CONCLUDING REMARKS.

The relative economy of the system of construction here advocated, will be best illustrated by instituting a comparison of weights per foot lineal, for similar spans, executed or designed on different systems.

The weight of 1 foot lineal of superstructure, including towers, rails, timbers, and all, of the Parabolic Truss, is 2,910 lbs.

The spans of the Britannia Tubular Bridge are 460 feet in the clear. Each single tube is 470 feet long and weighs 1,400 gross tons, or 6,800 lbs. per foot lineal. A tube of 510 feet long, or 560 feet clear span, with proportionate strength, would weigh about 7,800 lbs. per foot lineal. The relative weight therefore of the Parabolic Truss and of the tube would be as 2916:7800, or as 1:2.67.

Now the Britannia tubes are calculated for maximum loads of 1 gross ton per foot. The Parabolic Truss is calculated to bear loads of 3,000 lbs. per foot lineal. The allowance per 6 inch for compression and tension is about the same in both plans.

The Lattice Bridge over the Rhine at Cologne, in Germany, has 4 spans of 330 feet each from centre to centre, two spans being covered by one beam. It is built with two trusses, supporting double tracks.

The average weight of the structure per foot lineal is 4,200 lbs., and we may therefore assume the weight, for single track at least, at 2,500 lbs. The openings measure 315 feet in the clear. Enlarged to 500 feet, the weight for a single track would be about 5,500 lbs. per foot. Therefore, its proportion to the Parabolic Truss is as 5500 : 2916, or as 1.88 : 1.

The maximum test-loads on the Cologne bridge are 2,000 lbs. for 1 foot of single and 4,000 lbs. for double track, maximum compression 8,000 lbs. and maximum tension 10,000 lbs. per 6 inch. This comparison does not favor the Parabolic Truss, because its comparative strength on closer scrutiny will be found much larger than that of the Cologne bridge.

While on the latter the maximum load is assumed at 2,000 lbs., the former is taxed with 3,000 lbs. By equalizing this charge, the weight of the Parabolic Truss will be found to be less than one-half of a lattice bridge of the same span.

The best design which can be made for a 500 foot clear span of Lattice Girder, in which all vertical stiffening pieces are omitted, and the diagonal struts, running forward at an angle of 45°, are made stiff enough within themselves to resist compression as well as to guard against lateral oscillations, if made wholly of iron, will weigh about 6,000 lbs. per foot lineal, arranged for single track only, and calculated for maximum loads of 3,000 lbs. per foot lineal.

The truss-posts, panel-rods, and also a portion of the chords, in the Parabolic Truss as here designed, add to its weight, without increasing its supporting power, under the action of a uniformly distributed load. But these members are necessary to maintain the system under the action of variable loads. Although a certain amount of waste is thus incurred, because the system cannot be rendered available without it, nevertheless, the superior strength of the combined upright and suspended arch is so great, that the degree of economy which results from this combination in long spans, cannot be approached by any other system. — In a fair comparison, it is presumed that the competing systems are constructed of the same relative strength and quality of materials.

If the question is to construct a Lattice Girder of 500 feet span, the substitution of steel for iron will of course at once suggest itself, because the weight of the structure becomes so great, and leaves so little supporting power for loads, that the employment of a stronger and lighter material will not only result in a great saving of weight, but also of cost. Whether iron or steel should be used in the Parabolic Truss is, of course, a question of comparative estimate.

The above estimate is based upon the employment of iron; and I doubt whether the substitution of steel will result in a saving. So long as the weight of the structure over the main span does not exceed 1 ton per foot lineal, and the cost of the work will be the same, whether of iron or of steel, I prefer the iron structure, because of its greater freedom from vibration, in consequence of its greater weight under the action of heavy transitory loads.

In the above comparison, a partiality might be charged in favor of Lattice, and against the Tubular System. Considered from a theoretical point of view alone, the Tube form is more economical than the Lattice, because of the great saving in the web. The web of a Tube may be considered as a closed Lattice, and the remarkable fact then appears, that the web-plates perform two offices: they resist by tension as well as by compression, the two forces acting at right angles to each other, and at an angle of 45 degrees with the chords. If, therefore, the capacity of the plate-web to resist compression as well as tension is the same per 6 inch, it follows that a solid plate-web requires only half the material which is needed in an open Lattice, where the members resist only one force. The stiffening pieces, however, which are required to prevent buckling, together with the waste of lapping and riveting, about double the quantity of metal, and thus the economy of the plate-web is lost, for large spans at least.