

CHAPTER II.

ELBOWS FOR ROUND PIPES.

Pattern for Round Pipe Cut on the Slant.

It should be borne in mind that the most important point in the making of patterns is accuracy in determining the lines that are required for the pattern. It is always better to spend a little extra time in finding the correct length of these lines than to have an ill-fitting article, or to waste

time in cutting or chiselling it into shape. If the pattern is for a stock article, then the greatest possible care should be exercised, so as to obtain a pattern as near perfection as possible; but, on the other hand, if it is required to set out a pattern for an odd job, the workman who has an ounce of common sense will know it is foolish to spend as much time in the setting out as will eat up the cost of the job.

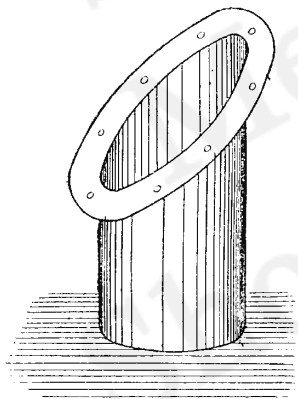


FIG 1.

Fig. 1 shows a sketch of the pipe, with flange fitted on the slant end. Generally, for those who have had but little practice at setting out, it is the best plan to draw an eleva-

tion of the pipe or pipe-joint for which the patterns are required. First draw the centre line (Fig. 2), and then, as it were, "clothe" this with the pipe by marking half its diameter on each side, and draw lines parallel to the centre

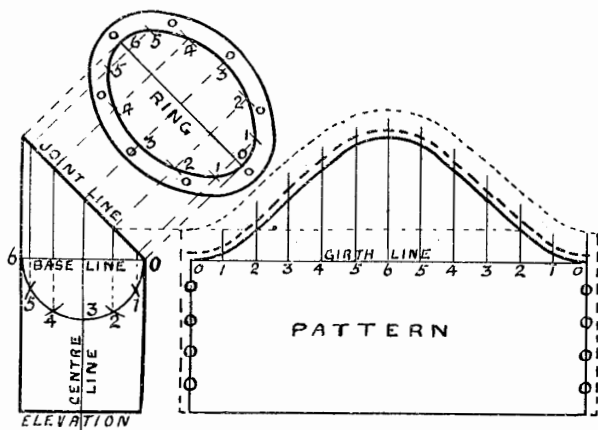


FIG. 2.

line, cutting them off to the required length. Now draw "base line," as shown, and on this describe a semicircle, and divide it into six equal parts by using the compasses at the same radius with 0, 3, and 6 as centres. Draw lines from "base line" to "joint line," passing through the points 1, 2, 3, etc., and parallel to the centre line, or square with the base line.

The pattern can now be developed by drawing a line, 0 0, equal in length to the circumference or girth of the pipe. This length can be obtained by carefully measuring along one of the six arcs 0 to 1 or 2 to 3, etc., into which the semicircle is divided, and setting it along the straight line twelve times. The arc can be measured by bending along it a strip of sheet metal or stiff paper, or a bit of thin wire; or it can be more accurately found by using the well-

known rule for calculating the circumference of a circle:—
“Multiply the diameter by 22, and divide by 7.” Thus, in the present case, if the diameter of the pipe is $10\frac{1}{2}$ in., its circumference will be 33 in., and, dividing this by 12, the length of one of the arcs will be $2\frac{3}{4}$ in.

The simplest plan, however, and the one most often adopted in ordinary practice, is to take the lengths directly from the drawn semicircle. Lines perpendicular to $O O$ should be run up from each point, and numbered as shown, and their lengths cut off equal to the corresponding lines between “base” and “joint” lines in the elevation. In workshop practice, it is most convenient to take these lengths off with the compasses, and set them up the proper lines; but in developing a pattern on paper, the heights can be projected from elevation on the pattern, as shown with line cutting off point 2. The points marked can now be joined up with a free-flowing curve, and thus the *net* pattern is completed. To add the proper allowances for thickness of metal—laps, seams, joints, and wiring—is the most important part of the making of patterns, and this will be dealt with fully in subsequent chapters. In the present case, whatever is allowed for the side-riveted seam, half must be put on to each end of pattern. Thus, suppose the lap is $1\frac{1}{4}$ in., then $\frac{5}{8}$ in. will be the allowance for each end of pattern. It will be noticed that the centre lines for the rivet-holes are the end lines of the net pattern.

The thick dotted line at top represents the allowance for small flange for fastening ring to pipe, either by riveting, brazing, or soldering. The thin dotted line shows the allowance to be made if the whole flange is to be thrown off the pipe. Care must be exercised so as to get the allowance for flange the same width all along the pattern. This can be best done by setting the compasses at the required width, and drawing them along the curve at top of net pattern.

Attention is called to the method of numbering adopted. The figure 0 will in all similar cases be placed against the seam of pipe, and it will thus always come on the outside lines of net pattern.

