approximately $\frac{5}{32}$-in. deep) to enable the boards to be fitted closely together at the top and bottom surfaces when the tongues are engaged in the groove. The tongues are sometimes slightly rounded off so as to facilitate the laying of the boards and prevent them being damaged during the process.

Rebated, Tongued and Grooved Joint (see V).—This is a good but expensive joint and is sometimes adopted for hardwood floors where the boards are to be secured by nails which are required to be concealed. As described on p. 65, floor boards are usually fixed to the joists by *top nailing*, *i.e.*, the nails are driven through the entire thickness of the boards. This gives a somewhat unsightly appearance which is avoided if *secret nailing* is adopted, *i.e.*, each board is secured by hammering two nails through the tongues into each joist.

Splayed, Rebated, Tongued and Grooved Joint (see W).—This is another joint which is secretly nailed. It is an improvement upon that at V owing to the thicker and stronger tongue.

Ploughed and Tongued Joint (see X).—Grooves are formed or "ploughed" in the square edges of the boards to receive hardwood tongues or "slip feathers." It is rarely employed unless very thick boards are required and where the ordinary tongued and grooved joints would result in an excessive waste of material in forming the tongues.

Heading or End Joints.—Wherever possible, the boards should be sufficiently long to reach from wall to wall of a room in order to avoid end or heading joints. Where such joints are necessary, as for large floors, they usually take the form of the square joint shown at P. Each adjacent board is cut to cover half of the thickness of the joist below, the ends are closely butted together, and four nails are driven in, two on each side of the joint. Another form of end joint is called the *splayed* or *bevelled heading joint* (see Y); the ends are splayed to give a tight fit, and two nails are hammered in at an angle as shown. Rebated heading joints (see Q) are sometimes specified for good work. The appearance of the work is spoilt if the heading joints form one continuous line over the same joist. They should be laid to *break joint* as shown on the plan at H^1, Fig. 32; sometimes they are arranged as shown at J^1 when not more than three heading joints appear in one line, but the appearance is not so satisfactory.

(*Note.*—The boards used to cover the floor shown at A, Fig. 32, would not require heading joints, as 16-ft. long boards (see p. 62) would be used; the heading joints at H^1 and I^1 have been shown to illustrate their application.)

CRAMPING AND NAILING BOARDS.—The joints must be as close as possible before the boards are nailed. The best means of effecting this is to employ an appliance known as a metal *cramp*, the plan of one of which is shown at A, Fig. 33.

Cramping is performed in the following manner: After the top edges of the joists have been levelled, starting from one wall, the first board is laid at right angles to the joists and nailed. Five or six boards are laid loosely upon the joists. Two cramps are placed temporarily over joists which are some 2 or 3-ft. from the ends of the boards. Each cramp is fixed to the joist as shown at A, the arm D is rotated in the direction of the arrow "1"; this causes E to rotate towards the joist in the direction of the arrow "2," when the grooved surface on E and the sharp metal points at F (which project from the side and under the top plate at G) cause the cramp to grip the sides of the joist. A rough strip of wood is now inserted between the floor board and the plate C to protect the edge of the board, the arm B is rotated in the direction of the arrow "3," and this causes the plate C to move forward as shown by the arrow H to exert considerable pressure on the boards until the joints between them are completely closed. The boards are then nailed as described on p. 65, the cramps and the strip of wood are removed, and the operation is repeated on the next five or six boards.

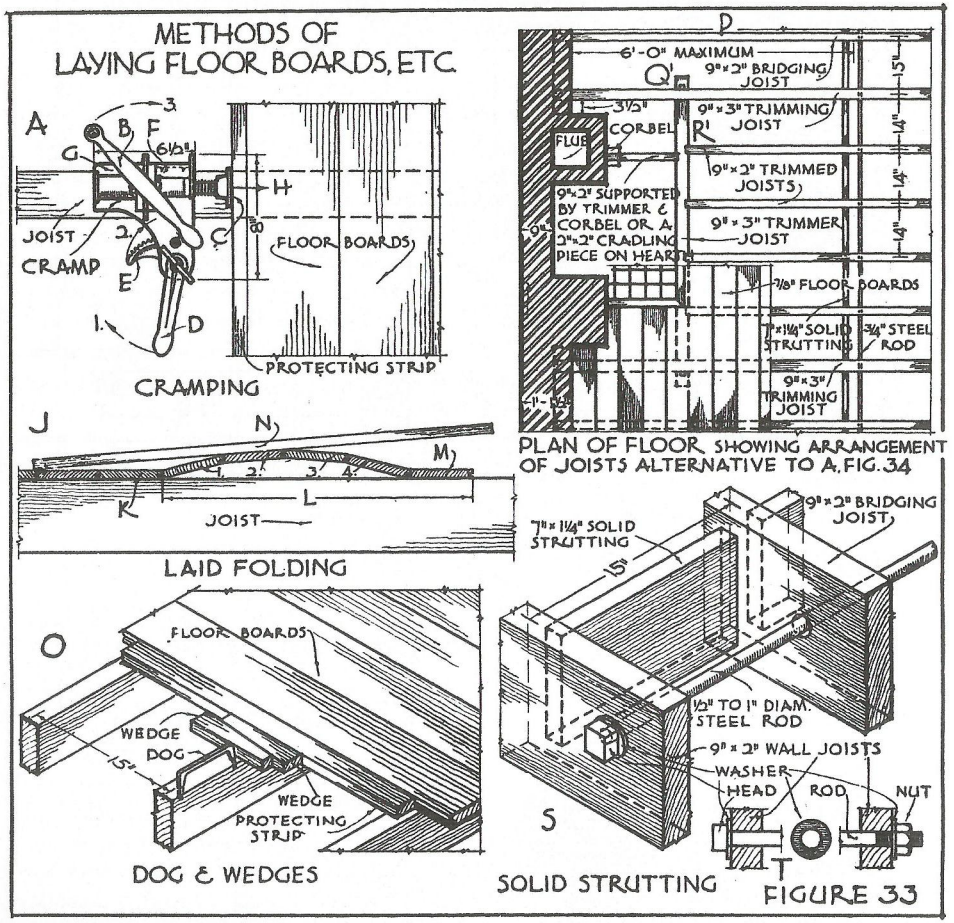

FIGURE 33

As the work proceeds towards the opposite wall, the last few lengths of boards cannot be cramped owing to lack of space. These boards may be brought up tight by using a piece of floor board which is inclined with the upper edge against the wall and the lower edge against the protecting strip; a few smart knocks with a heavy hammer on the upper end of the piece of board will close up the joints.

When a cramp is not available the joints between the boards may be closed by "jumping them in" or "laid folding." This method is shown at J, Fig. 33. Assuming that the floor has been laid up to K, a board M is nailed at a distance L which equals the width of the five boards when placed in position tightly by hand less $\frac{1}{4}$ to $\frac{1}{2}$-in.,