Dec. 18, 1934. A. C. BRIGGS 1,984,567

BRIDGE CONSTRUCTION

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Fig. 1.

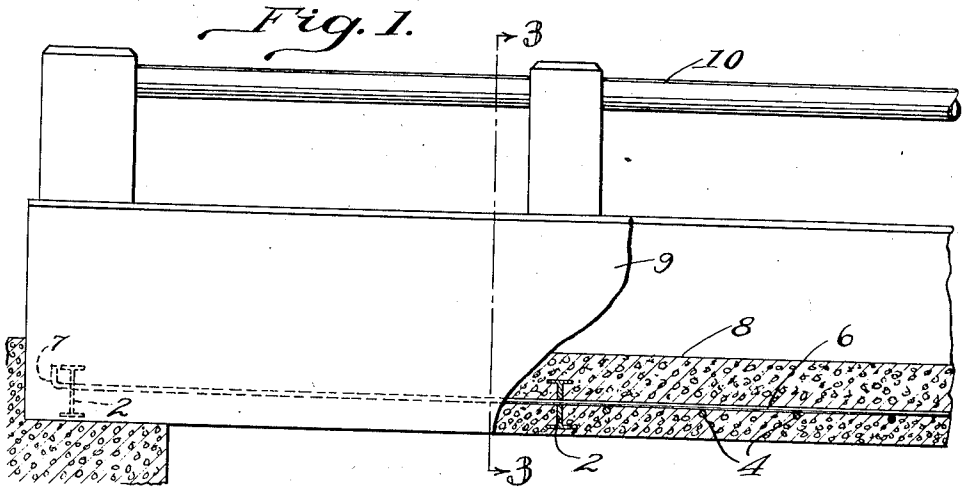


Fig. 2.

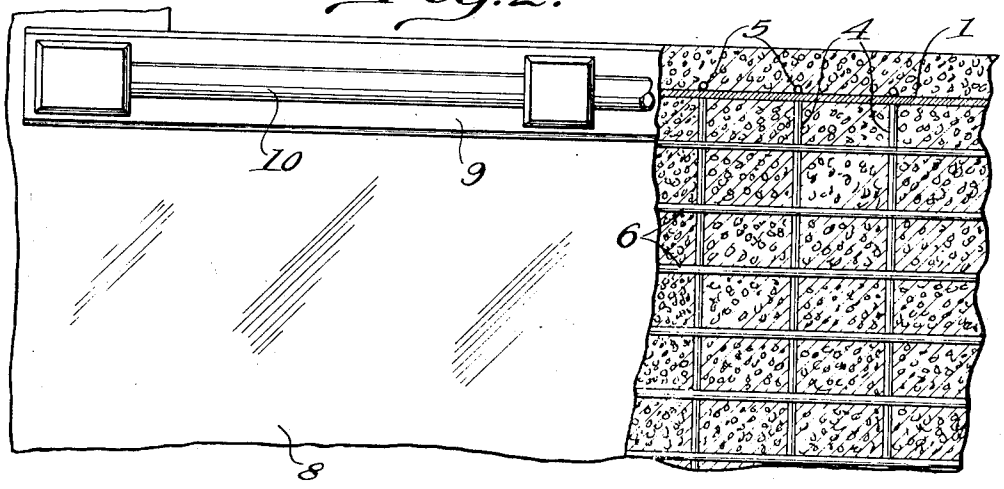
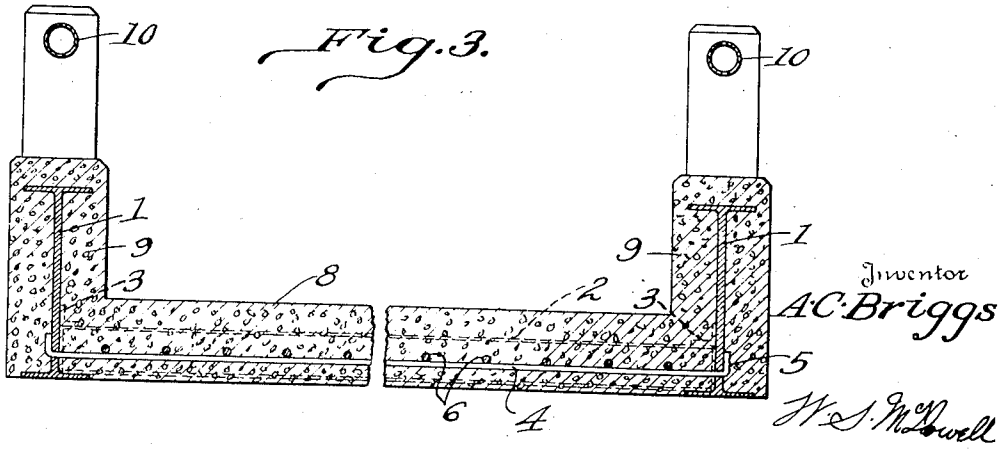


