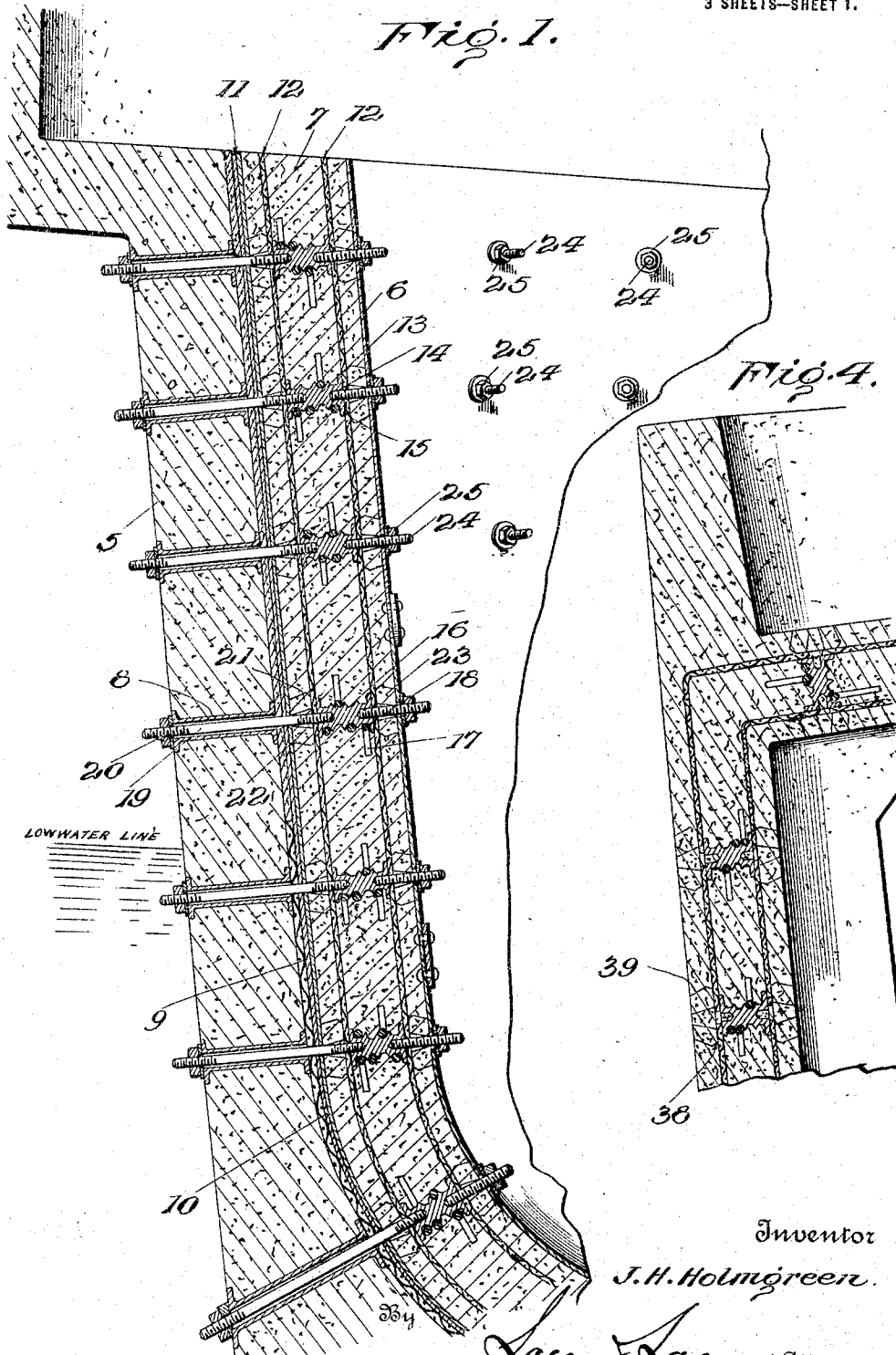


J. H. HOLMGREEN.
CONSTRUCTION OF THE HULLS OF CONCRETE SHIPS.
APPLICATION FILED OCT. 5, 1918.

1,303,667.

