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IMPROVED BRIDGE CONSTRUCTION.

The accompanying engravings illustrate improvements in the construction of bridges of long spans, on the cantilever and suspension principle combined, which was patented to J. D. Pierce on August 5, 1873.

The whole bridge, from A to B, Fig. 1, is composed of the middle truss, C D, of 316 feet, and of the two end or side trusses, A C and B D, each 296 feet long, in all 908 feet. The arches under and sustaining the side trusses constitute the bottom or compression chords. The clear span between foot of arches is 680 feet. The curved line, A C D B, is a chain which is under constant tension, and which extends to an anchorage at each end, at E. The arches are hinged at E and F, and the ends of the bridge sit on curved beds of rollers at G. The chords, F D, are cut at the intersections, C and D, and joints are there placed, also to serve as hinges. Within these four hinges the structure is free to move according to thermal demands, and hence to maintain its rigidity.

Fig. 2 shows how this system repeats in spans when one is not enough to cross over the river. S T shows the grade line, P and Q anchorage of the curved tension members in their opposite arches, and R, a pier on which the spans compound one half their respective weights.

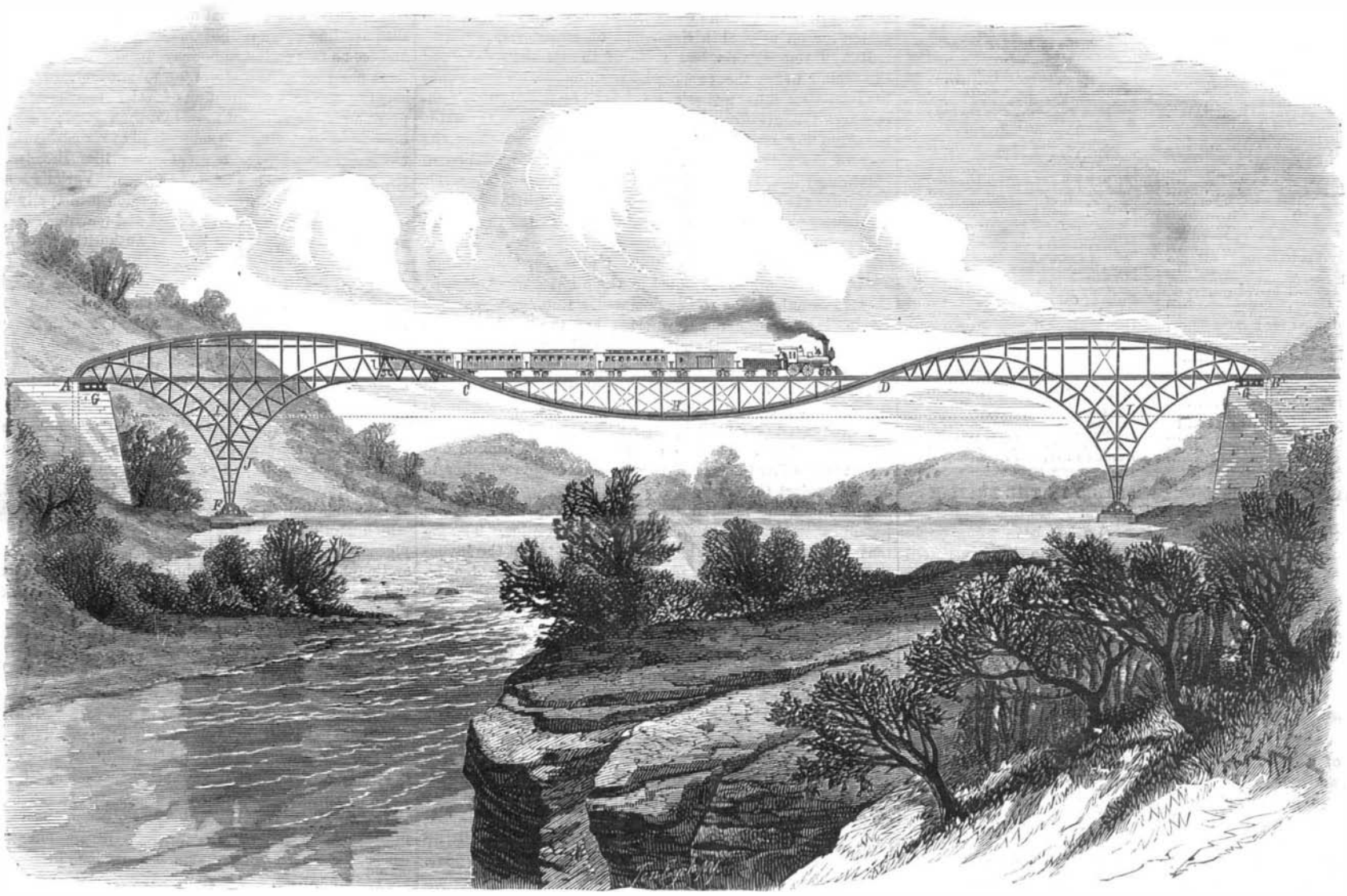
Regarding the comparative merits of this system, the inventor refers to data furnished by Mr. J. C. Trautwine, C. E., in his work on the subject. The table of weights of trusses there given, and the formula also for calculating others, has been compared with those weights of trusses as laid down in Mr. John A. Roebling's work on "Short and Long Span Bridges" and other authorities, and found to hold good approximately.