Fig. 3.



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Fig. 4.

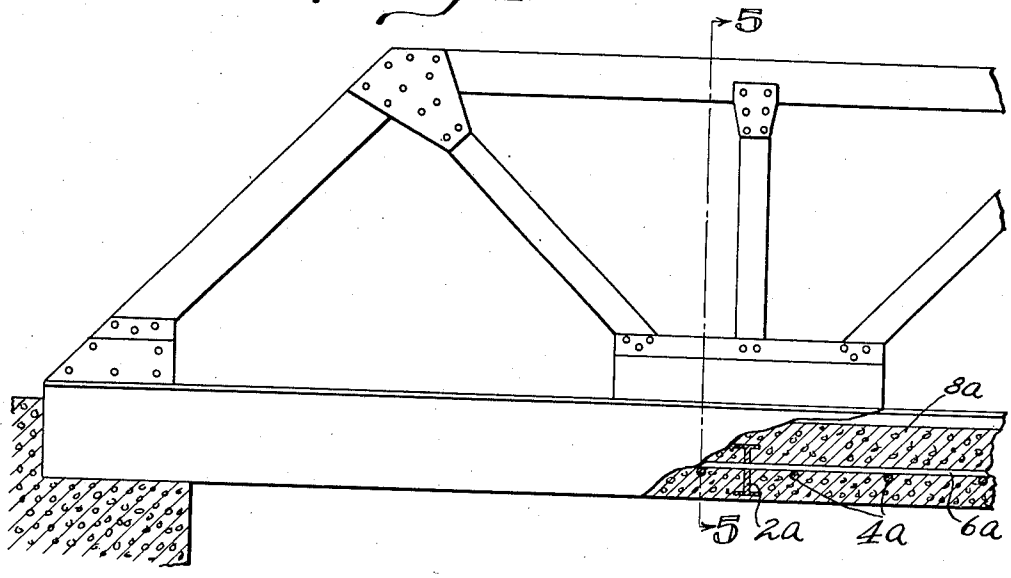
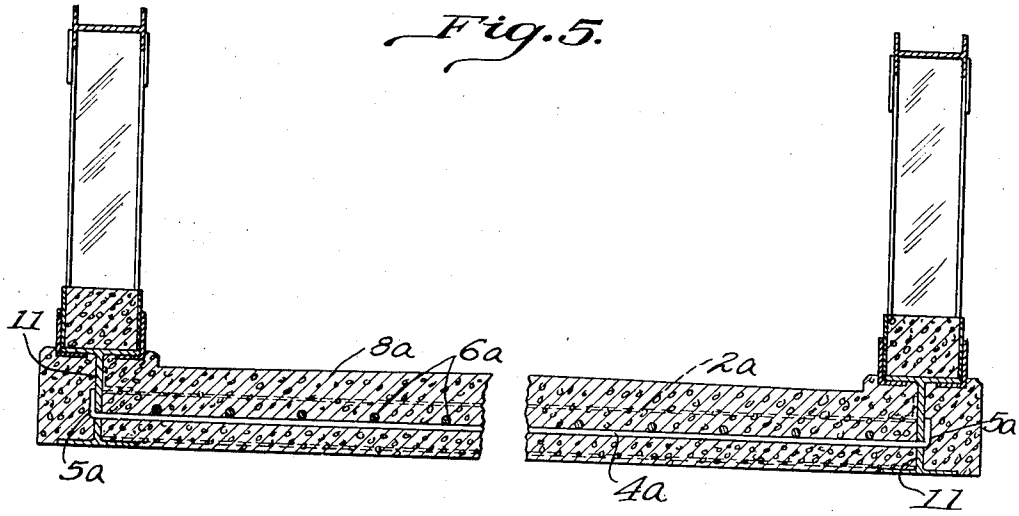


Fig. 5.



