

**No. 617,615.**

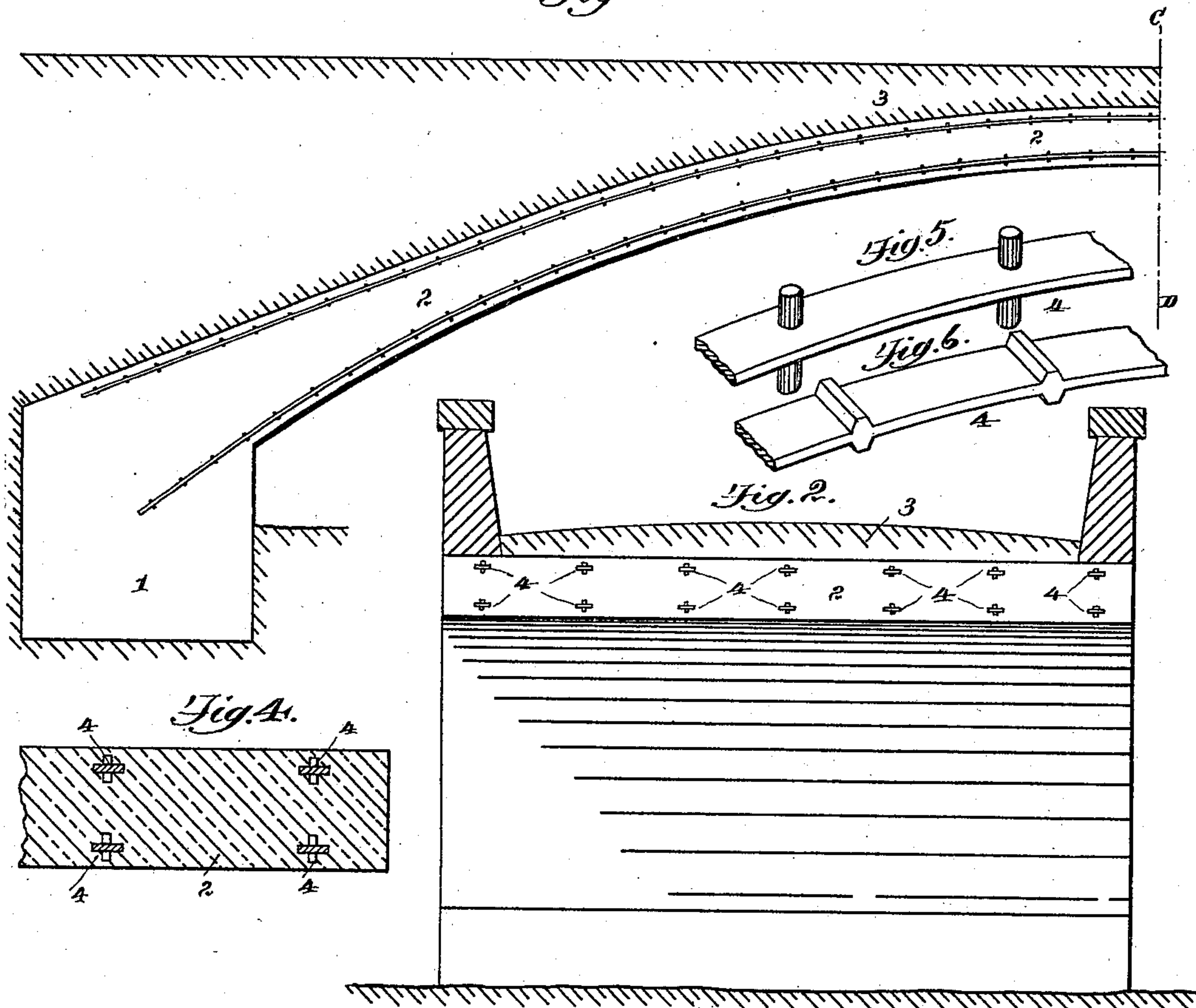
**Patented Jan. 10, 1899.**

**E. THACHER.**  
**CONCRETE ARCH.**

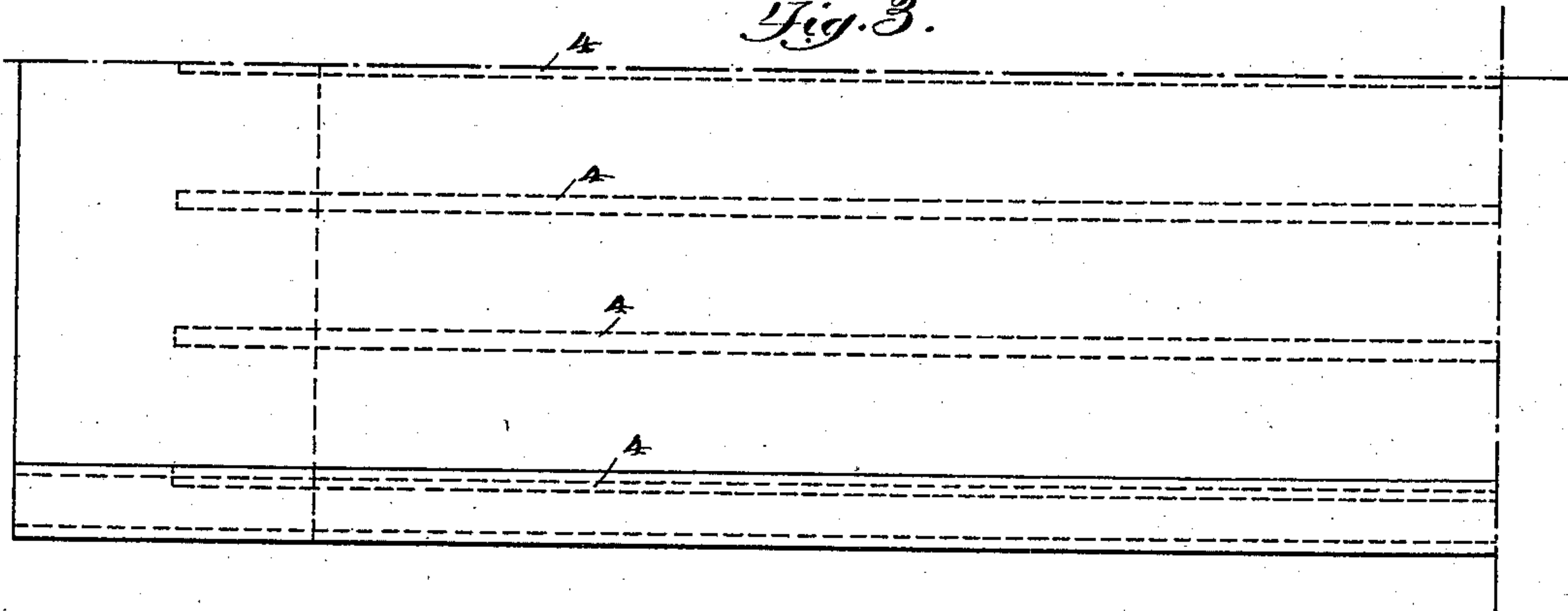
(Application filed Oct. 16, 1896.)

(No Model.)

*Fig. 1.*



*Fig. 3.*



*WITNESSES.*

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# UNITED STATES PATENT OFFICE.

EDWIN THACHER, OF DETROIT, MICHIGAN.

## CONCRETE ARCH.

SPECIFICATION forming part of Letters Patent No. 617,615, dated January 10, 1899.

Application filed October 16, 1896. Serial No. 609,053. (No model.)

*To all whom it may concern:*

Be it known that I, EDWIN THACHER, a citizen of the United States, residing at Detroit, county of Wayne, State of Michigan, have  
5 invented a certain new and useful Improvement in Concrete Arches; and I declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it pertains to  
10 make and use the same, reference being had to the accompanying drawings, which form a part of this specification.

My invention relates to concrete arches for bridges or vault-covering or for spanning  
15 openings in building construction; and it has for its object an improved arch structure in which iron or steel bars are embedded in concrete near the outer and inner surfaces of the arch in such a manner as to assist the con-  
20 crete in resisting the thrusts and bending moments to which the arch is subjected.

