed that this latter arrangement brings the girth line of the pattern for piece "B" across the pattern instead of at the end, as in the other two patterns. The extras for jointing are added on the same principle as explained for the elbow. In fixing the parts together, it should be noted that "A" fits into "B," and the latter into "C."

Cylinder and Cone Breeches-Piece.

The forms and shapes of breeches-pieces are numerous. Those of the oblique cone order and coppersmith's kind are dealt with in Chapter XXIX.; but there are still many, that do not come under the above names, which can be formed of portions of cylindrical and conical pipes, or the latter alone. We shall now give two examples of this class of work—one regular in form, and the other irregular —and this should suffice for all practical purposes.

Regular Breeches-Piece.

An elevation of the above is shown in Fig. 21. The centre lines are first laid out at the required angle, and a circle described about their meeting-point of the same diameter as the cylindrical pipe. The ends of the conical pipes are then marked down in their proper positions and correct diameters. Lines are now drawn to touch the circle, and where required produced until they meet. The intersection points of these tangential lines will give points

on the joint lines or joint lines produced. Thus, the line of connection, *d e*, between the pipes "A" and "C" is drawn by joining *d* to *f*, and where this line cuts *g h* will give the point *e*. It should be observed that this latter point does not coincide with the centre of the circle.

The girth line of the pattern for the pipe "B" is

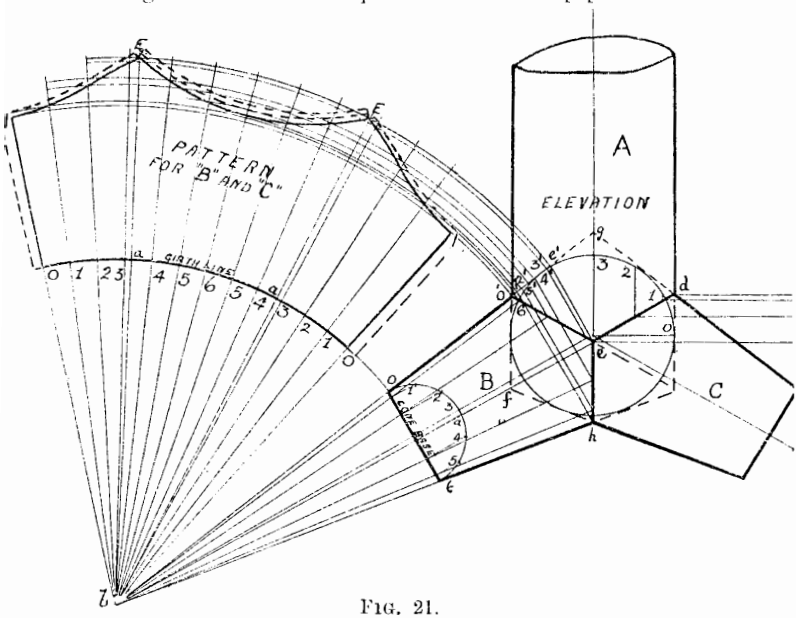

FIG. 21.

obtained by taking the end line of the pipe as a cone-base, and on this describing a semicircle, from which the girth line lengths can be measured and the radial lines drawn. Having projected the radial lines on to the outside line of the cone, the striking out of the pattern will be the same as in the former cases. There is, however, one little detail to which it is, perhaps, worth while calling attention. It will be noticed that the points E E do not lie on the regu-

larly-spaced radial lines, but in between the lines passing through the points 3 and 4 on the girth line. To obtain the former points accurately, extra construction lines must be put in. To do this, join e to b, and from where the line crosses the cone-base run up a perpendicular to the semicircle, so obtaining the point a. Now measure the arc 3 a, and set along the girth line from the point 3. Join b to a, and produce the line to meet the outside curve, which is swung around from e', in E.

The finding of the intermediate point has, in the above case, been explained at some length; and, as it is occa-

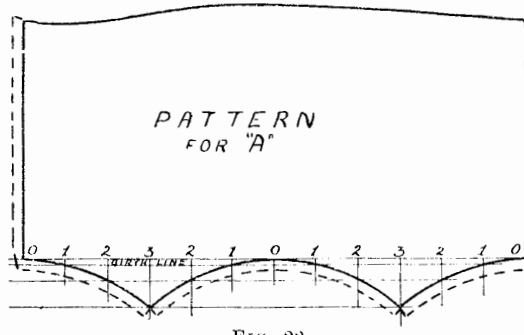

FIG. 22.

sionally necessary to use this construction, it is worth while taking notice of the method followed.

The pattern for the cylindrical pipe "A" (Fig. 22) is laid out in the usual manner, the right-hand upper quarter-circle being used in this case from which to project the lengths of the construction lines. The girth line will, of course, be equal to four times the length of the quarter-circle 0 to 3. The lengths of the cross lines are shown projected from the elevation. For a pane-down or knock-up joint a double lap is put upon the pattern for "A," a single lap for "B," and double lap along the middle part E E, and a single lap at the ends for "C."

Irregular Breeches-Piece.

The same principle as applied in the former cases can also be adopted as the method of construction for any kind of a three-way or other connecting-piece, built up wholly with conical pipes, or partly conical and partly cylindrical.