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BRIDGE CONSTRUCTION

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Application February 3, 1933, Serial No. 655,096

1 Claim. (Cl. 72—64)

This invention relates to improvements in bridge construction and, in its more specific aspects, has particular reference to an improved reenforced concrete and structural steel bridge of simple, economical and efficient design especially suitable for use in highway service.

It is an outstanding object of the present invention to provide a highway bridge composed principally of structural steel and concrete, and wherein an improved arrangement and cooperative grouping of the structural steel members is provided by which there attains, in comparison with ordinary bridge designs, a marked economy in the amount of metal employed without reduction in the load-sustaining properties of the bridge and its ability to withstand for prolonged periods of usage the deteriorating influences of vehicular travel thereover.

It is another object of the invention to provide a bridge so designed as to produce a more compact and rigid structure, wherein the principal metallic members are substantially completely embedded in the concrete floor slab and its integral upstanding sides, whereby to both protect the metal members and highly reenforce the concrete covering thereof.

With these and other objects in view, which will appear as the description proceeds, the invention consists in the novel features of construction, combination of elements and arrangements of parts hereinafter fully described and pointed out in the appended claim.

In the accompanying drawings:

Fig. 1 is a view partly in longitudinal section and partly in side elevation showing the arrangement of the parts entering into the design of the improved bridge construction comprising the present invention;

Fig. 2 is a top plan view, partly in horizontal section of the bridge construction;

Fig. 3 is a transverse vertical sectional view on the plane indicated by the line 3—3 of Fig. 1;

Fig. 4 is a detail view in side elevation of a slightly modified form of the present invention;

Fig. 5 is a transverse sectional view on the line 5—5 of Fig. 4.

Referring more particularly to the drawings, my improved bridge comprises a pair of transversely spaced, longitudinally extending girders 1. In the specific form of the invention illustrated in Figs. 1 to 3, these girders partake of the nature of I beams of appropriate length and of rolled cross sectional configuration found in structural steel members of this type. It should be understood, however, that the invention is not limited to the employment of girders of this specific type and of unitary one-piece construction, since it will be obvious to those skilled in the art that I may employ in lieu thereof fabricated beams in the form of a plurality of joined members formed from structural steel slabs or steel plate and shaped to constitute trusses or the like. I therefore employ the term load-sustaining members in the following claim as more accurately defining the true physical characteristics of the girders as indicated at 1.

Any suitable sub-structure (not shown) may be used in effecting the support of the members 1 in their bridge-forming positions, and inasmuch as such a sub-structure does not enter directly into the present invention, no more than passing reference need be given the same. In the construction of the bridge, the girders 1 are placed on the sub-structure in parallel, transversely spaced relative order, and these girders may be united by means of relatively smaller cross beams 2, which rest at their ends upon the lower and inner flanges of the girders 1, and, if desired, may be secured thereto in any suitable manner, such for instance as by means of the angle clips 3. The vertical webs of the girders 1 near the bottom flanges are perforated at suitable longitudinal intervals, and adapted to be received within these perforations are the ends of a number of transversely extending reenforcing rods 4 which, in this instance, after being cut into suitable lengths, have their ends upturned as at 5 so that they will be retained in secured relationship in connection with the girders. If desired, of course, the ends of the rods may be threaded for the reception of nuts, which may be used in lieu of the up-turned ends 5 in uniting said rods in connection with the girders. Likewise, the secondary cross beams 2 may be provided with perforations for the reception of longitudinally extending and transversely spaced reenforcing rods 6. The rods 6 extend parallel with the girders 1 and rest upon the upper surfaces of the transverse rods 4 and, as indicated, the ends of the rods 6 may be up-turned as at 7 to restrain the same against undesired longitudinal movement.

