

UNITED STATES PATENT OFFICE.

CHARLES PFEIFER, OF ST. LOUIS, MISSOURI.

IMPROVEMENT IN BRIDGES.

Specification forming part of Letters Patent No. 121,894, dated December 12, 1871.

To all whom it may concern:

Be it known that I, CHARLES PFEIFER, of the city and county of St. Louis and State of Missouri, have invented a certain new and useful Improvement in Bridges, of which the following is a specification:

My invention relates principally to the means used to receive the outward thrust of the ends of an arched bridge. Instead of (as is usual) building the abutments sufficiently ponderous to withstand the said thrust, I connect the abutments by tie-rods or string-girders, which extend, preferably, from a higher point at one abutment to a lower point at the other, and vice versa, so that the girders cross each other at mid-length.

Figure 1 is a side elevation of a bridge, showing my improvement. Fig. 2 is a top view of the same. Fig. 3 is a plan of one of the abutment-girders. Fig. 4 is an enlarged view, showing half of one end in elevation and one-half of the bridge in transverse section at the line *x x*, Fig. 1. Fig. 5 is an enlarged view of one of the horizontal brace connections.

A A' are the masonry foundations upon which the ends of the bridge are supported. B B' are the upright metallic abutments against which rest the ends of the upper and lower ribs or members C C' D D' of the arch. E E' are the abutment-girders or ties, each girder extending from the upper end of each abutment-frame, B, at one end of the bridge to the lower part of abutment B' at the other end, and vice versa, the girders crossing at their mid-length. These girders are preferably made as shown in Fig. 3, the ends being strapped around the abutments B B'. The two pairs of upper and lower members or ribs C D C' D' form with their braces *c d* a perfect arch. The end thrust of such arches has always heretofore been received by the solid rock forming the banks of the stream or by ponderous abutments of masonry. To avoid the great expense involved in the building of such abutments, and also for situations where such abutments are inadmissible, I have devised the plan of connecting the abutments by ties or girders to take the spreading thrust of the arch or bridge proper. The form of bridge known as the "bow-string girder" may at first glance be supposed to be similar to my device; but in such bridges the chord forms a necessary part of the bridge proper, and is firmly connected and braced

to and with the arched part; but my device belongs to the substructure, superseding a portion of the abutments, and is applicable to all arched bridges whether made of wood or metal. F are the end cross-ties. G are a number of cross-ties suspended from the arch by uprights H. I are the string pieces of the track, laid upon the girders G and supporting an upper course of cross-ties or sleepers, J, to which the rails *j* are attached. The uprights H act as stay-rods between the two members or ribs of the arch, and besides supporting the track by connection to the **I**-girders F may, more or less of them, be connected to the abutment-ties E E' to give vertical support to the same.

The horizontal tension braces (see Fig. 5) are shown as consisting of, first, a short bent bar, K, having an eye, *k*, at one end and a screw-threaded portion at the other; second, of a straight bar, L, having a hook, *l*, at one end and a screw-thread, *l'*, at the other; and third, of a right-and-left screw-threaded nut or sleeve, M, to screw on the right-and-left screw-threads of the pieces K L to adjust the tension of the braces. In applying these braces the screw-threaded end of the bent bar is passed through a hole near the end of the **I**-girder G, the hook *l* is then secured in the eye *k*, and another bent bar being passed through the other end of the next girder the tightening-nut is put on.

The lateral bracing may, if desired, be extended to the abutment-ties or girders E E' to brace the bridge or to prevent the vibrations of the ties. The abutment-ties E E' act very effectually to prevent the distortion of the bridge by a load thereon—for instance, suppose a load to have passed one-fourth across the bridge from the end marked A the tendency would be to depress that part of the bridge and to lessen the curvature of the arch at that point, and this would tend to increase the curvature upon the opposite shoulder. This compound action would tend to thrust outward the lower ends of the abutment-frames B and the upper ends of the abutment-frames B', which upper and lower ends are directly connected by the tie E, which would thus prevent all distortion of the arch with consequent straining of parts.

In a modified form, especially where the span is not large, but one tie, E, may be used on each side, and the ends may be forked so as to have

a more extended attachment to the abutment-frames.

I do not confine myself to the minor details of construction, as these may be varied to suit circumstances.

I claim—

In combination with a bridge-arch composed of two arched members, C C' D D', the abutment-girders or cables E E' extending in direct line

from the upper member at one end to the lower member at the other end, substantially as and for the purpose set forth.

In testimony of which invention I have hereunto set my hand.

CHARLES PFEIFER.

Witnesses:

SAML. KNIGHT,

R. T. BRADLEY.

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