Patented May 13, 1919.
3 SHEETS—SHEET 1.

Fig. 1.



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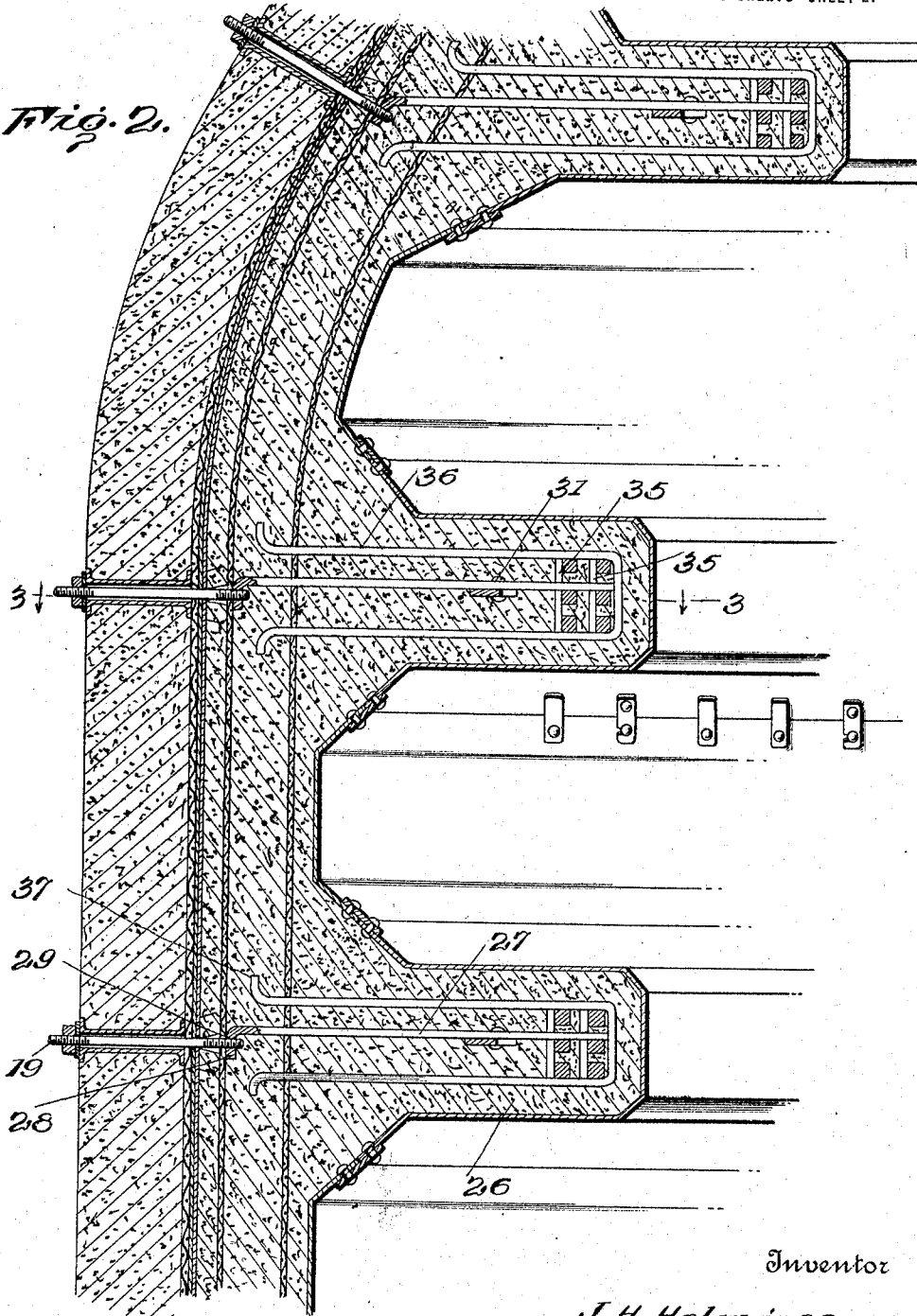
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Fig. 2.



