as shown by broken lines at H. An alternate form of raking coping is shown in the side elevation J, Fig. 27.

MASONRY JOINTS

The following are some of the various joints which are used in masonry: butt, rebated, tongued and grooved, rusticated, saddled, joggled, dowelled and plugged. Some of these have been referred to on the previous pages.

Butt or Square Joint.—This is extensively adopted and is formed by placing the square surface of one stone against that of another. Of the many examples of this joint which have been illustrated are the ashlar joints at B, Fig. 25, and those at F and G, Fig. 27.

Rebated or Lapped Joint (see A, B, C and D, Fig. 25, and H, Fig. 27).—In the former figure the check or rebate prevents movement between the arch voussoirs, in the latter example the rebate is adopted to secure a weather tight joint. Another form, known as a *rebated and broken joint*, is shown at J, Fig. 27.

Tongued and Grooved Joint (see K, Fig. 27).—It is now rarely used. It consists of a tongue or projection worked along one edge of a stone which fits into a corresponding groove in the adjacent stone. It is sometimes adopted as an alternative to the rebated joint in flat arches and between the horizontal slabs forming the landings of stone staircases.[1] It is also known as a joggled joint, which must not be confused with the cement joggled joint described below.

Rusticated Joints (see Fig. 27).—Plinths, lower storeys of buildings, and quoins are sometimes emphasized by the use of blocks of stone which have their margins or edges sunk below the general face. The term "rusticated" is applied to such masonry. That at L and M shows a *channelled* or *rectangular* joint and is often adopted (see also B, Fig. 26). Note that the sinking is on the *lower* stone; if the bed joint was at the bottom of the channel, water would lodge on the bottom and perhaps penetrate into the mortar joint. The vee-joint at N and O is formed when stones having chamfered edges are placed in position; see also Q and V, Fig. 19. A more elaborate form of vee-joint is shown at P and Q, Fig. 27, and is known as a *vee and channelled* joint.

Saddle Joint.—These are illustrated at A, C, M and Q, Fig. 26, and have been described on p. 49.

Joggles, Dowels and Cramps.—In order to prevent movement and displacement of certain stones the ordinary mortar joints between them have to be supplemented and strengthened by various means. This additional strength is obtained by the employment of joggles, dowels and cramps.

Joggled Joint.—The mortar joggled joint is adopted for the end joints of ashlar, especially when the blocks have a small bed (see p. 47), and for cornice stones (see p. 49). The grooves down which the grout is poured are roughly formed by means of a hammer and punch (see 6, Fig. 19).

Dowelled Joint.—Stones which are liable to become displaced are prevented from doing so by the introduction of dowels at the joints (see J, Fig. 22 and G, Fig. 27). Dowels are either of slate or gunmetal (an alloy of copper and tin) which are from 1 to 2-in. square in section and two or three times the thickness in length. They are set in cement mortar. A horizontal dowel in an end joint is usually run in with grout (through a vertical hole prepared for the purpose) after it has been inserted and the adjacent stone fixed (see R, Fig. 27).

Cramped Joint.—The joints between stones which are liable to be pulled apart in the direction of their length are reinforced with either metal or slate cramps.

Details of a metal cramped joint are shown at T, Fig. 27, which may be considered to be an enlargement of that shown by dotted lines at S, Fig. 24, and used to connect the coping stones. The cramp is a piece of *non-corrosive* metal,[1] such as gunmetal, which is from 1 to 2-in. wide, $\frac{1}{4}$ to $\frac{1}{2}$-in. thick and 9 to 18-in. long with ends which are turned down from $\frac{3}{4}$ to $1\frac{1}{2}$-in. The cramp must be fitted in tightly, after which it is grouted and covered with either cement or asphalt. A *slate cramped* or *keyed joint*, consisting of a double dovetailed piece of slate set in cement, is shown at S, Fig. 27. It is not so effective as the metal cramped joint.

Plugged Joint (see Y, Fig. 27).—This is an alternative to the cramped joint but is now rarely adopted. It is formed by sinking a hole (dovetailed on plan) below the top surface and a vertical vee-joggle in each end of the adjacent stones. The stones are jointed in the usual way (the hole and joggle being kept free from mortar), after which cement grout is poured down to form a *cement plug*. Formerly, molten lead was poured in to form what was called a *lead plug*.

MORTAR JOINTING

The thickness of mortar joints varies considerably, thus for ashlar the joints may be as fine as $\frac{1}{8}$-in. whereas those in random rubble work may exceed 2-in. width on face. Certain of the joints used for brickwork illustrated at T, Fig. 17, are also suitable for stonework, *e.g.*, flush joints are used for ashlar and the keyed or vee-joint may be adopted for thicker joints. The *mason's joint* is also used for wide joints. This may be of the three forms shown at U, V and W, Fig. 27. The two former are sometimes used for rubble work, and that at W is frequently adopted for pointing. These projecting joints should be of cement mortar if the character of the stone will permit it.

As mentioned on p. 47, the beds of ashlar blocks should be square with the face. When hand-dressed, there is a tendency for the mason to work *hollow*

[1] Stone landings are seldom used nowadays, reinforced concrete construction being preferred.

[1] Corrodible metal, such as wrought iron, must *never* be used for cramps, bolts, etc., which are fixed in stonework. Extensive damage has been caused to masonry which has been connected by wrought iron fastenings on account of them corroding. During its formation, the rust exerts pressure upon the stone to such an extent as to fracture it.