Dry Hydrated Lime (p. 21) should be reduced to a putty consistency by the addition of water and allowed to stand (*soak*) for about two days before being mixed with sand.

Black Mortars (see p. 26).—A common proportion is 1 part lime to 3 parts ashes or clinker (mixed in the mill). They are hard-setting mortars and are suitable for internal walls and for brickwork and masonry where the colour is not objected to.

Cement Mortar (see p. 2, Vol. I).—It is stronger than lime mortar and is therefore used in the construction of piers and load-bearing walls ; it is also usefully employed for work below ground level and for external walls in exposed positions on account of its impermeability. Cement mortar is now extensively used during winter, as it is not so liable to damage by frost, owing to its relatively quick-setting property. It must be used immediately after mixing. Efflorescence may be caused, due to the presence in the cement of carbonates and sulphates of potash and soda (see p. 13). The usual composition is 1 part cement to 3 parts sand ; tests have shown that nothing is gained by using a richer (and more costly) mix than this, provided the sand is well graded. A dense cement mortar should not be used for bedding and jointing low-strength bricks (p. 26).

Lime-cement or Compo Mortars.—Compo is a mixture of lime, cement and sand. It is usual to mix the lime mortar as already explained, and then *gauge* (add to) this mixture with the necessary proportion of Portland cement immediately before the mortar is required for use. Only non-hydraulic and feebly hydraulic limes should be used for this class of mortar. The addition of the cement increases the hydraulicity of the mortar, besides increasing its strength, and the rate of hardening is therefore accelerated. This quality makes it a useful mortar to be employed in winter. Compo is more open textured than cement mortar and is therefore better suited for bedding and jointing bricks of moderate or low strength. The gauging also increases the workability of the mortar. The proportions vary from 1 part cement : 2 to 3 parts lime : 9 to 12 parts sand. Eminently hydraulic and magnesian limes should not be gauged with cement.

Compo is an excellent mortar for rubble, flint and similar walling where a large proportion of bedding material is required. When ordinary lime mortars are used for this class of work there is a tendency for excessive shrinkage to take place, and this may cause cracks through which water may penetrate. Compo for such work may consist of 1 part cement : 4 parts lime : 12 parts sand.

Fire-resistant Mortar.—Ordinary lime and cement mortars are unsuitable for setting firebricks or fireclay blocks used for lining furnaces, fireplaces, etc., as they shrink considerably when subjected to heat. There are several proprietary mortars specially produced for this class of work. A good fire-resisting mortar consists of a mixture of 1 part cement (preferably aluminous cement, see p. 25) to 2 parts finely crushed firebrick (p. 16).

Strength of Mortar.—Cement mortar produces the strongest brickwork, non-hydraulic lime mortar walling is approximately half the strength of that in cement mortar, and the strength of eminently hydraulic mortars is intermediate between that of cement and non-hydraulic lime mortars. The strength of compo mortars depends a good deal upon the cement content and may be very little less than cement mortar.

Colour of Mortar.—Whilst the colour of the mortar is immaterial if the brickwork is to be covered with plaster or roughcast, it is very important that the colour shall suitably conform with that of the bricks when these are to be used in the construction of faced work. The appearance of brickwork is often spoilt through inadequate attention being paid to the colour and texture of the jointing material, even when the bricks are expensive facings. The colour of mortar is influenced by both the lime or cement and the aggregate, and in order to obtain the desired result it is sometimes essential to try out different materials and proportions.

The colour of lime mortar varies from white (when pure lime—p. 20—is used) to black (preceding column). Ordinary Portland cement mortar is grey in colour ; white Portland cement with a light-coloured sand produces white mortar ; different shades can be obtained by using coloured cements (p. 25). Sand varies in colour from white to dark brown or red. A yellow sand, mixed with a grey lime, produces a satisfactory colour for certain sand-faced brickwork.

Multi-coloured brickwork especially is apt to be disfigured by iron stains. As this staining disappears after the brickwork has weathered, it is advisable to defer the pointing of such brickwork.

In masonry, and in order that the mortar shall harmonize with the stone, it is a common practice to use crushed stone (p. 26) in lieu of sand. Thus, for Portland stone ashlar work the proportions recommended are 2 parts Portland cement : 5 parts slaked lime : 7 to 12 parts crushed Portland stone.

Waterproofed Mortars.—There are now available a large number of proprietary substances, called *waterproofers*, which are mixed with mortars to render them impervious. They are marketed in the form of powders, pastes and liquids. Their object is to either fill the pores of the mortar or to line the pores with a film of water-repellent material. Most of these, such as " Cementone," " Medusa," " Pudlo " and " Sika," are only suitable for cement mortars. As such mixtures must not be used after the initial set, it is necessary to apply the material without delay and in some cases within half an hour after the water has been added. Unused partially set mortar must be discarded.

The amount of waterproofer added varies and should be in accordance with the manufacturers' instructions. When in powder form, the mixture may consist of 1 part cement : 2 to 4 parts sand : 2 to 5 per cent. of the waterproofer ; the required amount of the powder is added to and well incorporated with the cement before being spread over the sand ; the whole is then mixed dry before the water is carefully added, after which it is mixed to an even consistency. When in the form of a paste, water is added very gradually to the waterproofer in the usual proportion of 1 part paste to 10 parts water whilst being well stirred to reduce the solution to a uniform consistency ; the cement and sand are well mixed dry before the solution is added, and then mixed wet to a workable condition. If in liquid form, it is usual to add 1 gal. of the waterproofer to every 15 gals. of water ; the cement and sand are mixed dry before this " gauging water " is added and finally mixed wet.

Further reference to waterproofers is made on p. 36.