No. 853,204. PATENTED MAY 7, 1907.

D. B. LUTEN.

ARCH STRUCTURE.

APPLICATION FILED OCT. 4, 1905.

Fig. 1.

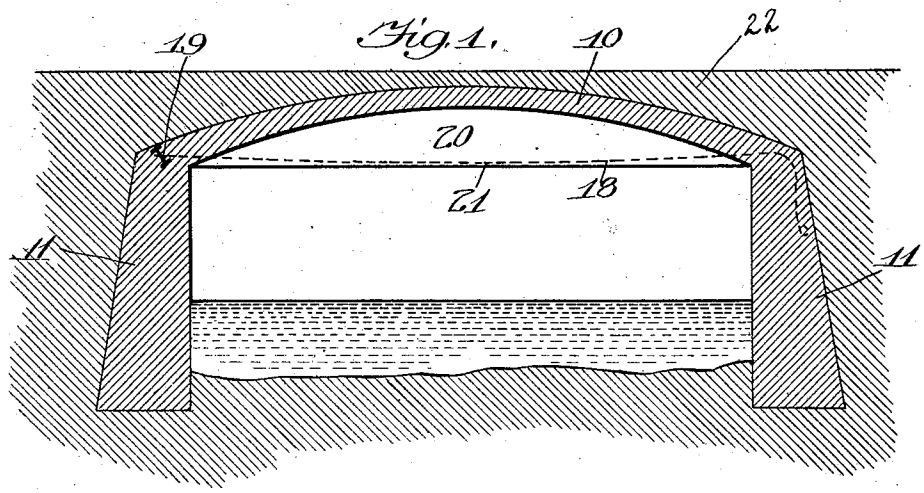
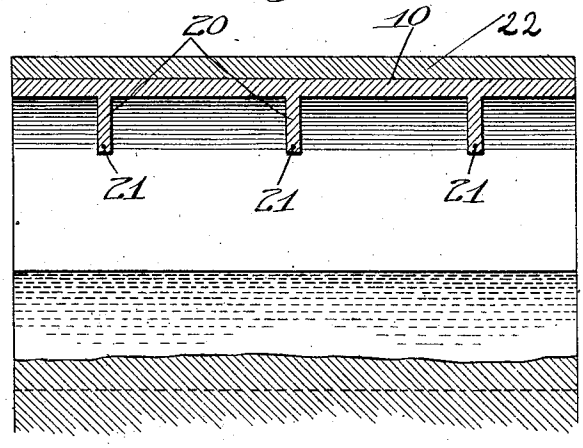


Fig. 2.



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ARCH STRUCTURE.

No. 853,204. Specification of Letters Patent. Patented May 7, 1907.

Original application filed May 17, 1902, Serial No. 107,812. Divided and application filed July 25, 1904, Serial No. 217,936. Divided and this application filed October 4, 1905. Serial No. 281,336.

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 certain new and useful Improvements in Arch Structures, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings, forming a part of this application.

This invention relates to improvements in arch structures of that class which are commonly designed to serve as bridges or viaducts across streams, roadways, ravines, etc., and which are usually constructed of concrete, stone, brick, cement, mortar and other materials; and the invention has for its general object to provide an improved arch structure for this and analogous purposes characterized by increased strength and capacity to resist the strains imposed upon the crown of the arch.

More particularly my invention relates to that class of arches which are provided with comparatively high abutments and comparatively low or approximately flat crowns, and are largely for small spans.

The invention comprehends as some of its important characteristics or features the employment of girders beneath the arched floor, preferably composed of the same material as the arched floor, the provision of reinforcing members depressed at the middle of the spans, and in the use of longitudinal girders joined by the arched floor and having reinforcing members embedded in said girders and extending from abutment to abutment.

The present application constitutes a division of an application filed by me July 25th, 1904, Serial No. 217,936, which was a division of my application Serial No. 107,812, filed May 17, 1902.

As above stated, my invention has to do with arch structures of the masonry class and particularly contemplates the strengthening and reinforcing of such structures especially when employing a low or flat crown to resist vertical strains through the latter by the employment of tension rods anchored in the abutments and partially supporting the weight of the crown particularly at and adjacent to the longitudinal center of the latter.

In the accompanying drawing, I have illustrated an arch of the type referred to, equipped with the tension rod feature disposed in accordance with the preferred form of the invention; and referring thereto, Figure 1 is a longitudinal sectional view of the arch, and Fig. 2 is a cross sectional view of the same at the center of the arch.

