D. B. LUTEN.

PROCESS OF BRIDGE CONSTRUCTION.

APPLICATION FILED JUNE 27, 1913.

1,090,081.

Patented Mar. 10, 1914.

3 SHEETS—SHEET 1.

Fig. 1.

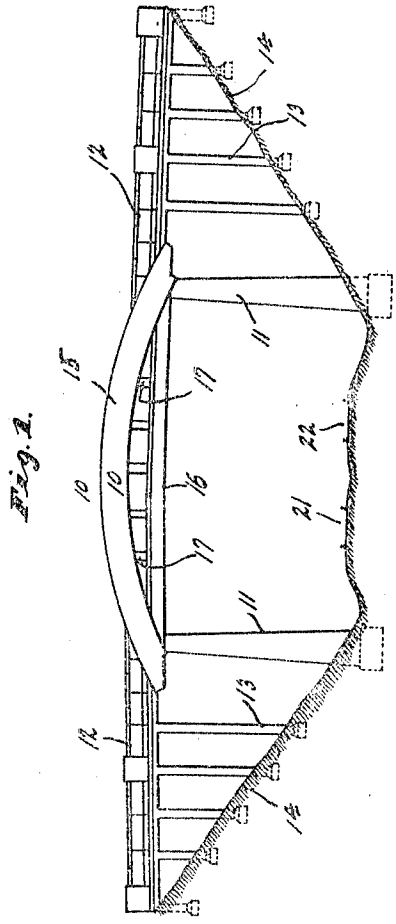
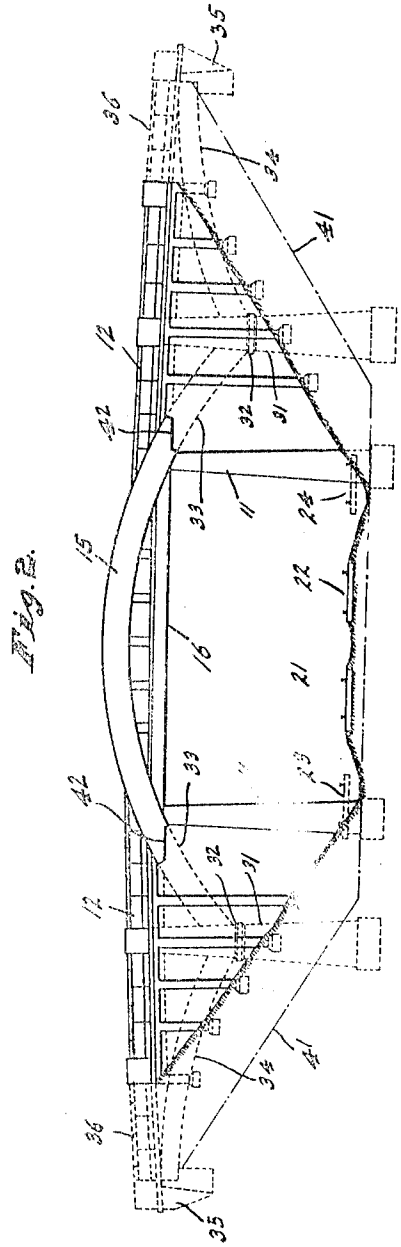


Fig. 2.



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3 SHEETS—SHEET 2.

Fig. 3.

