thickness of the bed joints is therefore not increased. Hand shears are used to cut the material into lengths as required.

The example at B shows the application of 2½-in. (see A), 7-in. and 12-in. wide Exmet. Combinations of these widths are used for thicker walls, and when so employed, the material considerably improves the longitudinal tie which is especially weak in thick walls. The strips should be lapped 3-in. at the intersections, as shown, and at the joints. Sometimes only 2½-in. wide strips are used for any thickness of wall, one strip to each half-brick thickness of the wall, and is thus similar to that shown at D. The amount of reinforcement used depends upon the nature of the loading, and whilst it may be necessary to reinforce every course, it is usual to provide reinforcement at every third or fourth course. Another arrangement consists of staggering the strips, thus in a 13½-in. wall, one 2½-in. strip is placed on one course at 1-in. from the external face, another strip is provided in the centre of the next course, and in the following course a 2½-in. strip is placed 1-in. from the internal face; this is repeated for the full height.

Cavity walls (p. 40) may be reinforced by a 2½-in. strip at every third course of each 4½-in. lining. Partition walls, built with bricks laid-on-edge, may also be strengthened by the provision of 2½-in. wide Exmet. The 2½-in. wide strips especially are suitable for curved walls (p. 44), as this width can be readily bent as required. Expanded metal is also used to strengthen walls of chimney stacks and parapets built in exposed positions. Further applications include footings, walling over wide door and window openings, boundary and balcony walls and tall chimneys. Reinforcement of retaining walls, piers and arches is referred to in next column and on p. 48. It can also be usefully employed at toothings (see p. 4, Vol. I) when the bond between new and existing walls at the indents is reinforced if the strips are left projecting beyond the old work and built-in as the new wall is constructed.

Another well-known form of meshed reinforcement, called Bricktor,[1] is shown at C. It is made of steel wire, black japanned as a protection, produced in 2 and 2½-in. widths and sold in coils. The 2-in. width is suitable for brick-on-edge partitions and consists of four straight *tension wires* of 17 B.W.G. (0·058-in. dia.) interlaced with three 19 B.W.G. (0·042-in. dia.) *binding wires*. The 2½-in. strips have five tension wires and four continuous binding wires, each twisted to and between a pair of tension wires as shown. One strip is provided at every half-brick thickness of the wall (see D). It is very easily handled, and is used for similar purposes and in like manner as described for Exmet.

A type of reinforcement much used to strengthen brick walls in the past is shown at E and F. This consists of wrought iron (known as *hoop iron*, hence the name applied to the bond) or mild steel flat bars which vary in width from ⅞ to 1¼-in. and $\frac{1}{16}$ to $\frac{1}{10}$-in. in thickness. Protection against rust is provided by dipping the bars in hot tar; these are then at once sanded to increase adhesion of the mortar. One strip is provided per half-brick thickness of wall, and it is usual to reinforce every sixth course (see E). This detail shows the treatment at a right-angled quoin where the ends are double-hooked (see J) and beaten flat; alternatively, the middle and inner strips may be continued and single-hooked (see K) to the two outer strips. At an intersection (see H) the bars are interlaced and single-hooked. Any joints between long lengths are in the form of a welt (similar to D, Fig. 73, Vol. I). Although less effective, thin wire twisted round the bars may be used instead of the more expensive hook-and-welt joints. Hoop iron is now rarely employed, and whilst it is stronger than Exmet and Bricktor, it is more costly. It is also difficult to bed the bricks evenly unless the joints are unusually thick.

[1] A product of Messrs Johnson's Reinforced Concrete Engineering Co. Ltd.

Retaining walls (those supporting earth, etc.) are often reinforced. If either of the meshed types are used, 2½-in. strips may be embedded in the vertical joints to assist in resisting lateral pressure in addition to the bed joint reinforcement. Another form of reinforcement consists of vertical bars of circular section, and details of an actual retaining wall[1] of such construction is shown at L, M and N. This 9-in. wall is built of engineering bricks in cement mortar (1 : 3) and reinforced with vertical mild steel bars near each face, in addition to steel meshed strips at every fourth course. The bricks opposite the vertical bars are purpose-made and grooved as shown at P. These grooves are slightly larger than the diameter of the bars to permit the latter to be grouted in with mortar to prevent corrosion. In constructing such a wall the bars are accurately placed in position, the ends being bent and anchored into the concrete foundation (see L). Erection of the bars is facilitated by the use of thin (10 B.W.G. or 0·134-in. dia.) steel wire ties at every fourth course. These ties, which are built in as the work proceeds, are twisted round the bars, and those round opposite bars are tightened by twisting their ends. When the top course has been completed the grooves on face are well pointed so that the vertical rods are completely encased in cement mortar. Vertical damp proofing (see p. 52) completes the wall. If it is an area wall it may be finished with a stone or reinforced concrete coping and the ends of the vertical bars would be bedded in it to strengthen the work.

The walls are designed in accordance with the stresses to be resisted, and the size and spacing of the vertical reinforcement are therefore variable. Sometimes the bars are arranged near to both face lines of the wall, opposite to each other and in pairs at 9-in. centres with steel wire connections placed in the horizontal joints.

Perforated bricks may be used instead of grooved or slotted bricks, the centre of the perforations being about ¾-in. from the external face. As these must be threaded over the vertical bars, they are not so convenient as the grooved bricks, although they are quite suitable for dwarf walls such as balcony, parapet and garden walls. The position of the vertical bars is concealed when perforated bricks are used in wall construction, and such are therefore preferred to grooved bricks when the appearance of the brickwork is of importance.

Many air-raid shelters have been constructed of reinforced brick walls. In such work the vertical bars are placed in position and the brickwork built round them. Special bricks are not employed, ordinary stocks being cut as required.

[1] Constructed by the patentees, Messrs B. Morton & Sons, Manchester.