SHORT-SPAN BRIDGES.

Barons closing this volume, I will offer a few designs of short-span railway bridges in which wire cables are introduced as auxiliary means of support in connection with the trusses. No great economy is effected by this combination, and in that respect this system bears no comparison with the Parabolic Truss. The simple fact is, that the parabolic principle far excels every other system in point of economy, and is the only one which is applicable to large spans, provided two reaches every other system in point of economy, and is the only one which is applicable to large spans, provided two reaches. The question is, for instance, to make two spans of 200, 300, or 400 feet each, then the best plan is to construct one parabolic truss of either 400, 600, or 800 feet length, with one centre tower on the middle pier, the tower and truss being stationary, and fixed upon that pier. No other design can compete with this in point of economy. But cases may occur when only one single span is wanted, and then the parabolic system is not so applicable. To illustrate such cases, I have made two designs, represented in Figs. 2 and 7. The inclined or tie-rods are placed on each side of the cable, in numbers of 2 at the centre, then 4, and 6 at the abutments—that is, 3 rods on each side of a cable.

The upper and lower chords are formed of channel-bars of 12 in. depth, riveted to the posts. The lower chords are not connected by a horizontal plate, but the upper chords are, and this plate forms the top plate of all, and is graduated in thickness and section from the center toward the abutments, so as to meet the various degrees of compression produced by the tie-rods. The upper channels, on the contrary, have a uniform section throughout, large enough to meet the pressure which is thrown upon them by the cables. Light counter-rods are introduced for the purpose of increasing and maintaining the stiffness of the trusses under the action of passing loads. Although counter-rods do not add to the absolute strength of a truss under a uniformly distributed load, yet they maintain its integrity under variable loads, and are therefore indispensable. The weight of metal expended in these counter rods is well applied. As will be noticed, the tie-rods as well as counter-rods have screws at both ends, and are screwed up to their proper tension. This is a common feature in all American panel-bridges; and it must be admitted that it is the most valuable feature. The practice of American engineers in this respect differs from the European practice, in which screwing up is rather considered a defect. But I would counsel the American engineer not to give up this valuable point. The great advantage of adjustment by screws is, that every main-tie and counter-tie can be put up to its exact degree of tension, and can then be made to do exactly its computed amount of work—no more, no less. This same uniform degree of allotted service is also obtained in a Warren Truss, and without any screws, but at a sacrifice of metal in the pins and eyes. Moreover, the Warren Truss is impracticable for large spans.

It is maintained by some writers on bridge construction, that the vertical members or posts in a panel-truss are useless members, and that they are only adding so much weight to the structure without rendering any efficient service. This is a mistaken view, however. In a correctly proportioned Pratt Truss, no more material is expended than there is in a Howe Truss, or in a Warren Girder, or in a Lattice—provided all counter-rods are omitted, and also provided that the vertical members in the centre of the truss are allowed no more section than is required by calculation. Theoretical estimates of the amount of linear forces expended in the different systems, will be found to give the same results. The Warren Girder has no theoretical advantage over any other combination. But when the different systems are brought to a practical test, then we shall discover considerable differences. For instance, no other girder can compete with a Warren Girder for small spans. There is no waste, except in the pins and eyes. But as the span increases, so does the comparative value of the Pratt or Howe System over the Warren Girder increase. The same applies to the Lattice form. As the span and depth of truss increases, so does its lumberiness increase, and all the compressive members of the web,