

a minimum fall, must be well screwed to the fascia. The double top tile course forming part of the soffit is provided to ensure that the wood fascia will not be exposed to view at the highest part of the gutter. A lead flashing, as shown, ensures watertight construction, and the roofing felt is brought over its upper edge. The hollows of the over tiles at the eaves are filled with mortar, and tile insets, shown at Q, add to the appearance. The lower ends of the vertical battens are cut short (see r and q) to permit of this.

NOTE.—The space between the head of the bottom over tile and the tail of that above it is exaggerated and is due to the clearance at the laps of the unders which has been shown purposely to make the detail clear.

The ridge is usually finished with half-round or segmental ridge tiles. Conical or tapered hip tiles which course in with the Spanish tiles provide a suitable finish at the hips. Verges are treated as before described, as are also valleys and abutments.

There are several forms of tiles manufactured to resemble Spanish tiles. Thus, the overs are sometimes hog-back in shape, and in another type both unders and overs are much flatter than the traditional form.

INTERLOCKING TILES.—A number of tiles are now made which have patent locking devices, the object of which is to prevent their dislodgment even in the most exposed positions. Some of these do not require nailing, whilst others are secured to battens by means of wire. Thus, for example, one device consists of two lugs formed on the underside at the tail of an Italian over, which closely engage the shoulders at the head of the over which it overlaps. In the "wired" variety, which has usually a head and side locking device, a piece of wire is passed through a hole formed in a nib and twisted round the batten.

Most tiles of the interlocked type are machine-made. Some of these, of continental origin, have stamped on them a central ornament in relief, such as a rib or diaper. Because of their initial cheapness, and also owing to the available local materials failing to meet the large demand which followed the Great War, large numbers of these foreign tiles were used in this country. Many were underburnt and so lacking in durability that they had to be replaced within a very short period.

CONCRETE TILES.—Within recent years there has been an increasing demand for roofing tiles made of concrete or cement mortar. Plain tiles, pantiles, interlocking tiles, and ridge, hip and valley tiles are made of this material. Cement, sand or crushed stone, pigments and an accelerator are materials employed in their manufacture.

The cement used is usually ordinary Portland cement. The aggregate must be clean, well graded and must pass a $\frac{1}{8}$ -in. sieve. The pigments vary according to the colour desired. Thus, a black is produced by carbon black pigment, blue by ultramarine pigment, brown by burnt umber pigment, yellow by yellow ochre, green by chromium oxide and a red colour is effected by the use of red oxide pigment. An accelerator is introduced to expedite the rate of hardening, and that used is calcium chloride.

Concrete tiles are produced in machines which are either of the hand-operated or the automatic type. Thus, concrete plain tiles, which are cambered, each having two nibs or a continuous nib and of the same size as clay plain tiles, are made in a hand-operated machine in the following manner: The cement, aggregate, accelerator and water are thoroughly incorporated in a batch mixer (see p. 34, Vol. II). An oiled pallet is placed in the cast-iron moulding box of the machine which is then filled with concrete. After being consolidated the surface of the concrete is levelled or struck off and the pigment, mixed with cement and sand, is sprinkled over it from a sieve and trowelled in. In some machines the area of the pallet and box is twice that of the tile, and after the last operation, a hinged metal frame is swung down to divide the concrete slab into two and form the nail holes. The pallet with the two nibbed and cambered tiles is raised by depressing a treadle.

In an automatic machine the above operations are effected as the pallets on a track are automatically moved and brought in turn under separate parts of the machine. Thus, in sequence, the pallets are sprayed with oil, fed with the mortar mix, consolidated, surface smoothed off, cut into units by a rotating knife, surface colour applied and rolled in, nail holes formed and the edges finally trimmed.

After moulding, the tiles (with their pallets) are carefully stacked horizontally on racks and taken to the curing chamber, in which the air is conditioned to the required temperature and humidity, and left for twenty-four to forty-eight hours, according to the amount of accelerator added to the mix. The tiles are de-palleted, dipped in a tank containing sulphate of iron solution (which improves the colour and removes any white film formed whilst in the chamber), and finally removed to an open shed or yard where they are stacked to complete the hardening process.

The quality of concrete tiles is covered by the British Standard Specifications for "Concrete Plain Roofing Tiles, No. 473—1932" (which specifies the sizes to be 10½-in. by 6½-in., 10½-in. by 6¾-in. or 11-in. by 7-in. by at least $\frac{7}{16}$ -in. at the centre cross-section and $\frac{3}{8}$ -in. at the head and tail) and "Concrete Interlocking Roofing Tiles, No. 550—1934." These specifications give particulars of transverse and permeability tests with which the tiles must comply. Whilst these concrete products, produced by these relatively modern methods, have not been subjected to the real test of time, there is no reason to doubt their durable quality, provided the best materials and workmanship have been employed in their manufacture. The appearance of such mechanical units is, of course, much less attractive than that of the richly textured hand-made clay tiles.

ASBESTOS-CEMENT SLATING, TILING AND SHEETING

Asbestos-cement is now widely used in the manufacture of many building materials, including roofing slates, tiles and corrugated sheets, wall boards, rainwater goods, felt, etc.