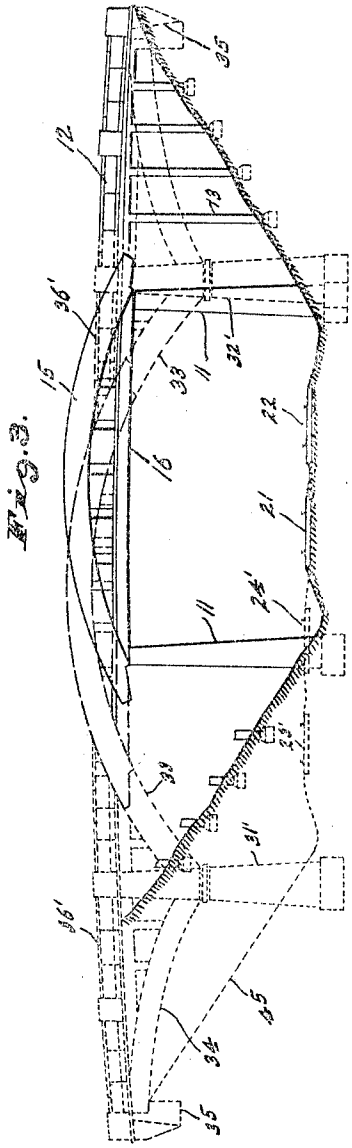
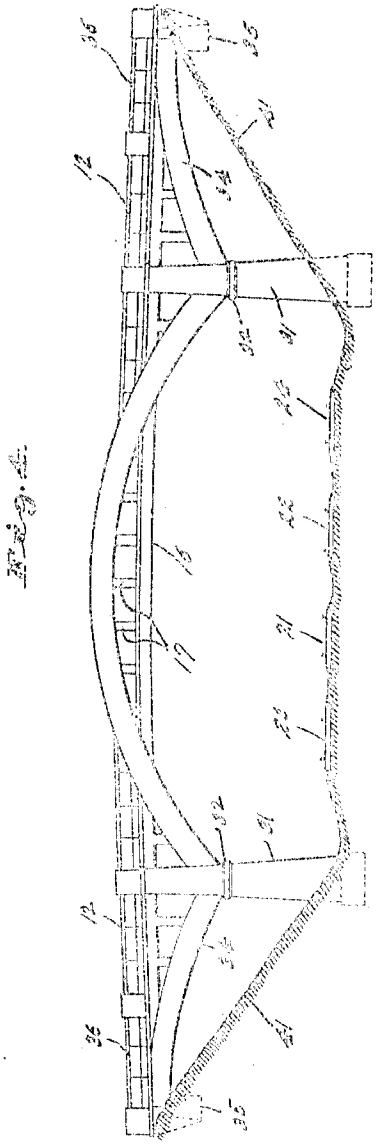


Fig. 4.



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3 SHEETS—SHEET 3.

Fig. 5.

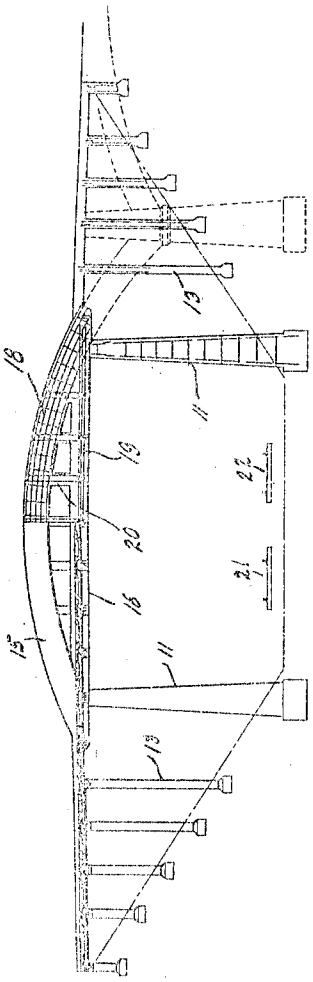
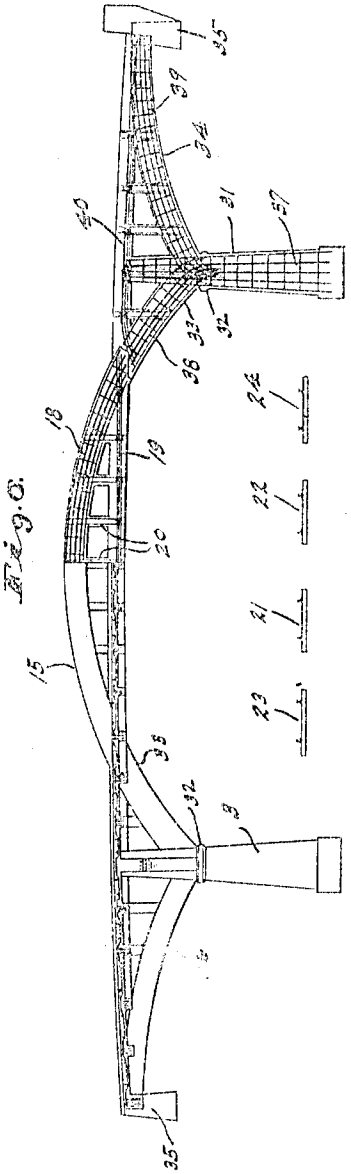


Fig. 6.



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PROCESS OF BRIDGE CONSTRUCTION.

1,090,081. Specification of Letters Patent. Patented Mar. 10, 1914.

Application filed June 27, 1913. Serial No. 776,024.

To all whom it may concern:

Be it known that I, DANIEL B. LUTEN, a citizen of the United States, residing at Indianapolis, in the county of Marion and State of Indiana, have invented a new and useful Process of Bridge Construction, of which the following is a specification.

