

## Working pipes and tubes

A workshop practice often encountered on full-size work, the principles of which are helpful in small scale tasks. Geometer shows the novices how to avoid pitfalls

**T**HE IMPORTANT THING to remember when working pipes and tubes is to avoid collapse and splitting. The various methods employed are governed by material, diameters, wall thickness, radii and angles of bends.

When sawing thin-walled tubing, fine-pitch hacksaw blades are essential; by holding the tube in the vice, inserting a close-fitting mandrel or rod and placing packing round the outside distortion can be prevented, as at A. Alternatively, soft clamps can be made from pieces of board, gripped together and a piece of thin cardboard placed between them, these are drilled centrally to the size of the tubing. Large size clamps can be bored in a four-jaw chuck.

Copper and brass pipes of small diameter but relatively thick-walled can be bent easily unless the radius of the bend is very small. For a bend of minimum radius, the material should be annealed, i.e., heated to red and quenched in water. Small steel pipes should be bent at red heat unless the curve is very gradual, when cold bending is possible.

### Bending small pipes

A bend of particular radius can be obtained by turning the pipe round a piece of suitable rod and a coil can be made by carrying the pipe the required number of times round the rod. Where there is surplus pipe, it is often best to bend first and cut afterwards.

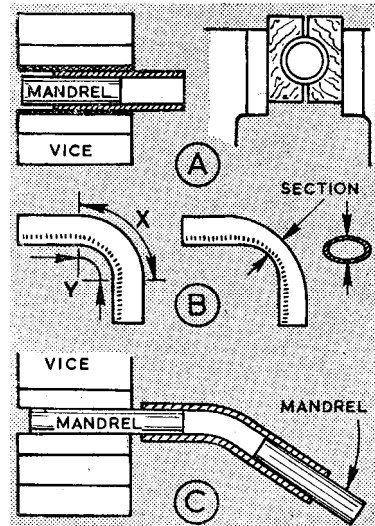
In bending larger pipes or tubing of thinner section, recognition must be made of the fact that, as at B, the material round the outside of the bend X must stretch and that on the inside Y must compress. If bent unsupported or without means of effecting the stretching and compressing, the tubing will either acquire an oval section or collapse and split at the bend.

### Bending larger pipes

To prevent this splitting and collapsing with pipes that are not too large, fill them with lead or white-metal, bend them when cold and then heat to clear them. Larger pipes can be plugged at one end, filled with sand which is rammed tight, then plugged and bent as required; steel pipes should be heated. The sand must be quite dry to avoid generating steam and the risk of a consequent explosion.

Bending can be performed, as at C, by using two mandrels or rods; one is held in the vice and the other is pulled by hand or by slipping it over another piece of tubing.

Very close smooth bends can be obtained on large pipes by sawing out V-sections almost through the pipe,



as at D, then pulling it round to the curvature. The join is then soldered, brazed or welded, according to material and equipment. On this principle, neat bends with wrinkles instead of cuts can be made with pipes that are not too large and a welding torch is available. The set-up can be as at C; the torch flame is swung round and concentrated at various points, as at E, to form each wrinkle, and the bend gradually made.

### Obtaining angles

Right-angle and other bends can be fabricated, as at F and G, provided the pipes are one size and each is cut at the same angle-half the angle between them. At F, each pipe is cut at 45 deg.

On a bend incorporating three or more pipes, angles are considered individually. At G, the angle between two pieces is 45 deg. and cuts are made at 22-1/2 deg. T-pieces and branch pipes, as at Hand I, can be fabricated by filing out the curvature on the joining piece, applying this to the main pipe, scribing round it, then chain-drilling and filing the hole, finally brazing or welding.

Pipes can be enlarged slightly by tapping with a hammer when on a mandrel, on this principle they can be flared, as at J. The mandrel is held in the vice and the pipe fitted on and rotated while being tapped. When flaring, the mandrel is applied at an angle.

An accurate flare or cone can be produced on a small pipe, as at K. A die is produced from two pieces of steel (as for the soft clamps A) by drilling, then running in a centre drill. The pipe is then gripped and opened with a conical punch.