The elevation of an irregular breeches-piece, which is composed of two conical pipes and a cylindrical pipe, is shown in Fig. 23. The joint lines are obtained exactly the same as in the former cases. The only pattern set out is that for the conical pipe "C," as the others can be obtained in a similar manner. To complete the cone of which "C" is a part, the side lines are produced to meet in c, and the cone-base, drawn as shown, being made the same diameter as the dotted circle.

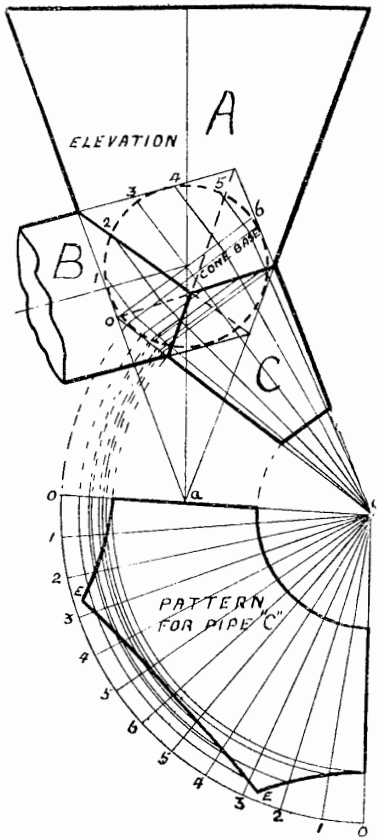

FIG. 23.

Half of the latter is used as the semicircle for obtaining the required construction lines, perpendiculars being drawn from the division-points down on to the cone-base. The pattern is struck out in the same manner as that shown for Fig. 21. The points E, E, on the pattern

have been found without the use of intermediate construction lines, the curves through 1, 2, and 4, 3, being simply produced until they meet in E. No allowance has been attached to the pattern for jointing, as this can be put on according to requirements.

What has been said about allowing for thickness of metal in connection with Fig. 19 will apply equally well in the above class of work. For heavy plate work great care must be taken in this direction if work accurate to dimensions or neat joints is the desideratum.

Equal-angled Three-way Piece.

When three pipes of the same diameter fit together at equal angles, as in Fig. 24, the simplest way to obtain the elevation, and thus the pattern, is to draw a circle (shown dotted in the figure) equal in diameter to the pipes, and obtain the elevation of the joint line, as shown. The pattern can then be set out, as in other cases. If the joint is to be paned down, or knocked up, the allowance on pattern will be a double edge for middle part and a single edge on end parts, the pattern then serving for each branch.

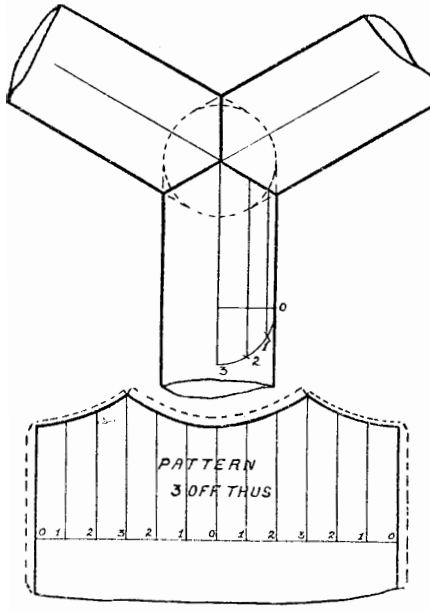

FIG. 24.

Unequal-angled Three-way Piece.

For this the elevation can be set out, as in the last case,

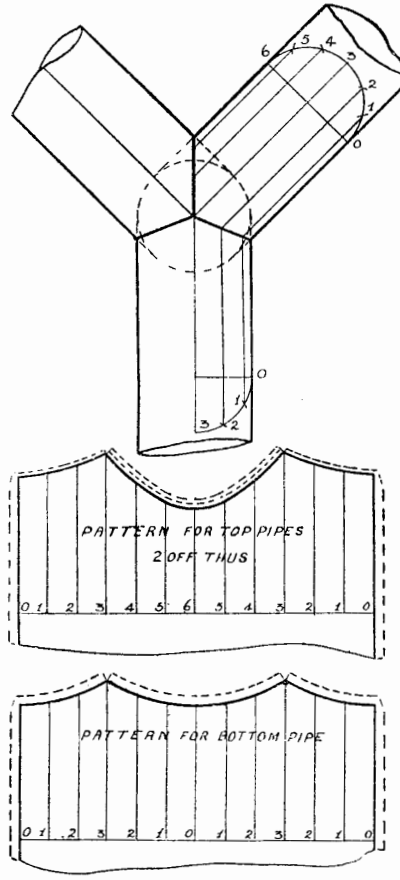

FIG. 25.

the centre lines being drawn to the required angles. In Fig. 25 the two top pipes make equal angles with the bottom

pipe, consequently one pattern will do for the two pipes, the only difference being in the arrangement of the laps, the two dotted curves on the pattern showing respectively the laps for the two pipes.

If the three angles that the centre lines of the pipes make with each other are all unequal, then it will be necessary to have three distinct patterns, the setting out of these being similar to the cases already mentioned.