C. G. MORTENSON.

METHOD OF REINFORCING BRIDGES AND LIKE STRUCTURES.

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1,331,871. Patented Feb. 24, 1920.

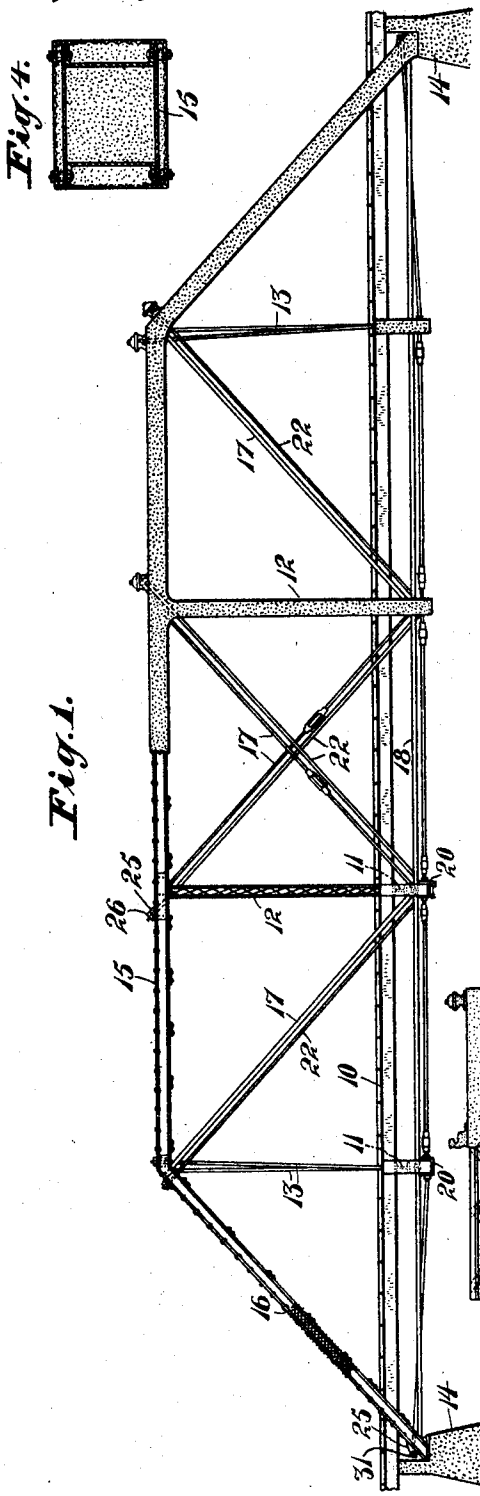


Fig. 1.

Fig. 4.

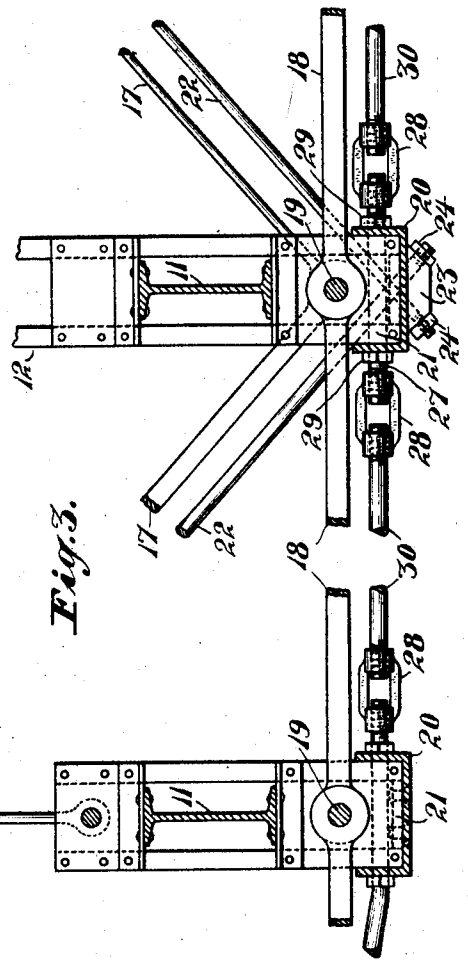


Fig. 3.

