

so as to shorten the span of top chord or sill, and transmit the load as directly as possible to the vertical members and footings. In addition to the concrete members, two diagonal, steel tie-rods with turnbuckles were placed in the second story of each bent to balance the thrust produced on the outer vertical by the outer diagonals in the top story. The middle bents were tied with double diagonal rod bracing at each intersection in each story in addition to the horizontal concrete ties. The details of the concrete tower and the timber falsework above are shown in Fig. 5.

The timber falsework or centering carried on this concrete tower was made up of two vertical bents and four radially inclined bents at each side. (See Fig. 4.) The two vertical bents and the two intermediate inclined bents on each side were made up of four lines of struts parallel to a vertical plane passed through the centre line of structure and two inclined lines of wind bracing struts outside of these to give the bents lateral stability; on the outer and inner inclined bents this bracing is omitted. Each of these lines was made of round unheven timbers bolted together in pairs and they were securely tied together in bents with double lines of horizontal and diagonal sway bracing timbers with the various bents tied together longitudinally in the same manner. In order to allow the

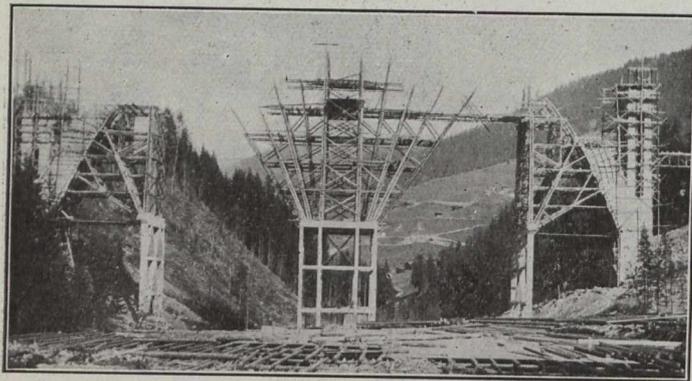


Fig. 7.—View of Falsework Under Construction, Showing Side Falsework Bents.

raising of centres if necessary and to facilitate striking them, all bents were blocked up on the tower on hardwood wedges.

Near the top, the bents are connected by lines of arched struts following very closely the line of the arch rings. At this line the bents branch out into three sets of struts, one following the line of bent and the other two set diagonally and capped with lines of saddle ribs, thus forming an arched truss to carry the decking. Upon the saddle ribs longitudinal timbers, in short lengths cut to the curve of arch ring, were laid and upon these transverse joists to carry the longitudinal lagging for soffit of arch ribs, also the side forms. Fig. 6 shows these details very clearly.

The height of this falsework above the tower was 133 ft., making the total height of centering over 200 ft., which no doubt makes this one of the highest centerings ever used for arch construction.

Side Towers.—The side towers or bents near abutments consisted of single latticed concrete bents supporting one vertical and two inclined bents of timber falsework and tied to the arch abutments by steel I-beams to brace them longitudinally and take up the thrust of the inclined timber bents. (See Fig. 7.)

The framing of the falsework over side towers is similar to that just described except that six lines of posts of struts were used in each bent instead of four. In addition to these, inclined wind bracing struts were framed to the vertical and first inclined bent. The side falsework was tied to the central portion near the top of the former by a continuous set of horizontal and diagonal bracing. The detail framing of concrete bent and timber work is shown in Fig. 8. Each longitudinal line of falsework was laid out, marked and assembled complete on a large platform in the valley close to the arch before erecting. (See Fig. 7.)

Centering for Approaches.—The approach span piers and also the columns supporting roadway deck over arch

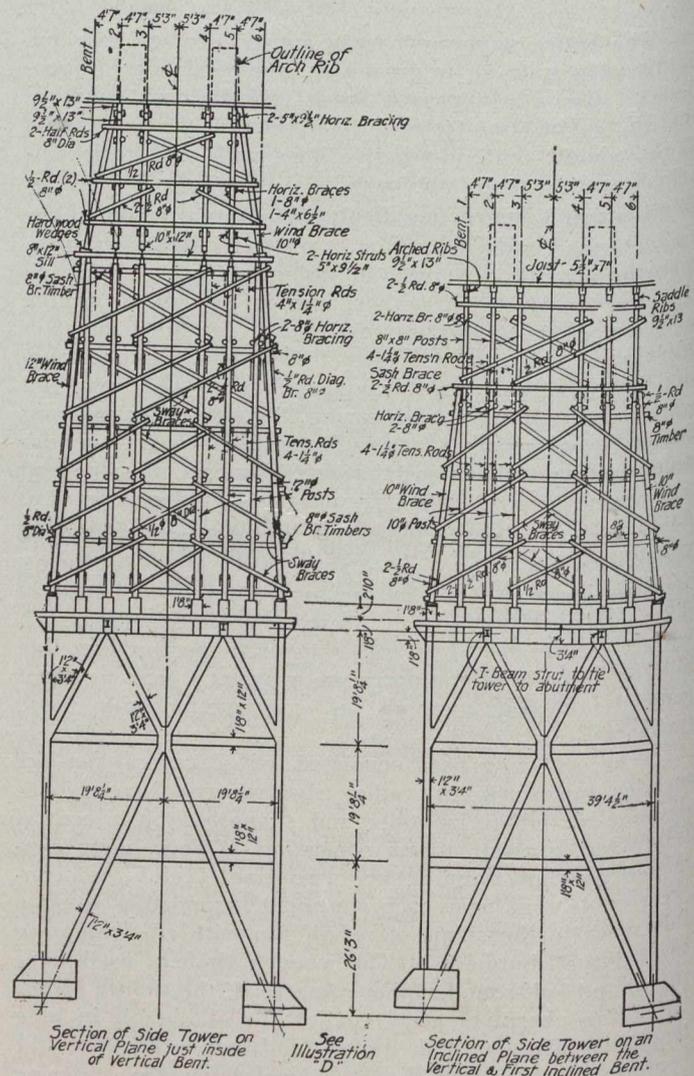


Fig. 8.—Details of Side Towers and Timber Falsework.

were built up in forms partially self supporting, the top portion being held in line by a light framework of round timbers built around the piers, while the bottom was anchored to the concrete previously poured.

The forms for the continuous girders and floor beams and slabs forming the deck were carried on steel trusses connected in pairs by rigid steel bracing. The top chords of trusses were broken so as to conform very nearly with the desired outline of girder soffits and one pair placed under each girder. During construction of the piers the trusses were raised in various stages, by means of block and tackle, between piers to serve as working or storage platforms. In Fig. 3 the centering trusses for two spans