By my invention I provide, first, for an effective connection between the bars and the concrete, employing lugs, dowels, bolts, or  
25 rivets, which pass through the bars and project into the concrete, in which they are embedded, and thereby reinforce the adhesion between the metal and the concrete and prevent any end movement of the bar through  
30 the concrete, so that the complete crushing or shearing of the concrete must take place before a separation can be effected; second, I employ bars of such a form that they can be readily and cheaply spliced if a greater  
35 length of bar is required than that which can be conveniently rolled or shipped; third, I provide bars that can be manufactured at a small cost and as a standard or stock article and can be readily bent when used to the  
40 curve of the arch into which they are to enter. Consequently they can be stored or shipped in straight form. In ordinary structures and generally I arrange the bars in pairs, which are usually disposed so that one of the pair  
45 rests vertically above the other member of the pair, although I do not consider this manner of disposing the bars as essential in all cases. The bars act as the flanges of beams to resist bending moments, whereas the shearing stresses, which are small, are taken by  
50 the concrete alone. In their normal condition the bars and the concrete act together,

and the work done by each depends on its moment of inertia and modulus of elasticity; but if the concrete is defective and has a tendency to crack the bars will greatly aid in  
55 resisting such tendency, and if a crack should take place the relation of the parts will be changed and the bars will do the work of the concrete and prevent the falling of the structure.  
60

In the drawings, Figure 1 represents in vertical longitudinal section one-half of a bridge-arch. Fig. 2 is a cross-section at the lines  
65 C D of Fig. 1. Fig. 3 is a plan showing one-fourth of an arch. Fig. 4 is an enlarged cross-section of a portion of the arch. Figs. 5 and 6 show small portions of two styles of bars.

Similar numbers refer to similar parts  
70 throughout the figures.

The abutment 1, the arch 2, and the spandrel-filling 3 constitute the complete structure, in which 4 indicates the metal bars (iron or steel) embedded in the concrete near the  
75 lower face and the upper face thereof. These bars extend well into the abutment or pier 1 and are provided with projections extending in either direction from the surface of the bars. The projections may be produced either  
80 in the form of lugs made integral with the bars, as shown in Fig. 6, or in the form of dowels or rivets placed in and secured to the bar after it has been rolled. They should  
85 project far enough to give to the bar a good hold on the concrete. For small structures, in which but few bars are required, I should prefer the form shown in Fig. 5, in which a  
90 dowel or rivet pin with upset heads are placed through holes in the bar. In larger structures, where many bars are required, I should prefer a specially-constructed bar like that shown in Fig. 6.

The use of the double bars enables me to not only bend them at the time they are re-  
95 quired for use to any desired arc of a circle, but enables me to bend them so that the different members of each pair are differently arched, and, furthermore, it enables me to completely embed the lowermost member of  
100 the pair before the uppermost member is placed, thereby securing an intimate contact between the bar and the concrete without requiring the great particularity of filling and



ramming under that is necessary where a bent I-beam with extending flanges is employed and necessarily put in place before any of the concrete is filled in around it.

5 What I claim is—

1. The combination with abutments, and a concrete arch spanning the intervening space, of a series of metal bars, in pairs, one bar of each pair above the other, near the  
10 intrados and extrados of the arch, and extending well into the abutments, each bar of a pair being independent of the other, substantially as described.

2. The combination with abutments, and  
15 a solid concrete arch spanning the intervening space, of a series of metal bars in pairs one bar of each pair vertically above the other, near the intrados and extrados of the arch, and extending well into the abutments,

each bar of a pair being independent of the 20 other, and each bar being flat and provided with projections, substantially as described.

3. The combination with abutments, and a concrete arch spanning the space between the abutments, of a series of metal bars in 25 pairs, one bar of each pair above the other bar, near the extrados and intrados of the arch, each bar of the pair being independent of the other and one bar of each pair extending well into the abutment, substantially as 30 described.

In testimony whereof I sign this specification in the presence of two witnesses.

EDWIN THACHER.

Witnesses:

D. W. BRADFORD,  
VIRGINIA M. CLOUGH.