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Fig. 3.

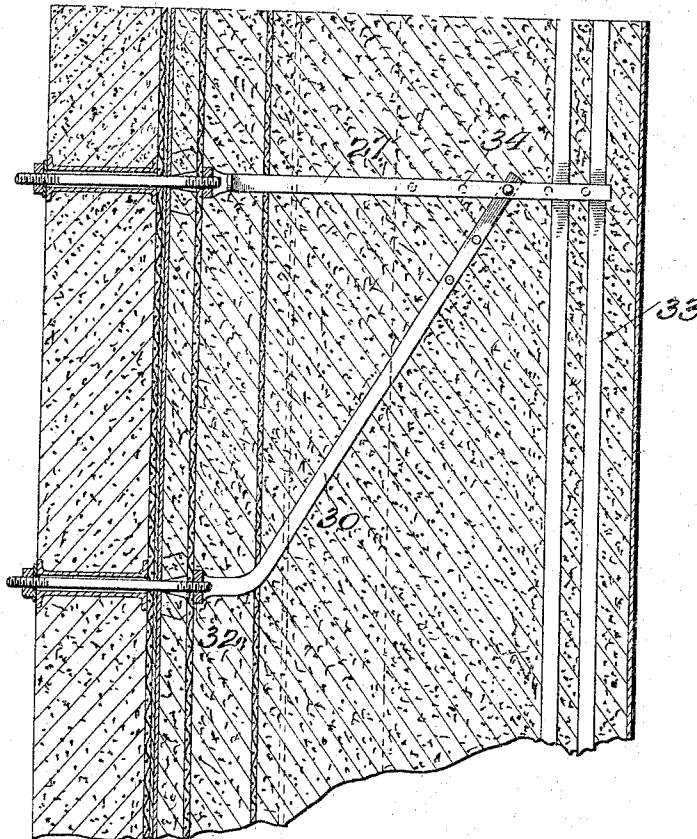


Fig. 5.

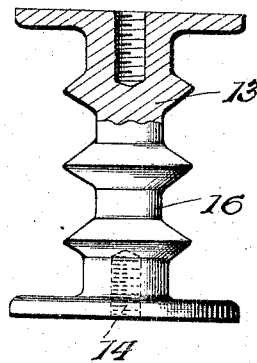
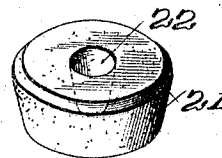


Fig. 6.



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UNITED STATES PATENT OFFICE.

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CONSTRUCTION OF THE HULLS OF CONCRETE SHIPS.

1,303,667.

Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, JULIUS H. HOLMGREEN, a citizen of the United States, residing at San Antonio, in the county of Bexar and State of Texas, have invented certain new and useful Improvements in Construction of the Hulls of Concrete Ships, of which the following is a specification.

This invention relates to concrete ships and other floating craft and more particularly to the construction of the hulls thereof.

The object of the invention is to provide a concrete hull capable of being conveniently and expeditiously cast or molded in a suitable form and which will be comparatively light in weight and at the same time possess sufficient strength and durability to effectually withstand all strains to which ships are subjected incident to ocean travel.

A further object of the invention is to provide a concrete hull the walls of which are reinforced and strengthened by the provision of binding elements or rods which engage suitable supporting members embedded in the concrete of which the wall is formed, said rod supporting members also serving to properly space circumferential strips of foraminous material which constitute a further reinforcement for the walls of the hull.

The invention further contemplates the provision of a plurality of frusto-conical spacing members or disks which are disposed at opposite ends of the rod supporting members and bear against the adjacent strips of foraminous material, the outer faces of the disks being disposed flush with the contiguous faces of the walls of the hull so as to space the foraminous material a sufficient distance therefrom to prevent electrolytic action when the hull is launched.

