

These are supported by walings which, in turn, are maintained in position by inclined struts or *shores*. The feet of the latter abut against stout timber sole pieces, or wood platforms, well anchored into the ground.

Sometimes patent interlocking sheet piling of steel is used instead of timber. These are driven in, like runners, trenches are excavated, the retaining walls are constructed and the bulk excavation is then carried out.

The sides of smaller general or site excavations are often supported by runners, walings and long baulk timber horizontal struts propped vertically at intervals.

These methods are described more fully in Vol. IV.

### CENTERING

Centres up to 6-ft. span are described on pp. 83-85, Vol. I. Most syllabuses of Building Construction, Second Stage, include centering suitable for spans not exceeding 10-ft., and typical examples of these are illustrated in Fig. 20 of this volume.

The construction of centres differs widely according to the shape, span, width of soffit and the material of which the arches are to be constructed, in addition to the scantlings of the timber available.

A centre must be of sufficient strength to temporarily support the load to be imposed without distortion, and it must therefore be designed to resist the compression and tension stresses set up during and after the construction of the arch (see p. 62). Being a temporary structure, it must be economical in material and capable of quick construction. Folding wedges must be provided to permit of vertical adjustment, such as the slight raising or lowering of the centre into correct position prior to the construction of the arch, and for its subsequent easing and striking with the minimum vibration.

**CENTRES FOR POINTED ARCHES.**—An example, suitable for the Venetian arch illustrated at L, Fig. 19, Vol. II, is shown at M and N, Fig. 20. Each rib, to which laggings are fixed, is well nailed to upper and lower ties or *stretchers*. The construction is similar to that shown for the semicircular arch at J, Fig. 43, Vol. I.

**CENTRE FOR CIRCULAR OR BULL'S-EYE ARCH** (see E, F and G).—This opening is to receive a fixed or pivoted light, the frame of which is fixed in the recess. The lower half of the brickwork is constructed as explained on p. 51, Vol. II. This must be allowed to set before the centre is placed in position. The centre consists of two portions, one for the external purpose-made arch and the other for the rough arch,<sup>1</sup> and it rests upon wedges supported by struts. It will be noted that no laggings are used for the external arch, as they are not required when the width of soffit is only  $4\frac{1}{2}$ -in. Neither have they been employed for the inner arch on account of the small span. If necessary, a short cross-brace may be nailed centrally to the underside of the upper ties. The outer portion

<sup>1</sup> The lower half of this rough arch need only consist of one ring (see sketch c) if the internal face is to be plastered; otherwise it may be formed of two rings as suggested by the broken lines at E.

consists of a pair of ribs nailed to upper and lower ties; sometimes only one rib is used for such a small span. Because of the greater width of soffit the inner centre requires two ribs, placed at approximately 7-in. centres, nailed to two pairs of ties. In lieu of struts the wedges of each portion may be supported on a ring of bricks laid dry on the lower half of the arches.

The elevation of the inner portion of the centre has been omitted at E; but for the sizes of the members this is similar to that of the outer portion shown.

**CENTRE FOR SEMICIRCULAR ARCH WITH ORDERS.**—The centre illustrated at A, B and C, Fig. 20, is suitable for the head of the entrance shown at A, Fig. 19, Vol. II. In effect, this is a compound structure consisting of a centre for each of the four rings. The centre for the inner ring, which is first erected, is similar to that shown at J, Fig. 43, Vol. I. Laggings, as shown, are sometimes used, but as the soffit is only  $4\frac{1}{2}$ -in. wide it is usual to dispense with them and employ a centre similar to those shown for rings 2 and 3; when the span is small the latter type may be further simplified by the omission of one of the ribs. As indicated on the plan B, the centres for rings 2 and 3 may be of the type shown for the outer arch at G, described above. The centre for the outer ring 4 is of the type shown at M, Fig. 43, Vol. I, and needs no further description; here again the laggings may be omitted.

Because of the projecting tiled impost (see A, Fig. 19, Vol. II), the lower ties are slightly above the centre to which the voussoirs of each ring radiate. It is therefore desirable to use a short centre block for each wood ring centre, with a space between each (see broken lines on plan) to permit of the use of radius rods or lines, as described on p. 24, Vol. I. In order to simplify the drawing, these blocks have been omitted from section D-D.

Some bricklayers prefer to bring into use each ring centre only as required. Thus, that needed for ring "2" would not be placed into position until ring "1" was built, and the outer centre would not be placed on its supports until after the construction of ring "3." This provides for greater accessibility and there is less likelihood of the brick voussoirs being stained from extruded mortar during construction. This also enables the individual adjustment of the centres preparatory to the construction of each ring, as the upper bearers would not be continuous, as shown, but each centre would have a short bearer nailed to each end of the lower ties, with small wedges between it and the lower continuous bearer.

**CENTRE FOR SEMICIRCULAR STONE ARCH** (see J and K).—This arch is similar to that shown at A, Fig. 37, Vol. II, the span being increased to 10-ft. in order to illustrate a centre having the maximum span stated in the syllabus. The construction closely resembles that of the centre shown at M, N and O, Fig. 43, Vol. I. Each built-up rib of 9-in. by  $1\frac{1}{4}$ -in. stuff is connected at its feet by two 7-in. by  $1\frac{1}{4}$ -in. ties. Two inclined struts or braces and a vertical central strut or post are provided in addition to an inclined cross-brace and a horizontal cross-brace. The members must be well nailed at the joints to ensure rigidity. Two stout laggings per voussoir are shown. Setting wedges may be used (two are shown