With the steel members assembled in the positional order specified, suitable forms (not shown) are erected adjacent to the same permitting of the pouring and shaping of the concrete floor slab 8 thereabout. In this instance, the floor slab is of U-shaped cross sectional configuration so that its upstanding sides 9 will completely en-

case the girders 1. Any suitable type of guard rail 10 may be mounted upon the upper portions of the sides 9, if such guard rails are needed.

In view of the construction disclosed, it will be seen that the present invention provides a strong, compact and rigid bridge structure wherein a novel reenforcing is included, completely embedded in the concrete body of the bridge, which is of such arrangement and design that a considerable saving in the amount and weight of the metal is effected over comparable previous types of bridges of this general class. In other words, lighter side girders or equivalent load-sustaining members may be used, together with lighter and fewer cross members and associated reenforcing rods. It is particularly in this matter of metal economy that the present invention has been directed and in relation to previous standard types of bridges of this type, the amount of structural steel is reduced from 40 to 50 per cent, and the total amount in the structure 25 to 35 per cent. While this advantage in metal economy has been obtained, the arrangement of the metal members in the concrete is such as to provide a construction of long life and durability, of a more compact and rigid design, and one wherein the impact, due to the passage of heavy and rapidly moving loads thereover, is reduced to a minimum. Inasmuch as the bottom of the bridge is of flat planar form, sub-structure design is simplified and another economy thereby effected. Since all the exposed steel members of the bridge are above the slab 8, the same are easily reached for painting purposes, thereby simplifying and proving an economy in the up-keep of the bridge.

Again, in the construction of bridges of this type, if the length should exceed a certain limit, it will be found economical to replace the girders, of the type indicated at 1, with specially designed trusses. In Figs. 4 and 5, such a truss arrangement has been disclosed. This truss differs from the ordinary truss in that the lower chord is designed so that it will be sufficiently strong to act as a girder between panel points and support the slab floor of reenforced concrete. The lower chord may be designed in two parts; one part to meet the direct stress in that member and the other to support the slab floor and its attendant load between panel points, but preferably the two may be combined in a single form and designed from a steel girder beam, as indicated at 11, to which the slab 8*a* may be attached, as shown in Figs. 4 and 5. A cross strut 2*a* is placed at each panel point in order to tie the trusses 11 together, and a light lateral system is used to line up the trusses and hold them in alignment until the slab is poured and the system is encased in concrete. The transverse reenforcing bars 4*a* are cut to correct lengths, passed through corresponding holes in the lower chord girders and bent or clinched as at 5*a*, or threaded for the reception of nuts. The longitudinal reenforcing bars 6*a* are passed through corresponding sets of holes in the cross struts 2*a* and rest upon the transverse bars 4*a*, the bars 6*a* extending substantially the full length of the slab and have their ends bent or clinched.

Ordinarily for short span bridges, not over 40 feet in length, two steel girder beams, as indicated at 1, of sufficient strength may be employed to replace the trusses, which are used in bridges of greater lengths, the girders serve to further reduce the quantity of steel required. In both forms of my invention, however, it will be observed that as compared with ordinary bridge design, there is a very great saving both in the total number of beams or girders employed and in the total weight of the metal entering into the construction of the bridge.

Obviously the bridge is capable of considerable modification within the scope of my invention and therefore I do not wish to be limited to the specific features shown and described, but reserve the right to employ such modifications that may be said to fall within the scope of the following claim. For instance, more than one pair of girders may be required for a bridge used in association with a wide roadway.

What is claimed is:

A highway bridge comprising a plurality of relatively widely spaced girder beams having anchored thereto a concrete slab, a plurality of transverse reinforcing bars spaced relatively closely together passing through said concrete slab and securely attached to each of said girder beams to anchor said slab thereto, said transverse reinforcing bars being subject to tension and imparting to the floor additional strength and load carrying capacity, and auxiliary reinforcing means extending through said concrete slab to prevent cracking from expansion and contraction strains.

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