

depending upon the width of the boards; the four boards, 1, 2, 3 and 4, are then placed as shown and forced into position by jumping on the board N which is laid across them. The boards are finally nailed and the operation repeated.

Another method is adopted in the absence of a cramp, as shown at o, Fig. 33. A metal *dog* is driven into a joist, and the boards (four or five at a time) are brought close together by tightening the hardwood wedges by means of a hammer.

When the boards are secretly nailed, and each board has therefore to be cramped and nailed separately, it is usual to cramp each board with the aid of a strong chisel which is driven into the top of a joist close to the protecting strip and used as a lever. The blade of the chisel is forced against the strip and the pressure closes the joint.

The boards are secured by nails called *floor brads* (see E, Fig. 66) the length of which should be twice the thickness of the boards. When top-nailed, two brads are driven through each board to every joist which it covers, including two nails at the ends. The brads are about 1-in. from the edges, and after the boards have been fixed, the heads of the brads are driven below the surface by using a hammer and *punch* (see 10, Fig. 67). Tongued and grooved boards (in addition to square and rebated boards) are usually top-nailed as shown by broken lines at s, Fig. 34. Occasionally they are secretly nailed as shown in the two positions at t, the higher position being the better of the two as the tongue is less likely to be damaged. The secret nailing of boards which are jointed as shown at v and w has been mentioned on p. 64. The nails used for this purpose are usually $2\frac{1}{2}$ -in. *oval wire nails* shown at A, Fig. 66, as they are less liable to split the tongues. The heads of these are also punched. In order that water and gas pipes, electric cables, etc., which are frequently run below the floor boards, may be readily accessible, the boards over them are not nailed but are screwed.

In good work it is customary to fix a *hardwood margin* round all fireplace hearths, as shown in the plan at A and the detail at J, Fig. 32. This ensures a more accurate finish and a neater appearance than is presented if the ends of the boards are stopped against the concrete or tiles. The floor boards are rebated to receive the 2-in. by $\frac{3}{4}$ -in. oak margin which has mitred angles; if $\frac{7}{8}$ -in. thick boards are used, the margin is of the same thickness and the ends or edges of the boards are butted against it.

Double Boarded Floors.—Double flooring is sometimes required for buildings of the factory type (where the floors are subjected to excessive wear) and for domestic and other buildings which require good class floors. As is implied, the floors are laid in two thicknesses. The first covering or sub-floor (or counter-floor) usually consists of $\frac{3}{4}$ -in. roughly sawn square edged boards laid diagonally across the joists to avoid their joints coinciding with those of the boards above. The upper boards may be of $\frac{3}{4}$ to 1-in. (nominal) hardwood (usually oak or maple) which are fixed at right angles to the joists.

2. WOOD COVERED CONCRETE FLOORS.—Floors may consist of concrete which are covered with either wood boards or blocks. Two examples of this type are shown at w and x, Fig. 32.

Boards on Concrete (see w).—Wood *fillets* are partially embedded in the concrete floor and the boards are fixed to them. Special precautions must be

taken to prevent dry rot; the concrete must be dry, the fillets should be well seasoned, and the top of the concrete is sometimes given two coats of bitumen.

The concrete floor is laid to the level of the underside of the fillets and the top surface must be level throughout. The fillets are placed at 15-in. centres and kept temporarily in position by nailing cross battens to them. More concrete is then placed in position to within $\frac{1}{2}$ -in. of the top of the fillets. Both sides of the fillets may be splayed, although it is more economical if only one side is splayed (as shown at w), when one pair of fillets may be obtained from a $4\frac{1}{2}$ -in. by 3-in. scantling.

Blocks on Concrete (see x).—The concrete floor is covered with wood blocks, a bituminous material or mastic being used as an adhesive. The blocks may be of well-seasoned softwoods (such as redwood, British Columbian Pine and pitch pine) or hardwoods (such as oak, maple and teak). Their nominal sizes vary from 9 to 12-in. long by 3-in. wide by 1 to $1\frac{1}{2}$ -in. thick. Two of many types are shown at y and z, Fig. 32, the former being the simplest and is commonly used. The blocks are fixed by dipping the lower portion into the hot bituminous mastic, and then bedded on the concrete to which the mastic adheres. When they are pressed down, the liquid mastic rises in the grooves, as shown by the blackened portions in the illustrations. The thickness of the mastic is almost negligible. The blocks are laid to various designs, those most common are of the herring-bone and basket (shown at x) patterns. A simple border consisting of one or two rows of blocks is placed next to each wall.

The concrete floor is finished with a *floating* coat, usually 1-in. thick, consisting of 1 part cement to 3 parts sand. It must be finished quite level and must be absolutely dry before the blocks are fixed, otherwise the mastic will not adhere to it. The building must be thoroughly dry before such floors are laid, otherwise the seasoned blocks will absorb moisture and may swell to such an extent as to cause the floors to rise in the centre.

CLEANING OFF AND PROTECTING FLOORS.—On completion, wood floors should be *traversed* or “flogged.” This consists of planing the boards to a level and smooth surface either by hand or machine. Hardwood floors are afterwards scraped (see scraper, p. 130), rubbed smooth with glass-paper (see p. 130) and finally oiled or waxed and polished. Floors should be protected against damage during subsequent building operations by liberally covering them with sawdust. This prevents plaster, paint and dirt from soiling and scratching the boards or blocks and the sawdust absorbs moisture.

UPPER FLOOR

The plan, section and various details of an upper floor of a room which is of the same size as the ground floor already described are shown in Fig. 34. The bridging joists are placed across the shortest span, and as there are no intermediate supports (such as sleeper walls), their clear span is 12-ft. In accordance with Table II. (see p. 61) the size of these joists will be 9-in. by 2-in. An alternative arrangement of joists which would be adopted if the shortest span was in the other direction is shown at p, Fig. 33.