In the modern development of railroads, there is continually arising the necessity of increasing the number of tracks, as from a single track to a double track and from a double track to four tracks. As grade crossings have already been largely abolished and are being further abolished each year, and are in many instances replaced by viaducts or bridges crossing the tracks, increasing the number of tracks becomes very expensive if all the viaducts or bridges crossing the railroads must be demolished and larger viaducts or bridges substituted for them. And yet it is impracticable to build the viaducts or bridges of sufficient span initially for possible future increase in the number of tracks.

The object of my invention is to provide a process of bridge construction and a bridge structure whereby a bridge or viaduct, especially a concrete bridge or viaduct may be built initially with a given span, as across two railroad tracks, and may later be given an enlarged span, as across four railroad tracks, without involving the destruction of the entire bridge or viaduct.

The accompanying drawings illustrate my invention.

Figure 1 is an elevation of the initial condition of a bridge involving my invention, the bridge here spanning two railroad tracks; Fig. 2 is a view showing a transition condition as the span of the bridge of Fig. 1 is being widened to cover four tracks, one on each side of the original two; Fig. 3 is a view showing a transition condition as the span of the bridge of Fig. 1 is being widened to cover four tracks, the two additional tracks being on the same side of the original two tracks; Fig. 4 is an elevation of the completed bridge after it has passed through the transition condition and spans the four tracks; Fig. 5 is an elevation of the bridge in its initial condition, showing the general arrangement of reinforcing or tension members; and Fig. 6 is an elevation of the complete or widened bridge, showing the general arrangement of the reinforcing or tension members therein.

The bridge is originally constructed with a central, bow-string girder 10, supported at its ends by two piers 11, and provided with approaches 12 carried by pillars 13 suitably set in the embankments 14 at the sides of the right-of-way, the parts 10, 11, 12, and 13 all conveniently being of concrete. The bow-string girder comprises curved or arc-shaped members 15 and chord or string members 16, the latter forming the floor of the bridge and subtending the arch formed by the members 15, and the members 15 and 16 being joined by uprights 17. Preferably suitable reinforcing or tension members 18 are embedded in and extend along the curved members 15. The ends of the members 18 are conveniently anchored to tension members 19 embedded in and extending along the chord or string member 16 into the end of the members 15. Other tension members 20 may be embedded in the uprights 17, and are preferably suitably anchored in the members 15 and 16, as by being connected to the tension members 18 and 19. The bow-string girder is self-contained as to thrusts, exerting no end thrusts on its supports.

In the arrangement shown, the girder spans two railroad tracks 21 and 22, the piers 11 being located at the outer sides of such tracks. The bridge is now as shown in Fig. 1. Now let it be supposed that it is desired to add two more tracks 23 and 24 to the two tracks already comprising the railroad, and that these two additional tracks are located on opposite sides of the tracks 21 and 22 already in use. In order to make this addition, the span of the bridge must be increased. Therefore, two new piers 31 are built on the outer sides of and beyond the piers 11, and from springings 32 on the inner sides of these piers are extended arch sections 33 which joint to and form continuations of the members 15 of the bow-string girder 10. From the outer side of each pier 31 is extended an arch segment 34, the opposite end of which rests on, and may be anchored to, an abutment 35. The piers 31 and the arch segments 33 and 34 are cast to include the pillars 13 which intersect them, the latter being roughened if desired at the place of intersection to allow permanent gripping of the new concrete to the old. Then approach extensions 36 are added to continue the approaches 12 to the abutments 35. The parts 31, 33, 34, 35, and 36 are also

conveniently of concrete. The piers 31 are provided with reinforcing members 37, the arch segments 33 with reinforcing members 38, and the arch segments 34 with reinforcing members 39, the ends of the members 37 and 38 remote from their supporting pier 31 being connected by tie-rods or tension members 40 which are conveniently embedded in the approaches 12 and approach extensions 36 and extend into and are permanently anchored in the ends of the members 33 and 34. This makes the members 33, 34, 12, and 36 supported by each pier 31 a self-contained unit as to thrusts, the approaches 12 and approach extensions 36 being sufficiently larger than the members 33 to balance the weight of the bow-string girder on the members 33. The tension members 40 embedded in the approaches 12 are preferably put in place when the bridge is built in its initial condition. The bridge is now in the transition condition shown in Fig. 2. After the concrete has hardened, the embankment is excavated to the line 41, the piers 11 are removed, and the parts of the pillars 13 below the arch segments 33 and 34 are cut off and removed. Then the additional tracks 23 and 24 are laid under the bridge, which now appears as shown in Fig. 4. The joint 42 between the ends of the members 15 of the bow-string girder and the arch segment 33 is inconspicuous or even invisible in the completed bridge shown in Fig. 4.