The middle truss of 316 feet, at 1·23 tuns per lineal foot, weighs 388·6 tuns. The other two, though a little shorter, have a weight double that of the middle truss; this sum includes the arches under them and on which they lie.

The whole bridge, track included, would weigh about 1,943·4 tuns, and the total cost is estimated at $372,757.00.

The greatest strain that comes on this bridge of 680 feet span, the inventor calculates, is less than that of a truss of 450 feet span of like requirements. Comparing the cost with other systems of rigid character, and supposing that it be desired to cross the same river, with one center truss of 680 feet and two side spans of 114 feet each, all of the usual triangular, quadrangular, or lenticular type, a saving of nearly 50 per cent is found in favor of the present system. With very long spans, it is claimed that the percentage of saving will be even greater. Besides, the fact of avoiding piers in navigable rivers is of considerable importance. Captain J. B. Eads tells us, in his report of June, 1868, to the directory of the Illinois and St. Louis Bridge Company, that it is idle to talk about putting piers in a river without some obstruction to navigation, whatsoever the span.

The dotted line, I I, Fig. 1, shows how a second grade line



PIERCE'S IMPROVED METHOD OF CONSTRUCTING BRIDGES WITH LONG SPANS.

The anchorage is the first work begun in carrying the plan into practice. The end trusses, resting on arches, are next built out, self-sustaining. On their completion, a chrome steel chain or wire cable is drawn over the opening space. This furnishes support for putting in the middle truss. The cables first act as overhead false works; but after filling this function, when the bridge is completed, they remain as one of the supports of the middle truss, and in fact of the whole bridge, and are counted as integral members of the same.

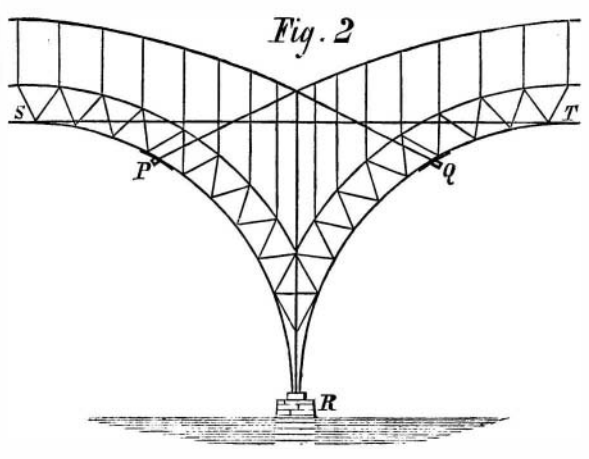


Fig. 2

They are shown at H, Fig. 1. By their amount of power, the curved chord (webbed to the straight ones) is relieved in strain and amount of material.

It should be observed that the structure presents a small area of surface to storms compared with others of like length of span. Anchored to the earth at each end, and with a large portion below the center of gravity as well as above, its re-

may be suspended from the trussing above, and through that below, the straight chords.

The arches are made ribbed to provide stiffness under passing trains, but the amount of material is but little increased thereby.

No high claim is made for this system when all is free to have piers low and ever so often; but where deep waters are to be crossed, and it is desirable not to interfere with navigation, then it is this plan commends itself. To places like Lewiston, N. Y., this plan is claimed to be especially suitable; as instead of a great truss 60 feet high and 600 long, as lately proposed, a depth of trussing of about 25 feet would answer. The system can also be much varied to suit localities, thus offering an interesting field for skill in designing and æsthetic treatment.

For further particulars address J. D. Pierce, Arrington, Nelson county, Va.

Mind and Health.

The mental condition has far more influence upon the bodily health than is generally supposed. It is no doubt true that ailments of the body cause depressing and morbid conditions of the mind; but it is no less true that sorrowful and disagreeable emotions produce disease in persons who, uninfluenced by them, would be in sound health; or if disease is not produced, the functions are disordered. Not even physicians always consider the importance of this fact. Agreeable emotions set in motion nervous currents, which stimulate blood, brain, and every part of the system into healthful activity; while grief, disappointment of feeling, and brooding over present sorrows or past mistakes, depress all the vital forces. To be physically well one must, in general, be happy. The reverse is not always true; one may be happy and cheerful, and yet be a constant sufferer in body. —*Brooklyn Journal of Education.*