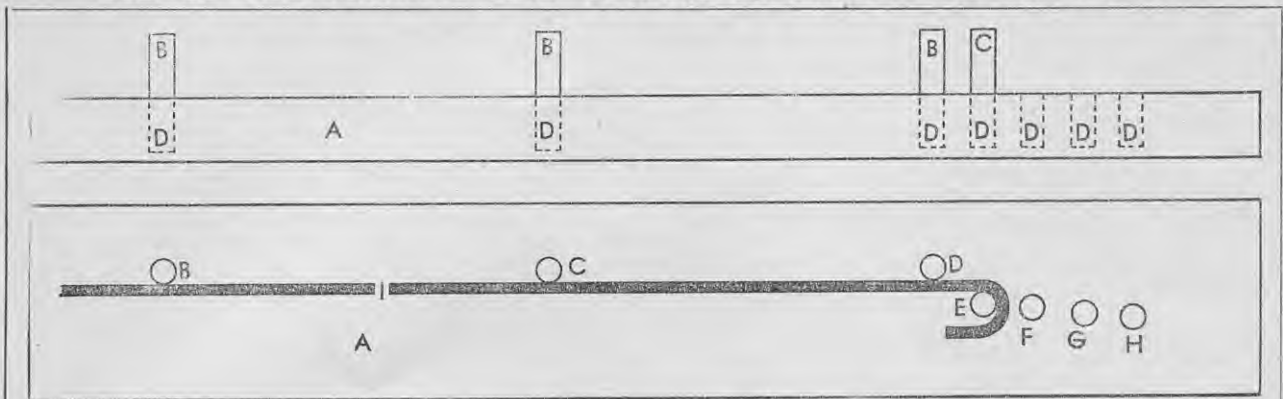


USE OF REINFORCING AND BOXING IN MOULDING CONCRETE



A simple bar bender. Upper—Elevation. A—Piece of timber. B—Fixed steel dowels $1\frac{1}{4}$ in. in diameter. C—Adjustable steel dowel $1\frac{1}{4}$ in. in diameter. D—Holes to accommodate dowels. Lower—Plan. A—Timber. B, C, D, E, F, G, and H—Dowel holes. I—Bent bar. For bending $\frac{3}{8}$ in. diameter rod dowel C (in the upper illustration) is fitted to hole E; for $\frac{1}{2}$ in. diameter rod to hole F; for $\frac{3}{8}$ in. diameter rod to hole G; and for $\frac{3}{4}$ in. diameter rod to hole H.

positions in such a manner that they are easily assembled. Even if they can be assembled, wrongly-bent bars will not occupy their correct positions and are therefore not capable of providing the necessary resistance moments. They may also reduce the coverage of concrete if too close to the forms, causing the concrete to spall off.

When a reinforced structure is designed accurate drawings of all reinforcing are prepared, and reinforcing must be bent exactly as shown in the drawing, as the designers have studied the methods of positioning as well as its strength characteristics. Reinforcing can be ordered already cut and bent according to drawings, but if this work is done on the site, accuracy is essential.

The simplest equipment for bending light bars consists of a number of steel dowels fitting into holes in a baulk of timber supported so that its upper surface is 3ft. to 3ft. 6in. above ground level (see diagram above). A length of gas or water pipe which slips over the free end of the bar is used for pulling the bars round the dowels to make a bend. Simple bar-bending machines are also obtainable and give good results.

The dimensions of tails and hooks on reinforcing bars are of little importance and any excess in length may be taken up at these points. In bending bars with a crank near each end it is advisable to start by making these bends first and using any surplus length of bar in the end hooks.

Forms of Shuttering

Timber

Concrete is worked in a plastic state and can be moulded to any shape required. The moulds, or sections from which the moulds are built, are known as boxing, forms, or shuttering, and consist of either timber or metal. Timber is by far the commonest material from which concrete forms are constructed, but sheet metal is used for special applications where a required profile is more easily obtained by bending a sheet of steel.

Some contractors use sectional steel shuttering which can be bolted together and forms a very convenient means of erecting shuttering for straight-run work such as walls.

The most suitable timber for use as boxing is pine, as it is relatively cheap and, being soft, is easily worked. It is also available in all sizes and is easily obtained.

Freedom from knots and coarse grain is desirable, as these will show on the finished concrete; for this reason white pine (kahikatea) is one of the best timbers to use for mouldings or in any situation where an extra-smooth finish is required. However, white pine is too expensive and has too little strength for form timber generally.

Partially-seasoned timber is the best for form construction, because if the timber is too dry, it will tend to swell from absorption of moisture, and green timber will tend to dry out and shrink in hot weather, causing fins and ridges on the concrete.

Timber may be rough or dressed. It may be dressed in various ways, such as on all four sides, on one side and one edge, on one side and two edges, etc. Generally it is best to use timber dressed on all four sides, as it will then be of more uniform size and is more easily adaptable for different purposes. Wood of any size should be dressed to uniform thickness so that the pieces will match up; this is particularly important with sheathing, because otherwise the joints will require to be planed down.

Sheathing 1 to 2in. thick for straight runs such as walls may be tongue and grooved, square, or have a bevelled edge. Tongue and groove gives the best results, and a bevelled edge is good if the wood is very dry, because when built up it will not buckle so easily when swelling.

Thickness of timber will depend on the available supply and the load to be carried, but more often on the supply, as any normal size can be used to advantage by adjusting the spacing of the supports. For all gen-

eral purposes 1in. timber dressed to 13/16in. will be found the most useful, planks 6in. wide being the most handy, except for a large area of sheathing where 12in. planks will require less labour to erect.

The lengths of timber ordered for boxing should, where it can be specified, be of such a size that they can be used to the best advantage with the least waste. Attention to this point may save an appreciable amount of timber if the work is extensive.

Sheathing can be ordered in random lengths as it generally has to be cut up, and short lengths can always be worked in.

Where exact dimensions have to be met joists, studs, posts, beam bottoms, etc., should be ordered to the nearest commercial length to the height or span required. A span of, say, 5ft. 6in. should be ordered in 12ft. lengths for the least waste. Care in specifying the lengths is important; otherwise there will be a lot of short ends and a surprising percentage of waste.

As timber is a costly item in reinforced concrete construction it should be ordered and used with care.

Nails

Common wire-cut steel nails are generally used. Double-headed nails, if they can be obtained, are an advantage, as they can be withdrawn easily.

Wire and Bolts

In vertical sections such as columns and walls a horizontal pressure caused by the hydrostatic head of the wet concrete will act on the shutters. As this pressure is exerted equally in all directions, it can be guarded against by tying the boxing supports with wire or bolts. No. 9 black, annealed wire gives the best service for ordinary work. Steel or galvanised-iron wire should not be used, as it is brittle, hard to handle, and too springy.

Bolts with washers and nuts are used in heavier wall construction. If they are to be drawn after use, they should be well greased or fitted with sleeves.