

D. B. LUTEN.

ARCH.

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1,060,922.

Patented May 6, 1913

Fig. 4.

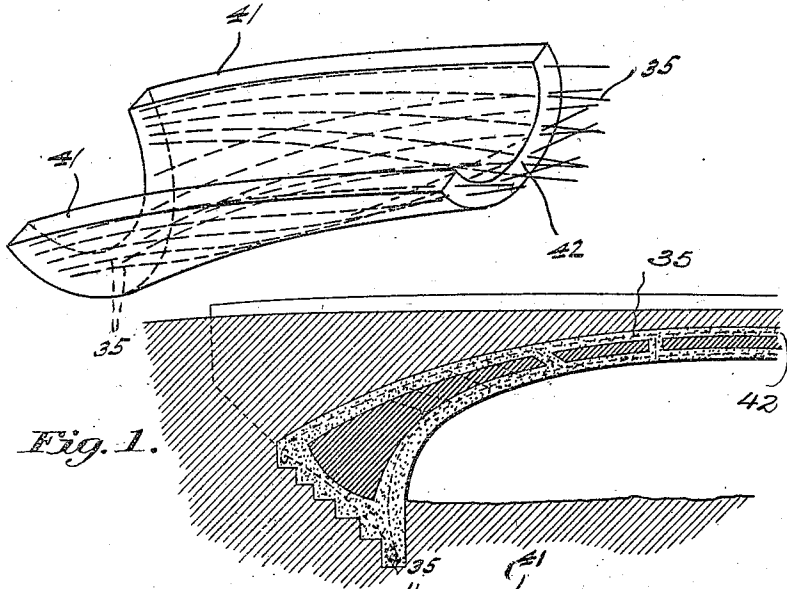


Fig. 1.

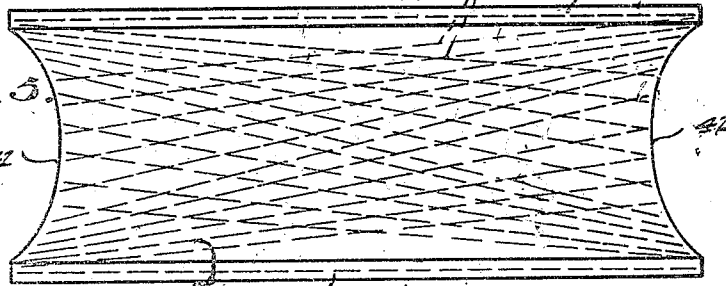


Fig. 5.

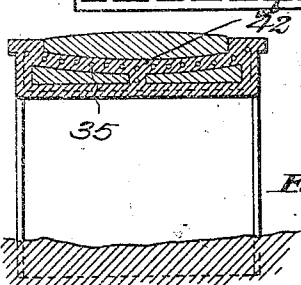


Fig. 2.

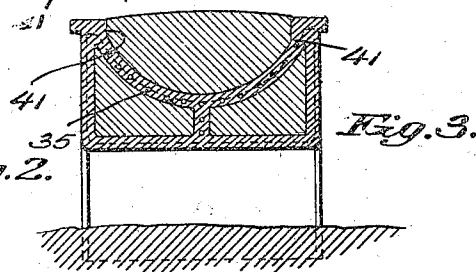


Fig. 3.

WITNESSES:

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ARCH.

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Specification of Letters Patent.

Patented May 6, 1913.

Original application filed April 24, 1905, Serial No. 257,165. Divided and this application filed July 8, 1911. Serial No. 637,454.

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 Improvement in Arches, of which the following is a specification.

My invention relates to improvements in arches and has for its purpose to provide an arch structure with its upper and lower surfaces curved in the usual way transverse to the axis of the arch, but also curved longitudinally of the axis and concave outwardly, and the resulting structure reinforced to produce great strength with minimum materials and labor.

The present application constitutes a division of an application filed by me April 24, 1905, Serial No. 257,165.

The invention is illustrated in the accompanying drawings in which the same reference characters designate like parts throughout the several views.

Figure 1 is a longitudinal section of an arch, Fig. 2 is a transverse section at the crown, Fig. 3 is a transverse section through the abutment, Fig. 4 is a perspective view of a half arch embodying my improvement, and Fig. 5 is a plan view of such an arch.

The upper and lower surfaces of the arch are of the form of a warped surface somewhat similar to a shoe-horn, as shown in Fig. 4. A surface that can be rolled out on a plane, as a cylinder or cone, or any other developable surface, which is necessarily generated by the motion of a right line in parallel or intersecting positions will crack easily along one of the lines of generation when distorted; but a warped or double curved surface of the form shown cannot crack or break along a straight line but must separate on a curved line. It is for this reason that the shoe-horn is so much stiffer and resists distortion so much more efficiently than would the same piece of metal if merely of the usual form of arch without curvature longitudinal of the arch axis. If now the form of arch proposed be made of concrete with steel embedded across the probable line of fracture this form of arch will require much greater stretch of the em-

bedded steel than the type of arch curved in one direction only. And consequently its strength would be greatly increased or the same strength secured with decreased material.

Longitudinal tension rods are passed longitudinally through the arch and at the haunches are closely grouped near the tension edges which are the upper outside edges of the arch near its ends. At the crown of the arch they are more closely grouped near the center and preferably pass diagonally across the roadway. Thus as is shown in detail in Fig. 4 the rods 35 pass near the edges 41 at the haunches and near the center 42 at the crown. And while the rods 35 will be at 41 on one side of the roadway for that end of the arch these same rods will cross diagonally across the roadway through the crown of the arch to the corresponding edge on the other side of the roadway at the opposite end of the arch. The regions of greatest tension in such an arch will be when loaded with a concentrated load at the crown, at the center at the crown and at the sides over the haunches. Hence such an arrangement of diagonal members for reinforcement effectually reinforces the structure at its greatest tension regions. And by this means the regions of greatest tension where greatest separation of the material would result in case of fracture, are reinforced with rods or other members concentrated at those regions and with the reinforcing members running in substantially straight lines through these tension regions.

I claim:—

1. A reinforced concrete arch comprising a concrete body having a cross-section of an inverted arch shape, and reinforcing members embedded in the arch and crossing each other diagonally.

2. A reinforced concrete arch having a cross-section of inverted arch form, and with embedded reinforcing members concentrated near the middle at the crown and near the sides over the abutments.

3. A concrete arch having a cross-section of inverted arch form, and reinforcing members embedded in the arch and substantially

straight through the tension regions at crown and haunches.

4. A reinforced concrete arch having a cross-section of inverted arch form, and
5 with embedded reinforcing members concentrated near the middle at the crown.

In witness whereof, I, have hereunto set

my hand and seal at Indianapolis, Indiana, this 6th day of July, A. D. one thousand nine hundred and eleven.

DANIEL B. LUTEN. [L. S.]

Witnesses:

B. H. MORSE,

PAUL KLINGENSMITH.