A further aim of the invention is to provide a novel form of reinforcement for the ribs of the hull and means for supporting the rib reinforcements within the mold during the molding operation.

A still further object of the invention is generally to improve this class of devices so as to increase their utility, durability and efficiency.

Other and incidental objects will appear during the course of the detailed description of the invention. In the drawings, wherein I have illustrated the preferred embodiment of the invention, and wherein similar reference characters designate corre-

sponding parts throughout the several views:

Figure 1 is a vertical sectional view of a portion of a concrete ship embodying the present invention and showing the mold set up and in position to receive a charge of concrete,

Fig. 2 is a horizontal sectional view showing the construction of the ribs of the hull and manner of reinforcing the same,

Fig. 3 is a vertical sectional view taken on the line 3—3 of Fig. 2,

Fig. 4 is a vertical sectional view of a portion of the cast or completed hull,

Fig. 5 is an enlarged side elevation of one of the rod supporting members detached, and

Fig. 6 is a similar view of one of the spacing washers or disks detached.

For the sake of illustration and for the further purpose of enabling those skilled in the art to readily construct a concrete hull embodying the present invention, I have shown and described a mold, but it may be here stated that said mold and its associated parts form the subject matter of a separate application, executed of even date herewith, and that no claim is made in this application thereto, the present invention being confined to the mechanical construction and reinforcement of the hull *per se*.

The outer wall or shell of the mold is indicated by the numeral 5 and is preferably formed of concrete while the inner wall 6 is preferably formed of one or more relatively thin sheets of metal suitably united, said walls being spaced apart to form an intermediate molding chamber or compartment 7 adapted to receive the concrete or other material of which the body of the hull is formed. The outer wall 5 is relatively thick and provided with a plurality of openings preferably extending the entire height thereof and in which are seated cylindrical sleeves 8 certain of which are adapted to permit the passage of water to the inner surface of the wall 5 for the purpose of floating the cast or molded hull out of the form in which it is cast. The inner face of the mold is covered by a strip of wire netting 9 over which is placed a sheet metal plate 10 and one or more layers of waterproof paper 11, the wire netting 9 extending for a portion only of the height of the wall 5 and the paper strips 11, which constitute the surface lining of said wall, being preferably ex-

tended the entire height of the mold. Arranged within the molding chamber 7 are spaced circumferential strips of wire netting or other foraminous material 12, which strips are maintained in parallel relation to each other by means of rod supporting members indicated at 13. These rod supporting members 13 are preferably cylindrical in cross section and are provided at their opposite ends with threaded sockets 14 and laterally extending flanges 15. The intermediate portion of each rod supporting member is formed with a series of circumferential grooves 16 which form seats for a plurality of reinforcing members or rods 17. Certain of the rods 17 extend vertically of the hull and others horizontally and diagonally thereof, said rods being retained within the seating grooves by means of binding wires 18 and said rods being also preferably tied to each other at predetermined intervals by similar wires or other binding elements.

The rod supporting members 13 are supported within the chamber 7 during the molding operation by means of anchoring bolts 19 which extend through the sleeves 8 for engagement with the adjacent threaded sockets of said members and are provided at their outer ends with clamping nuts 20 which bear against the flanged ends of the sleeves 8 as shown. Interposed between the outer strip of wire netting 12 and the adjacent face of the surface lining, are a plurality of spacing members or disks 21 having therein to permit the passage of the bolts 19. Similar spacing members or washers 23 are interposed between the inner wall 6 and the adjacent wire netting 12 and are provided with correspondingly conical openings to permit the passage of auxiliary securing bolts 24 provided with clamping nuts 25. The disks or washers 21 and 23 are preferably formed of concrete and serve the purpose of spacing the strips of wire screening 12 inwardly a sufficient distance from the adjacent faces of the hull of the vessel to prevent electrolytic action when the hull is immersed or partially immersed in water incident to launching the vessel. The inner set of washers 23 also serve to space the inner wall 6 of the mold from the screen material, as will be readily understood.