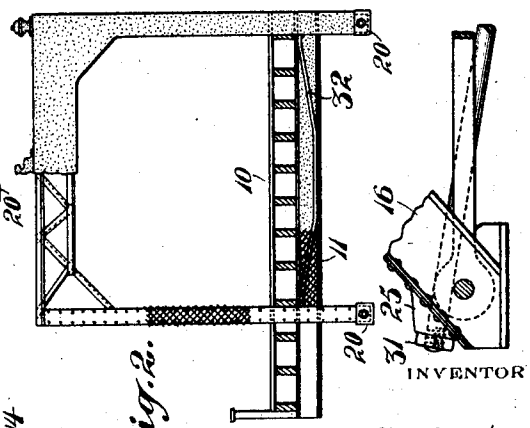


Fig. 2.

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METHOD OF REINFORCING BRIDGES AND LIKE STRUCTURES.

1,331,871. Specification of Letters Patent. Patented Feb. 24, 1920.

Application filed June 25, 1919. Serial No. 306,596.

To all whom it may concern:

Be it known that I, CHARLES G. MORTENSON, a citizen of the United States, residing in the city and county of San Francisco and State of California, have invented new and useful Improvements in Methods of Reinforcing Bridges and like Structures, of which the following is a specification.

This invention relates to bridges and like structures, and particularly pertains to a method of reinforcing the same.

At the present time engineers are confronted with a problem in bridge construction and repair which has proven quite difficult. Due to the fact that traffic has increased over all highways and railways and that the tonnage of the traffic is materially increased over the tonnage contemplated when bridges were built, and, furthermore, to the weakened condition of bridges which have arisen by the action of the elements and general deterioration, it has become necessary to replace many bridges or to provide some adequate means for reinforcing the bridge structures. As it is imperative that traffic is not interrupted, it is more desirable to increase the capacity of bridges than it is to tear them away and build larger and stronger bridges sufficient to meet the traffic demands. And it is the principal object of the present invention to provide means whereby the steel structures of both highway and railway bridges may be adequately reinforced without interruption of traffic and by a method which will not only restore the bridge to its original strength, but provide any additional strength desired and further insure that the bridge, so reinforced, will be further protected against the action of the elements.

The present invention contemplates the use of stirrups or reinforcing caps which may be mounted upon the lower ends of bridge posts and which will receive additional cord and tension reinforcing members, coöperating with the original bridge structure, after which all of the structural elements of the bridge are incased in concrete to form a homogeneous, ferro-concrete bridge structure of any pre-determined strength.

The invention is illustrated by way of example in the accompanying drawings, in which:—

Figure 1 is a view in side elevation, showing a bridge partially reinforced by the present method and as partially incased in concrete to form a ferro-concrete structure.

Fig. 2 is a view in end elevation showing the portal of a partially completed bridge, reinforced by the present method.

Fig. 3 is an enlarged fragmentary view, showing the manner of mounting the reinforcing members upon the bridge structure and partially disclosing the connections with the bridge abutment, one of the floor beams and one of the bridge posts, parts being broken away for the sake of convenience.

Fig. 4 is a view in transverse section through one of the chords fitted with corner angles.

In the drawings, a five-panel structural steel bridge is shown, and it is the object of the present invention to provide means for reinforcing this bridge, and at the same time, increasing its strength. It will be understood that any type of bridge might be employed in carrying out the present method and in the present structure, a floor 10 is provided and mounted upon transverse floor beams 11. The two center floor beams are supported by vertical posts 12, while the outer beams are supported by vertical rods 13. The ends of the floor are, of course, resting upon the abutments 14. Top chords 15 are provided and supported upon the upper ends of the post 12 and are further supported at their opposite ends by end chords 16, these latter chords resting upon the abutment. The structure is further tied together by a plurality of diagonal rods 17 connecting the various chords 15 and 16 with the floor-beam structures and the posts 12. The bridge is tied together longitudinally by a plurality of chord rods 18, which are fastened to chord pins 19. These pins are secured upon end-plates forming a part of the floor-beam structures.