If in increasing the number of tracks of the railway, the increase is unsymmetrical, as because the two additional tracks 23′ and 24′ are both to be added to the same side of the tracks already in use, as indicated in Fig. 3, the process of widening the span is only slightly different. In that case, the starting point as before is with the bridge in the form shown in Fig. 1. The bow-string girder 10 is supported on false-work, the piers 11 are removed, and the bow-string girder is rolled in its entirety on the false-work to a position over the center of the four tracks (two new and two old) which the road is to have. It is usually necessary to demolish part or all of the approach on that side of the bridge toward which the bow-string girder is moved, though the other approach 12 may usually be left intact. Then proper excavation of the embankment is made to the line 45, to accommodate the two new tracks 23′ and 24′, the piers 31′ and 32′ are built, the arch segments 33 and 34 are constructed on these piers, retaining as much of the original concrete as is in proper place (practically the entire approach 12 and the upper parts of the pillars 13 at the right hand side of the bridge), then approach extensions 36′ are added to complete the approaches, and then the false-work is removed, leaving the bridge in the same condition as above described, or as shown in Fig. 4.

I claim as my invention:

1. The process of constructing a bridge or a viaduct, comprising constructing a bow-string girder of concrete, reinforcing such girder so that it is self-contained as to thrusts, supporting such bow-string girder on piers under its ends, constructing piers farther apart than the length of such bow-string girder, building arch segments from such last named piers and of sufficient length to extend under the ends of the bow-string girder, and removing the first named piers and allowing the bow-string girder to rest on said arch segments.

2. The process of constructing a bridge or a viaduct, comprising constructing a bow-string girder, supporting such bow-string girder on piers under its ends, constructing piers farther apart than the length of such bow-string girder, building arch segments from such last named piers and of sufficient length to extend under the ends of the bow-string girder, and removing the first named piers and allowing the bow-string girder to rest on said arch segments.

3. The process of constructing a bridge or a viaduct, comprising constructing a bow-string girder of concrete, reinforcing such girder so that it is self-contained as to thrusts, constructing piers farther apart than the length of such bow-string girder, building arch segments from such piers and of sufficient length to extend under the ends of the bow-string girder, and allowing the bow-string girder to rest on said arch segments.

4. The process of constructing a bridge or a viaduct, comprising constructing a bow-string girder, constructing piers farther apart than the length of such bow-string girder, building arch segments from such piers and of sufficient length to extend under the ends of the bow-string girder, and allowing the bow-string girder to rest on said arch segments.

5. The process of constructing a bridge or a viaduct, comprising constructing a bow-string girder, constructing piers farther apart than the length of such bow-string girder, building lateral projections from such piers and of sufficient length to extend under the ends of the bow-string girder, and allowing the bow-string girder to rest on said lateral projections.

6. The process of constructing a bridge or a viaduct, comprising constructing a bow-string girder, supporting such bow-string girder on piers under its ends, constructing piers farther apart than the length of such bow-string girder, building lateral projections from such last named piers and of sufficient length to extend under the ends of the bow-string girder, and removing the

first named piers and allowing the bow-string girder to rest on said lateral projections.

7. The process of constructing a bridge or a viaduct, comprising constructing a bow-string girder, constructing piers farther apart than the length of such bow-string girder, building lateral projections from such piers and of sufficient length to extend under the ends of the bow-string girder, and allowing the bow-string girder to rest on said lateral projections, building approach extensions on the sides of said piers opposite to said lateral projections, and connecting said approach extensions with lateral projections by tension members.

8. The process of constructing a bridge or a viaduct, comprising constructing a self-contained cross member and supporting such cross member by piers under its ends, constructing piers farther apart than the length of such cross member, and building a lateral extension from each of said last named piers toward the other sufficiently far so that the adjacent ends of such extensions are no farther apart than the length of such cross member, making each of such extensions self-contained with its supporting pier, and removing the first named piers and allowing the cross member to rest on said extensions.

9. The process of constructing a bridge and a viaduct, comprising constructing a self-contained cross member and supporting such cross member by piers under its ends, constructing piers farther apart than the length of such cross member, and building a lateral extension from each of said last named piers toward the other sufficiently far so that the adjacent ends of such extensions are no farther apart than the length of such cross member, and removing the first named piers and allowing the cross member to rest on said extensions.

In witness whereof, I have hereunto set my hand at Indianapolis, Indiana, this twentieth day of June, A. D. one thousand nine hundred and thirteen.

DANIEL B. LUTEN.

Witnesses:

FRANK A. FAHLE,

G. B. SCHLEY.