The ring to form the flange can be set out from the elevation of pipe. The long diameter 0 6 will be equal in length to the joint line, and the intermediate points can also be taken from the same line. The widths at the different parts of the ring can be taken from the lines with the corresponding numbers on the semicircle in elevation. These points will now all be joined with a curve and the width of flange marked around. As the hole in the flange-ring is an ellipse there are many other ways that might be employed for marking it out—some shorter, some longer—and the best of these methods shall be shown as occasion demands.

Flanging.

A fair amount of skill is required to throw-off or stretch a flange properly. The first thing that should be done is to cut a gauge (Fig. 3) out of a bit of sheet brass, and with this mark the depth of the flange all round on the inside of the pipe.

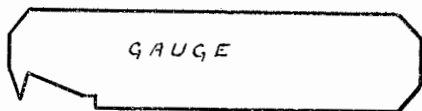


FIG. 3.

In stretching the flange on anvil, head-stake, or other tool it should be remembered that it is the outer edge of the flange that requires the greatest amount of hammering, as the length round the outside of flange will be greater than the inside by just about $6\frac{1}{4}$ times the width of the flange. If the pipe is made out of $\frac{3}{8}$ in. or thicker metal the flange will have to be turned over hot, and in this case the depth of flange should be marked on the plate when flat, with centre-punch marks.

In the flanging of plate metals there is no need to exercise quite so much care to avoid the splitting of the flange as there is with sheet metals, as there is a greater volume of metal to allow for drawing. Since the introduction of mild-steel plates of uniform structure, flanging operations can be carried out with a greater degree of certainty than in the old days, when iron of an indifferent quality had to be used. All the advice in the world, however, will not make a mechanic into a good flanger without plenty of practice.

If holes are required in the flange, no attempt should be made to put these in the sheet or plate before bending or flanging, as the flange is almost certain to break across the holes, and if, by good luck, it does not, it will be found that the holes are drawn out of shape.

In stretching, throwing-off, or flanging sheet metals, annealing plays an important part, so that as soon as an edge shows signs of becoming hard or brittle it should be at once got red-hot and allowed to cool down.

Square Elbow for Round Pipe.

Possibly one of the commonest jobs an iron-plate worker is called upon to do is to make a square elbow for a round pipe. An elbow of this description may be required either for a stove pipe, a rain-water pipe, or a ventilating shaft. The pattern for it can be set out in a variety of ways, all giving the same result. One of these methods is shown in Fig. 4. This may be described as the general method, which is applicable to all kinds of pipe joints for circular non-tapering pipes. An elevation of the elbow is drawn in the usual way, and a semicircle described as shown. For the pattern the circumference of the pipe is set along the line *00*, vertical lines are run up from each numbered point, and these cut off equal in length to the line with the same

number running between base and joint lines in elevation. Before making any allowances for jointing, the method of fastening the pipes together should be decided. There are

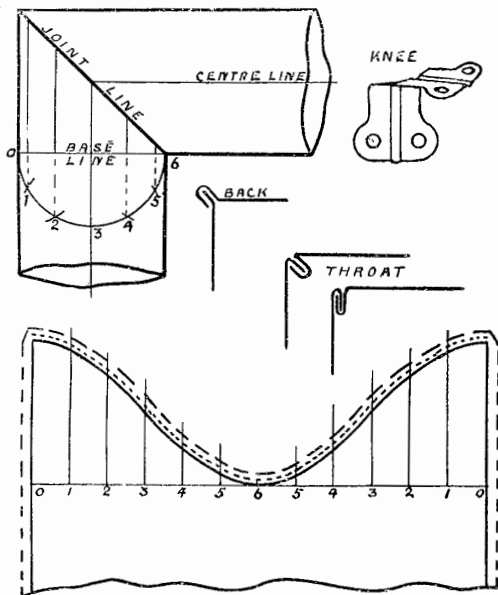


FIG. 4.

many ways in which the joint can be made, the method adopted depending upon the purposes for which the pipes are to be used. In Fig. 4 it is assumed that they are seamed together, the plan often followed in making elbows for stove pipes. A sketch of joint at back and two sketches of the joint at throat are shown. After the pipes are edged, or as it is called, panned together, it is usual to knock-up that part of the joint round the throat as shown in the bottom sketch. The four thicknesses of metal are of course hammered perfectly tight together. A knee is sometimes

riveted in the throat of the elbow, which adds considerably to its strength.

For ordinary thicknesses of sheet iron, say 24 gauge, the allowance for the single throw-off may be 3-16 in., and for the double edge a little greater than $\frac{3}{8}$ in. These allowances are shown by the dotted lines on pattern. The side seam will be grooved, and it will be sufficient to allow $\frac{3}{8}$ in. on each side to cover for what is required for a $\frac{1}{4}$ in. groove. The way to make allowances for the different kinds of joints will be dealt with fully in subsequent chapters. Notches at 0 0 must not be cut too large, or the result will be a hole in the joint of the elbow. The object of the notches on pattern is to avoid having to stretch or throw-off the four thicknesses of sheet which form the groove, which if attempted would, in many cases, break the grooved seam. Besides this, if the groove would stand turning over, it would result in an unsightly lump on the joint seam. It is always the safest plan to cut a long notch, as shown in the pattern at 0 0 (Fig. 4).

