

form of ring adopted in the case cited is as objectionable as suspension bridge cables would be if forced by restraint to follow similar lines. A comparison of the lines of this arch ring with that of the Niagara Falls and Clifton arch (Fig. 17), in which the axial curve lies within the limits specified, will further illustrate the point.

The use of curves which are noticeably flat on the haunches is particularly objectionable for arches of low rise, the reason being that apparently full advantage has not been taken of the possible rise. The observer distrusts such a design as much too bold, and prefers a form of ring which appears to carry the superimposed loads much more directly to the abutments. It is not always due to the choice of a highly erroneous curve for the ring that the objectionable feature under discussion arises. A curve which is structurally correct for the greater part of its length may, for flat arches, be made to appear flat on the haunches through contrast by the introduction of a short, sharp curve joining up the ring with the face of the abutments. Local flatness may also be apparently introduced by a careless joining up of a number of circular arcs to produce the desired curve for the ring.

In the case of arches of such height that the rise may be made one-half of the span, the form of ring which best satisfies the eye depends upon the type of construction. Since time immemorial the race has been familiar with the spandrel-filled Roman arch with semi-circular intrados, and our judgments of artistic construction have no doubt been largely moulded by it. For this reason the oval-shaped intrados, which is the correct curve for such arches, will be slow in gaining favour, as are most improvements in construction. With open-spandrel masonry or concrete arches of rise equal to one-half of the span, the close spacing of the spandrel posts gives a pressure curve which permits of a full semi-circular arc for the intrados, at the same time giving an outline which is always satisfying. Fig. 22, showing one span of the beautiful Connecticut Avenue Bridge, Washington, D.C., is an illustration of this. The semi-circular arch, as it is called, is seen to best advantage in a structure involving a succession of arches on lofty piers, as the Romans so well demonstrated in their magnificent aqueducts of masonry.

Another illustration is afforded in this connection of the coincidence of maximum structural efficiency and greatest beauty, for the form of arch ring which involves the greatest security for the tall piers in case of the development of an unbalanced thrust is at the same time most pleasing to the eye.

The development and use of the open-spandrel masonry or concrete arch gives further basis for the generalization under consider-