When a bridge of the present type is to be reinforced, caps 20 are mounted over the lower ends of the posts 12 and also over the lower ends of the floor-beam structures intermediate the posts 12 and the abutments. These caps are clearly shown in Fig. 3 as having a bottom plate adapted to be fitted against the lower end of the post-structures and having side flanges which conform to the sides of the posts and floor-beam structures to prevent longitudinal movement. In order to further stabilize the caps, plates

21 are secured to the bottom portions and extend upwardly between the panels of the structural members, this will act to hold the beam caps so that they cannot move and that any strain to which they are subjected will be directly transferred to the structures upon which they are mounted. The hangers which are disposed beneath the vertical posts 12 are supported by means of secondary diagonal 22, these members extend upwardly through the caps 20 and outwardly through the channel members of the posts to be secured through the chord members 15 and 16. A block 23 is mounted beneath the caps and is formed with diagonal faces to receive the nuts of the diagonal rods 22 and to permit these nuts, as indicated at 24, to be tightened. The chords are provided with filler blocks 25, which stand at an angle to the surface of the chords and act as bearing surfaces for nuts 26 upon the upper ends of the diagonal rods. The caps 20 carry said tension rods 27, which extends through the posts and the caps and are threaded at their opposite ends to receive turn-buckles 28. Lock nuts 29 are provided to be mounted upon the caps and to hold the tension rods in position. The turn-buckles are designed to receive the ends of secondary cords 30, which extend parallel to the original chord-bars 18. The tension rods 27 which extend through the structures of the end chords near the abutment are continued upwardly and pass through the foot of the chords 16, where they are secured by means of nuts 31, which rest against filler blocks 25 as previously described. Further reinforcement of the structure is provided by transversely extending tie rods 32, which are connected with floor beams and stand parallel there along, as shown in Fig. 2. By the use of the tie-rods 32, it will be seen that the floor will be more properly supported and can be reinforced to carry any load desired.

With the structure comprising the original bridge and the elements previously described as being added, the final steps in the process may be made. At this time the frame-work may be inclosed in forms and completely embedded within concrete as indicated in Figs. 1 and 2. This will provide a definite mechanical structure calculated to carry certain strains and stresses, which structure now forms a part of a ferro-concrete bridge of any predetermined capacity and having its vital elements protected by the surrounding concrete.

It will thus be seen that by employing the present method a bridge may be reinforced and preserved without molesting any of the structural elements thereof, and by the addition of elements having pre-determined factors of strength, the method resulting in providing a bridge of superior construction over the original condition and design to accommodate any load without having required an interruption of traffic or the prohibitive expense of tearing down the bridge and building a new one.

Reference being had to Fig. 4, it will be seen that the top and end chords are reinforced by corner plates formed of angle iron. This construction will prevent breakage of the corners of the finished work.

While I have shown the preferred method of carrying out the present invention, it will be understood that various changes in the steps of the method might be made by those skilled in the art, without departing from the spirit of the invention, as claimed.

Having thus described my invention, what I claim and desire to secure by Letters Patent is—

1. A method of reinforcing and protecting completed and used bridges which consists in adding parallel diagonal and chord rods to the frame-work thereof, and thereafter embedding the beams and posts of the bridge in concrete to form a ferro-concrete frame.

2. A method of reinforcing completed bridges which consists in mounting caps upon the bridge posts, thereafter connecting auxiliary chord bars to said caps then connecting auxiliary diagonals to the caps and extending them through the main chords and then embedding the bridge posts and the main beams in concrete to form a reconstructed and reinforced bridge.

3. A method of reinforcing a completed bridge, which consists in reinforcing the floor beams of the bridge with tie chords, thereafter mounting cap-members to the bridge structure at the ends of the floor beams then adjustably connecting chord rods to said caps, then passing diagonal rods through the caps and extending them upwardly through the main bridge frame and thereafter embedding the truss floor beams, the posts of the bridge frame and the main beams in concrete.

4. A method for reinforcing and protecting completed and used steel bridges and like structures, consisting in connecting the chord members with means to increase their tensile resistance, and embedding said members, and the compression members in a body of concrete.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

CHARLES G. MORTENSON.

Witnesses:

W. W. HEALEY,

M. E. EWING.