Stone steps are used externally in areas to basements, heating chambers, etc.

Another application of rectangular steps is given at H, J and K, Fig. 44. The elevation is that of the façade of a small public building, such as offices or a bank. Whilst this is not a common arrangement of steps for an entrance, it is given here as an alternative to the more usual form shown at C, and it has an advantage in that the balustrade is useful, especially to the infirm and older members of the public who may visit the building. A detail of the steps is given at G ; these are of good proportions, with the bottom of the front edges square rebated and the tread nosings moulded ; these nosings are returned on the outer ends of the step (see H and K). The steps and landing are built 6-in. into the main wall and are supported on a wall at the outer ends. The landing consists of three stone slabs (see H and J) connected together by *joggle joints* (see the section at H and also the detail at F, Fig. 45). Each bottom step consists of an edging of stone blocks cut to the section shown at G, with a 2 or 3-in. thick flag solidly bedded on a concrete bed (see section at H). The metal balustrade is secured to the steps as described on p. 115. Alternative designs of the latter are shown in Fig. 45.

STAIRS.—Stone was commonly preferred to timber in the construction of principal staircases of municipal and commercial, etc., buildings. This material has been largely superseded and such stairs are now chiefly of reinforced concrete construction (see p. 120). Where stone is still specified for this purpose, it is generally in districts where suitable local sandstone is employed.

A stone open well stair is detailed in Fig. 45. The plan H shows twenty steps, including landings, arranged round a 2-ft. 4-in. wide well. As shown in the sections G and J, these steps are of the spandril type already described. They are also known as *cantilever* or *hanging steps*, as each is fixed at one end only, the other being free and finished with a returned moulded nosing as detailed at A. The sketch at E shows the built-in end of a spandril step ; the spandril soffit is stopped at the face of the wall (or plaster) and a square seating is formed at the end which is built into the wall (which latter is preferably constructed in cement mortar), the wall hold varying from $4\frac{1}{2}$ to 9-in. The ends of these steps are bedded in cement and solidly fixed all round—especially at their top surfaces—with sound pieces of slate, etc. set in cement ; the steps are also jointed in mortar.

Each of the alternative spandril steps shown at B has its returned nosing continued to line with the face of the riser of the second step above it. Of good appearance, they are stronger than those at A because of their increased thickness. The steps at C form a broken soffit, the appearance of which is less satisfactory than the above. The moulded soffit formed by the steps at D is attractive. Alternative nosings are shown at C, K, L and M, the bold appearance of the latter being especially effective (see C, Fig. 37 and H, Fig. 38.) Note that the proportions of these steps agree with the rules stated on p. 82, Vol. III.

The half space landing consists of four slabs, joggle jointed, which are solidly built into the walls. The thickness of this landing may be either $6\frac{1}{2}$ or $8\frac{1}{4}$-in. (see R) ; whilst the latter gives a satisfactory finish on the underside where it joins step 19, it results in a large increase in weight of each slab. The joggles are stopped at the free ends at least, and thus only butt joints are exposed, as shown at F. Each of the quarter space landings may consist of two slabs, joggle jointed, to facilitate handling and fixing.

The steps may be built-in as the walls are being constructed, or fixing may be deferred until the walls have been built and the building is nearer completion. The latter is the usual course adopted and risk of damage to the steps is thereby minimized ; the pockets which receive the ends of the steps are formed and temporarily filled in with bricks laid in sand as the walling proceeds, which bricks are thereby easily removed when required. A storey-rod is used to ensure that the steps are built in at the correct heights (the bottom one being fixed first) and the free ends of the steps are securely strutted down to the floor ; these vertical wood struts must not be removed until the work has set. If built-in as the general work proceeds, the steps must be adequately protected with rough wood casings ; these must be well secured and should be frequently examined, as a dislodged casing may result in a damaged nosing.

The weight of wall tailing down the fixed ends of the steps must be adequate to ensure stability of a cantilevered stair. The strength of the stair shown in Fig. 45 would be considerably increased if, as shown at S, a mild steel beam was provided to support the half space landing at its outer edge and a steel channel or beam was introduced at the soffit of each flight and near to the free ends of the steps. The detail S shows the connection between the landing beam (which would have a 9-in. bearing on the walls) and the top flight channel. Such steelwork is necessary for wide stairs, especially if subjected to heavy traffic. Incidentally, it assists in preventing a total collapse of the stair in the case of fire. If desired, such steelwork may be encased in concrete and either plastered or finished with thin stone slabs bedded to the concrete, as shown at B, Fig. 46.

BALUSTRADE.—Two alternative designs of wrought iron balustrades are shown at G and J, Fig. 45, and alternative details of these are shown at K, L and M. The fixing of the balusters at K has been described on p. 115 ; as indicated, the dovetail mortice which receives the baluster must be set back from the end face of the step (unless the nosing is of the type shown at M). This reduces the effective width of the stair, and to avoid this the balustrade may be of the design shown at G and J where balusters of small section, connected at their lower ends to a $1\frac{1}{2}$-in. by $\frac{1}{4}$-in. bar, alternate at intervals with 1-in. square *bracket balusters*. The latter are so called because they are connected to the *ends* of the steps in a similar manner to that described, the balusters being curved to clear the nosings (see also detail L) ; the cover plate shown may be used to provide a good finish and it may be either bedded on cement or fixed by small screws secured to plugs driven into holes drilled into the stone. This detail also shows the method of fixing a wood handrail to a metal balustrade ; the upper ends of the balusters are screwed to a $1\frac{1}{4}$-in. by $\frac{1}{4}$-in. wrought iron bar and the handrail is secured to this with screws, the latter being fixed from below at intervals between the balusters. An alternative wood handrail, fixed in a similar manner, is shown at M. The balustrade may be of bronze as an alternative to wrought iron (see also B, Fig. 46).

The brick walls of this staircase may be either plastered or faced with ashlar