quadrant bead or cover mould may be introduced (see the right side of the binder). The lower arrises of the binder may be chamfered or otherwise moulded.

Detail B shows the binder consisting of two undressed deals which are bolted together at 2-ft. intervals, the upper bolts staggering with the lower. Two methods of covering the binder are shown. That on the left shows a casing or lining of $\frac{5}{8}$-in. dressed boarding secured to fillets nailed to the binder; the thickness of the fillets varies according to the over-all size and proportion of the binder desired. Alternatively, the lining may be fixed direct to the binder as shown on the right. The joints between the side and soffit lining boards may be either butt mitred, tongued mitred (see detail at G) or, preferably, lipped mitred (see detail at H).

The whole of the casings illustrated in Fig. 8 should be prepared and cramped on the bench to ensure tight-fitting joints.

An alternative casing, consisting of plywood, is shown at C and detailed at J. The angle beads provide an effective finish at the arrises.

A mock beam or binder is shown at D. Short lengths of floor boards, or equivalent, are nailed to alternate joists and the framed casing is fixed to these. This construction does not, of course, strengthen the floor, but it is sometimes adopted for dividing the ceiling into bays.

Detail E shows a wood casing fixed to cradling pieces which are notched over the flanges of the steel binder and nailed to the joists (see p. 34). The joints between the three pieces forming this casing and that at D may be any one of those mentioned above.

The detail at F is alternative to that shown at Q, Fig. 7 (see p. 34). The binders are supported on continuous bearers which are notched over the upper flange of the steel girder and bolted to its web. The sides of the bearers must be counter-lathed as explained on p. 31.

FIRE-RESISTING FLOORS.—Reference is made on p. 31 to the fire-resisting types of floor construction[1] now employed, in which little, if any, timber is used. Whilst a close study of such construction is outside the scope of the second year curriculum, it is thought desirable to include some of its details here in order that a comparison may be made between the older and relatively modern types of floors.

A, Fig. 9, shows a part-plan of a typical floor of a steel-framed building on which the steel members are indicated in outline. This is sometimes called a *triple* floor, as it consists of three sets of beams, *i.e.*, *filler* or *primary*, *secondary* and *main beams*. The filler beams, usually spaced at not more than $2\frac{1}{2}$-ft. centres, are encased in concrete and are either supported on, but not fixed to, the top flanges of the secondary beams or are secured to the webs of the latter beams. The secondary beams have steel angle cleats riveted or bolted at the ends, and these cleats are secured in a similar manner to the webs of the main beams. The latter are either riveted or bolted to the steel pillars. Such connections may be welded (see footnote to p. 121, Vol. II) in lieu of cleats and rivets or bolts. The cross-section of a pillar is similar to that of a steel beam. In addition to the filler beams, the secondary beams, main beams and pillars must be encased in concrete or other suitable incombustible material. The sizes of the various steel members depend upon the load to be supported, span, method of fixing, etc. The method employed of determining the sizes of the beams is given briefly in the examples on pp. 34 and 35.

Details of this floor are shown at B, C and the isometric sketch at D, Fig. 9.

In lieu of filler beams encased in concrete, the floor may consist of hollow concrete or fireclay blocks or beams supported on the concrete haunches of steel beams. One example of such a floor is shown at C, Fig. 10. The steel bars are provided to resist tension and shear stresses.

Another type of fire-resisting floor is shown at B, Fig. 10. This portion of a reinforced concrete floor is known as a *slab*. Such a floor may resemble somewhat that shown at A, Fig. 9, with *transverse bar* reinforcement at close spacing in lieu of filler beams. Another set of bars, called *distributing* or *longitudinal bars* are placed at a greater distance apart immediately over and wired to the transverse bars. Various forms of reinforcement—such as sheets of expanded metal—are also used as an alternative to the above circular bars; the expanded metal resembles that shown at A, Fig. 16, Vol. II. The entire floor structure is usually of reinforced concrete. Thus, the secondary and main beams are of concrete, reinforced with steel bars, and the concrete pillars have similar but vertical reinforcement; the pillars may be square, rectangular, octagonal or circular on plan.

FLOOR FINISHES.[1]—The following coverings will be described: (1) wood boards, (2) wood blocks, (3) plywood, (4) parquet, (5) cork and (6) rubber.

1. *Wood Boards.*—A description of this flooring appears on pp. 62-65, Vol. I. As stated, rift or quarter sawn narrow boards are preferred for first-class work, stock nominal sizes varying from 2 to $4\frac{1}{2}$-in. wide by 1 to $1\frac{1}{4}$-in. thick; the width of stock softwood boards used for general work varies from 5 to 7-in. Stock lengths vary from 2 to 16-ft. An attractive flooring is obtained by the use of hardwood boards of random widths, but these must be well seasoned to the correct moisture content if excessive shrinkage is to be avoided. Tongued and grooved boards are chiefly employed; most are square ended, but some of the hardwood boards (*e.g.*, Canadian yellow birch) are t. and g. at the ends.

A double floor (see "double boarded floors," p. 65, Vol. I), now much favoured, consists of a sub-floor of 1-in. square edged (or t. and g.) softwood boarding, laid diagonally, and covered with 2 to 3-in. wide hardwood boards which are only $\frac{3}{8}$-in. thick. This thin and narrow covering, which has a very attractive appearance, is known as *strip flooring*; the boards are t. and g. at the edges and ends and are usually secret nailed. One advantage of a double floor is that plastering can be completed and allowed to dry before the top flooring is laid; a common cause of damage to the finished floor is thus eliminated.

The timbers used for flooring include the following softwoods: Douglas

[1] This construction is treated in greater detail in Vol. IV.

[1] Magnesite, terrazzo, tiled, etc., floors are described in Vol. IV.