The hull of the vessel is provided with a plurality of circumferential reinforcing ribs 26 and molded within the concrete at said ribs are anchoring brackets each consisting of a horizontal bar 27 having its outer end bent laterally to form an angularly disposed foot 28 formed with a threaded opening 29 for engagement with the correspondingly threaded end of the adjacent anchoring bolt 19, as best shown in Fig. 2 of the drawings. Connected with the horizontal bar 27 is a diagonally disposed truss rod or brace 30

having one end thereof bolted at 31 to the horizontal bar 27 and its other end bent laterally to form a foot 32 similar in construction to the foot 29 and which foot 32 is engaged by one of the anchoring bolts 19. The anchoring brackets thus formed serve as a means for supporting or suspending a plurality of vertically disposed reinforcing rods 33 within the chamber 7, during the molding operation, and in order that these vertical rods 33 may be held from displacement when pouring the concrete within the mold, the horizontal bars 27 are provided with a plurality of openings 34 adapted to receive transverse rods 35 to which the vertical reinforcing rods are tied or otherwise secured. In the present instance, two sets of vertically disposed reinforcing rods are shown but it will, of course, be understood that as many sets of vertical rods may be employed as is found desirable or necessary to properly strengthen the ribs and that when more than two pairs of said rods are employed, a correspondingly increased number of the transverse rods 35 will be used in connection therewith for tying or supporting the additional vertical rods. The ribs are preferably further reinforced and strengthened by the provision of a plurality of stirrups 36, the closed ends of which encircle the vertical reinforcing bars while the open ends thereof are bent laterally at 37 and are embedded in the wall proper of the hull of the vessel. Attention is here directed to the fact that inasmuch as the anchoring brackets are secured to the body of the mold by the anchoring bolts 19, the vertical reinforcing rods 33 will be securely held in their proper position within the molding chamber during the introduction of the concrete therein, without danger of accidental displacement during the molding operation. It will, of course, be understood that after the hull is formed, the anchoring bolts 19 are released, leaving the anchoring brackets and reinforcing rods embedded in the concrete wall of the hull to strengthen the same. By bending either the reinforcing bar 27 or truss rod 30 at the foot 29, said bars and truss rods may be given any desired angle or inclination to accommodate the structure which is to be cast or molded.

It will further be noted that inasmuch as the walls of the openings in the spacing washers 23 are conical in shape and the exterior walls undercut at 38 and inclined at 39, said washers will be firmly anchored within the wall of the hull.

With the parts in the position shown in Fig. 1 of the drawings, concrete is poured, shoveled, or otherwise introduced into the molding chamber 7 and tamped or not, as desired. After the concrete has become sufficiently hard or solidified, the anchoring bolts 19 are withdrawn from the sleeves 8

and water from a suitable source of supply permitted to pass through the sleeves 8 to the inner face of the wall 5, the action of the water serving to dislodge the surfacing lining and float the cast hull out of the form, as fully set forth in my other application previously referred to. After the hull has been floated into the receiving dock the inner wall or shell 6 is removed and the openings in both sets of spacing members or washers are filled with concrete so that the outer faces of said washers will be flush with the contiguous faces of the hull of the ship, as best shown in Fig. 4 of the drawings. It will, of course, be understood that after the openings in the washers have been filled with concrete, the exterior of the hull will be coated or otherwise finished and, if desired, the inner face of the hull may be likewise finished prior to launching the vessel.

A concrete hull constructed in accordance with the present invention may be conveniently and expeditiously manufactured and will possess the requisite degree of strength and durability to enable it to effectually withstand crushing and other strains incident to ocean travel.

Having thus described the invention, what is claimed as new is:

1. In concrete construction, a wall having rod supporting members embedded therein, reinforcing rods engaging said members, reinforcing material bearing against the rod supporting members, and spacing elements disposed at the rod supporting members for spacing the reinforcing material inwardly from the opposite faces of said wall.