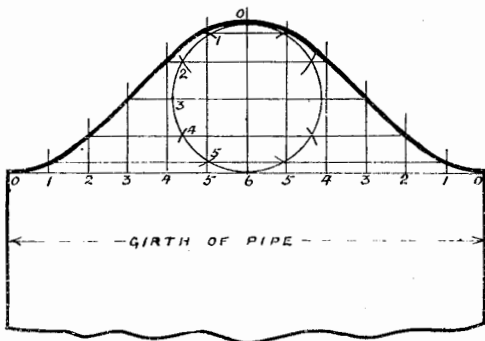


FIG. 5.

Without the sheet iron is of good quality, it is best to anneal around the edges for wide flange before attempting to throw it over. In fact the safest plan is to anneal

twice, first before flanging, and then again after, before the edge is turned back. It might be taken as a sheet metal worker's maxim, "Never spoil a good job for the want of a little annealing."

A simpler method for marking out the pattern for a square elbow is shown in Fig. 5; but it must be distinctly borne in mind that this method applies to a square elbow only, and cannot be used for any other kind of elbow or bend. A circle equal in diameter to the pipe is described and divided into twelve equal parts, the girth line 00 being divided up in the same manner. Points on the curve are obtained by running construction lines up and across as shown.

Elbow with Slip-Joint.

A ready way of jointing the two pipes of an elbow together is to slip one inside the other, first having turned down the edge inside the throat, and then turn the edge at back over the inside pipe. The patterns for this kind of a joint are shown in Fig 6. The elevation is drawn in the usual way, and the lengths $A D$ and $0 C$ made a little greater in length than the required lap. In setting out the pattern for the pipe with the outside lap, the lengths of lines are measured up to the line $0 D$, and marked up on pattern on the corresponding lines. This will give the curve $0 D 0$. In developing the pattern for the pipe with inside lap, lengths will be measured along to the line $C A$, and set up on pattern, and these will give the curve $C A C$. Hence, it will be seen that the curve for net pattern is $0 A 0$, for bottom pipe $0 D 0$, and for top pipe $C A C$. This is the way in which two pipes of exactly the same diameter can be jointed with a lap joint, one pipe fitting inside the other. The length of the curve $0 D 0$ is, of course, greater than that of $C A C$, and the difference in the lengths of these two curves can be made anything we

please by arranging the lengths of *A D* and *O C* in the elevation. The ellipse at the end of one pipe will be less in circumference than the ellipse at the end of the other;

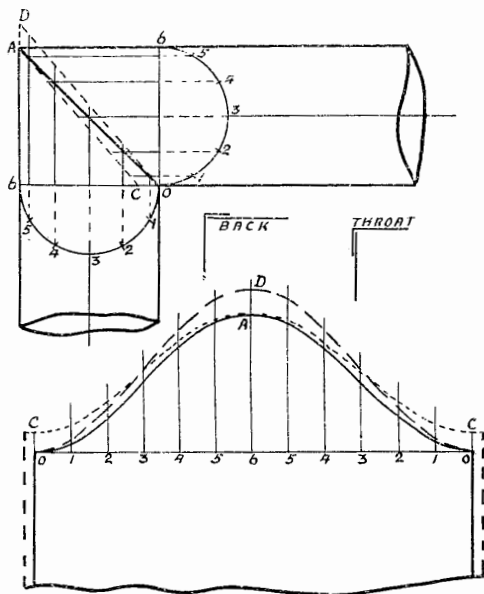


FIG. 6.

consequently, the smaller will go inside the larger. If no inside lap is required, as in the case of a galvanised sheet-iron rain-pipe elbow with soldered joint, then the length *C O* in top pipe will be made considerably shorter than in the figure. In every case the lengths that *A D* and *C O* are made will depend upon the thickness of the metal used.

Obtuse Elbow for Round Pipe.

The pattern for an obtuse elbow for a round pipe is shown in Fig. 7. The setting out of this pattern requires

no additional explanation to that given for previous patterns. In drawing the elevation of pipe, however, care must be taken to set it out to the required shape of bend. In the workshop dimensions are generally given in one of

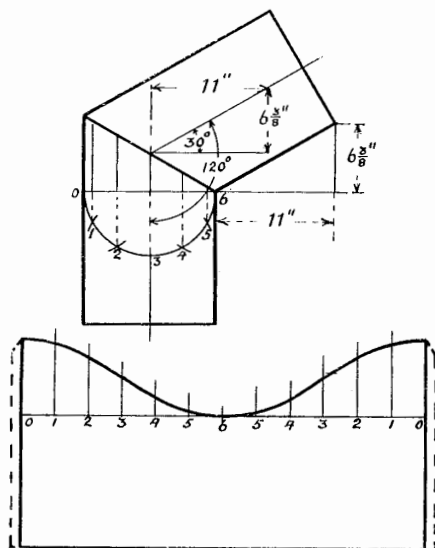


FIG. 7.

the three ways shown in the figure. The angle between the centre lines is sometimes given, which in this case would, of course, be $90^\circ + 30^\circ = 120^\circ$. Allowances for the side-seams only are shown in this pattern.