These figures illustrate a low or flat arch 10 supported on high bench walls, piers or abutments 11, and having the depending integral girders, beams or ribs 20 longitudinally disposed beneath and joining the crown or arched floor 10. As indicated in Fig. 2, these girders 20 may be placed at such intervals transversely of the arch as may be deemed necessary to sufficiently strengthen and reinforce the crown. Suspension rods 18 are anchored at or near the springings and extend from abutment to abutment from points slightly above the springings and are thus in a position to resist the thrust of the arch directly. These rods may be anchored on horizontal beams such as 19 embedded in the material of the arch at or near the springings as shown at the left of Fig. 1 or the rods may be extended outwardly and anchored in the bench walls or beams as shown at the right, or they may be secured in any desired manner. These suspension or tension rods or chords are preferably and as herein shown, sagged slightly at the center, and are preferably embedded in said internal ribs, girders or beams 20 which extend downwardly from the intrados of the arch to and around the rods. By permitting the rods to sag slightly in the middle, as at 21, the thrust of the arch producing tension in the rods will tend to straighten them and thus exert through the rib or girder 20 an upward pressure against the crown of the arch to counteract any settlement due to the loading or other causes.

The material of which the arch is composed is preferably concrete and the ribs 20 are also formed of concrete or the same material as the crown 10.

An earth filling 22 ordinarily comprising the roadway covers the entire structure, the

top of the arch being curved and the chord or girder having a straight lower edge as shown. In this type of arch, a rectangular opening forming the water-way is provided so that for the same span the water-way area is greater than for an elliptical or semi-circular arch of the usual type.

From the foregoing, it is apparent that my invention provides a simple and inexpensive means whereby vertical strains applied at or near the crown of the arch rib which would tend to break down the arch, and thrust it outwardly at its ends are resisted and counteracted by equal and opposite strains exerted upwardly and inwardly of the said parts, thereby making a very rigid and strong structure, and enabling the parts of the arch to be made much lighter than heretofore. Further results are gained in that the arch is simple in construction, of low cost, and of comparatively great discharge capacity.

Obviously my invention is especially advantageous and valuable in connection with small spans where low or flat type arches are of peculiar adaptability.

Various changes and alterations may be made in the details of construction without departing from the spirit or scope of my invention.

I claim:

1. A series of concrete girders joined by a curved floor.

2. A series of concrete girders joined by a floor curved longitudinally with the girders.

3. A curved compression member of concrete or similar material with metal tension chord embedded in a depending rib.

4. A reinforced concrete girder limited above by a curved drum with its axis transverse to the girder.

5. An arch of concrete with ties from abutment to abutment at or above the springing, and embedded in ribs of concrete.

6. An arch of concrete with ties from abutment to abutment near the springing and embedded in ribs of concrete.

7. An arch provided with depending internal ribs and suspension rods sagged at the middle embedded in said ribs, substantially as described.

8. An arch having bench walls and depending internal ribs, and suspension rods embedded in said ribs and anchored in said bench walls, substantially as described.

9. An arch having bench walls and depending internal ribs, and suspension rods sagged at the middle embedded in said ribs, and anchored in said bench walls, substantially as described.

10. A curved concrete slab supported on girders of concrete reinforced with tension members bent upward at their ends.

11. An arch having a curved extrados and with reinforced ribs depending from the intrados and bounded by a substantially straight line below.

12. A bridge floor supported above reinforced concrete girders curved above and straight below.

13. Reinforced concrete girders of decreasing height toward end of span and joined by a concrete slab with inclined upper surface.

14. A bridge of concrete or similar material bounded by a substantially straight line below and having a floor with inclined upper surface.

15. A curved concrete slab supported on reinforced concrete girders.

16. A concrete arch with curved extrados and depending girders.

17. An earth covered arch with depending ribs of reinforced concrete.

18. In a bridge, an earth covered concrete floor supported by reinforced concrete girders.

19. An arch having its thrust resisted by ribs and a reinforced member transverse to the ribs.

20. An arch of concrete or similar material with reinforced ribs resisting the thrust of the arch and a reinforcing member transverse to the ribs.

21. A curved structural member combined with intradosal ribs and a reinforcing member embedded in the end of the member.

22. A concrete arch having its horizontal thrust resisted at intervals by longitudinal members embedded in concrete ribs.

23. A concrete arch having its thrust resisted at intervals by longitudinal members embedded in concrete ribs and a reinforced abutment transverse thereto.

24. A concrete arch having depending girders with embedded ties from abutment to abutment and abutments reinforced transversely to the ties.

25. An arch adapted to transmit horizontal thrusts and stiffened by reinforced concrete girders adapted to transmit vertical forces only to the abutments.

26. A bridge of concrete or similar material, of thickness decreasing toward the ends of the span under an earth filling.

27. A bridge of concrete or similar material of thickness decreasing toward the abutment, and covered with a filling, of depth increasing toward the abutment.

28. A bridge of concrete or similar material with a substantially straight lower edge and supporting an earth filling of depth increasing toward the end of the span.

29. An arch of concrete or similar material having depending girders with embedded ties from abutment to abutment and a metal tension member transverse to the ties.

30. An arch having longitudinal metal ties embedded in concrete ribs below the crown and a transverse metal member from tie to tie.

31. An arch of concrete or similar material having its thrust resisted by a plurality of members of concrete or similar material transverse to each other.

In witness whereof, I have hereunto subscribed my name in the presence of two witnesses.

DANIEL B. LUTEN.

Witnesses:
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J. C. STUCKENBERG.