2. In concrete construction, a wall having rod supporting members embedded therein and provided with circumferential seating grooves, reinforcing rods seated in said grooves, reinforcing material bearing against the supporting members, and spacing elements disposed at the rod supporting members for spacing the reinforcing material inwardly from the opposite faces of said wall, the spacing elements being provided with openings which receive the concrete of which the wall is constructed.

3. In concrete construction, a wall having rod supporting members embedded therein, reinforcing rods engaging said members, reinforcing material bearing against the rod supporting members, and substantially frusto-conical spacing elements disposed at the rod supporting members and having openings formed therein for the reception of the concrete of which the wall is constructed, said spacing members serving to space the reinforcing material inwardly from the adjacent faces of the finished wall.

4. In concrete construction, a wall having rod supporting members embedded therein and provided with terminal laterally ex-

tending flanges and intermediate circumferential seating grooves, reinforcing material bearing against the flanges of said rod supporting members, reinforcing rods seated in the grooves and extending in different directions between the reinforcing material, and spacing members bearing against the reinforcing material at the flanges of the rod supporting members and provided with central conical shaped openings adapted to be filled with the concrete of which the wall is formed, said spacing members serving to space the reinforcing material inwardly from the opposite faces of the finished wall.

5. In concrete construction, a wall having rod supporting members embedded therein and provided with circumferential seating grooves, reinforcing rods seated in said grooves, foraminous material bearing against the opposite ends of the rod supporting members, and spacing washers bearing against the foraminous material at the rod supporting members and each having a centrally disposed conical shaped opening and a circumferential wall inclined in opposite directions, said washers serving to space the foraminous material from the opposite faces of the finished wall and the openings in the washers being adapted to be filled with the material of which the wall is formed.

6. In concrete ship construction, a wall having rod supporting members embedded therein and provided with circumferential seating grooves and oppositely disposed sockets, foraminous material bearing against the opposite ends of the rod supporting members and covering said sockets, and spacing members bearing against the foraminous material and provided with openings alined with the sockets in the rod supporting members, said spacing members serving to space the foraminous material inwardly from the opposite faces of the finished wall and the openings in said spacing members and sockets in the supporting members being filled with the material of which the wall is formed.

7. In concrete ship construction, a wall having transverse rod supporting members embedded therein and provided with terminal sockets and laterally extending flanges, the walls of the rod supporting members between the flanges being provided with circumferential grooves, reinforcing rods seated in said grooves, reinforcing material bearing against the flanges of the rod supporting members, and substantially frusto-conical spacing members bearing against the reinforcing material at the flanges and provided with conical openings registering with the sockets in the rod supporting members, the openings in the spacing members and sockets in the rod supporting members being adapted to be filled with concrete and

the outer faces of the spacing members being disposed flush with the finished surface of the wall.

8. A concrete hull for ships including a wall having a reinforcing rib, anchoring brackets embedded in the material of which the rib is formed and provided with a diagonal truss rod, and vertically disposed reinforcing rods embedded in the rib and supported by the anchoring brackets.

9. A concrete hull for ships including a wall having a reinforcing rib, an anchoring bracket embedded in the material of which the rib is formed and including a substantially horizontal bar having an angularly disposed foot provided with a threaded opening, a diagonally disposed bar connected with the horizontal bar and provided with a similar foot, and vertically disposed reinforcing rods embedded in the material of which the rib is formed and supported by said anchoring bracket.

10. A concrete hull for ships including a wall having a reinforcing rib formed integral therewith, an anchoring bracket embedded in the material of which the rib is formed and including a substantially horizontal bar having one end thereof provided with a plurality of openings and its other end bent laterally to form an angularly disposed foot having a threaded opening therein; a diagonally disposed truss rod secured to the forward portion of the horizontal bar and having its lower end bent laterally to form a similar foot, a plurality of sets of vertically disposed reinforcing bars embedded in the material of which the rib is formed, and transverse securing rods extending through the openings in the horizontal bar between each set of vertical rods and to which said vertical rods are tied or otherwise secured.

In testimony whereof I affix my signature.
JULIUS H. HOLMGREEN. [L.S.]

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."