INTRODUCTION.

No continent can boast of a more magnificent system of water-courses than ours, and on no other continent will there be a greater development of internal commerce, by land as well as by water. The construction of long span railway-bridges over our large navigable rivers, such as will not materially interfere with their free and easy navigation, becomes therefore a question of national importance.

Who can estimate the tonnage of the future (say one or two hundred years hence) which will be floated upon our navigable watercourses? Considering now that this immense tonnage will have to be moved at low rates, and that this can only be done on the large system, and that large tows, measuring from one to two hundred feet across, require ample water-way in passing a bridge, and that they cannot, without great risk, be exposed to oblique currents, produced by the close proximity of piers, the necessity of large openings in bridges becomes self-evident.

Another important consideration in favor of long spans is presented by the fact that foundations in the large rivers of the West, in order to be safe, must be sunk to the rock, else their security will be endangered by the deep scour caused by floods. This depth of scour may be greatest in an ice-flood, when narrow spans are so apt to produce ice-gorges, and thus force the current to undermine shallow foundations. But deep foundations are expensive, because the stability of piers of 150 to 200 feet high requires a broad base and a corresponding mass; hence the economy of larger spans, by decreasing the number of piers, is apparent at a glance.

Economy in construction will be the test of the future. Sooner or later those plans and systems alone will survive in practice which are the most economical; those alone will be adopted by the competent engineer which will afford the greatest amount of strength for the least amount of cost.

Ever since the question of suspension railway-bridges has been discussed, the opponents of this system have never objected to it on the score of economy; on the contrary, they were always willing to yield this point. Their apparently insurmountable objection is the inherent flexibility of such structures,—great enough in imagination to endanger the safety of passing trains. The utter groundlessness of this objection having been demonstrated by the complete success of the Niagara bridge, the low speed of trains maintained on this work is now made another potent argument.

To meet this, I will draw the attention of those who have not made up their minds on the subject, but who honestly seek further information, to the fact that all the large wooden railway spans, whose safety has never been doubted, are, in proportion to the span, more flexible than is the Niagara bridge. All iron bridges are flexible, because of the elasticity of the material composing them. But wooden structures are more so. A wooden truss of 200 feet span, after a few years’ use, will readily yield from three to four inches in the centre under the passage of a heavy train. The deflection of the Niagara bridge, when taxed with a fully loaded freight-train, from end to end, is ten inches, and this is principally owing to the straightening of the anchor cables. Suppose an ordinary wooden truss was lengthened out to 400 feet, and suspended by cables, its flexibility would be about the same as that of the Niagara bridge, and less in proportion than the 200 feet span without cables. Now has any engineer ever objected to our wooden railway-bridges on the score of flexibility? The man who did would be laughed at.

I here repeat what I have said on former occasions, that the principle of suspension will of necessity become the main feature in our future long span railway-bridges.

Theoretically considered, the principle of the arch, in an upright as well as in a suspended form, is the most economical. It will hold equally good in practice, if properly applied. To obtain the largest degree of economy, however, the two positions of the arch, the upright as well as the inverted or suspended, must be combined into one united system; and this system is now well known, and was equally well known in the last century as the Parabolic Beam, or the Parabolic Truss, as I prefer to designate it. The principle of the Parabolic Truss forms the main feature of the plans herewith presented. It has been applied with a view to economy as well as stiffness.