

May 29, 1923.

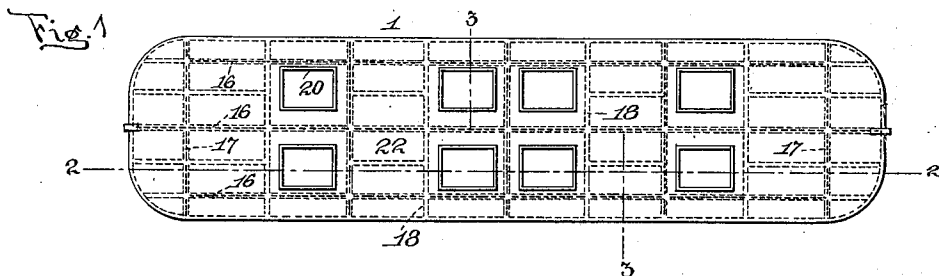
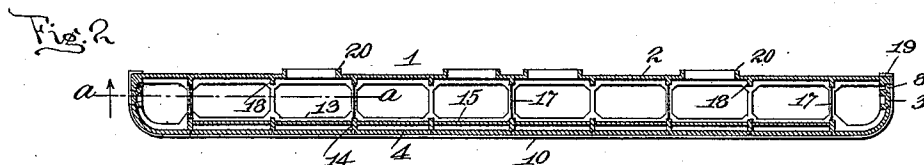
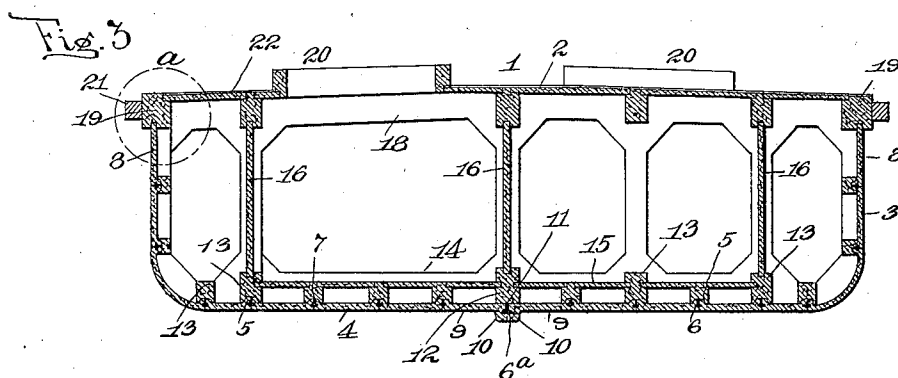
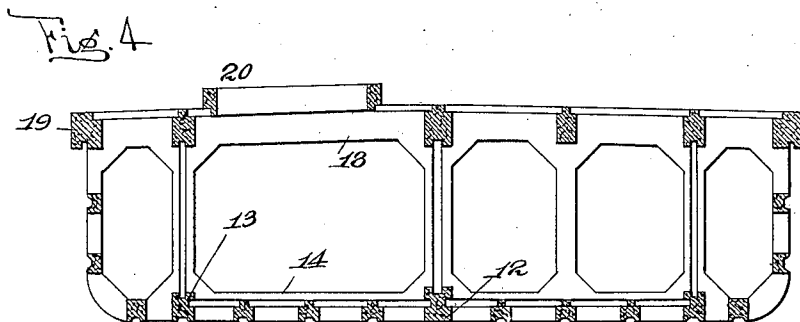
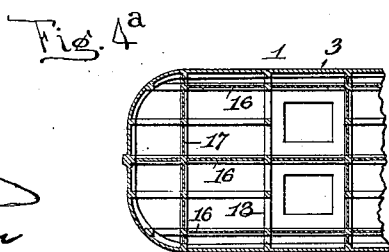
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1,457,006

REINFORCED CONCRETE VESSEL

Filed Jan. 2, 1918

2 Sheets-Sheet 1



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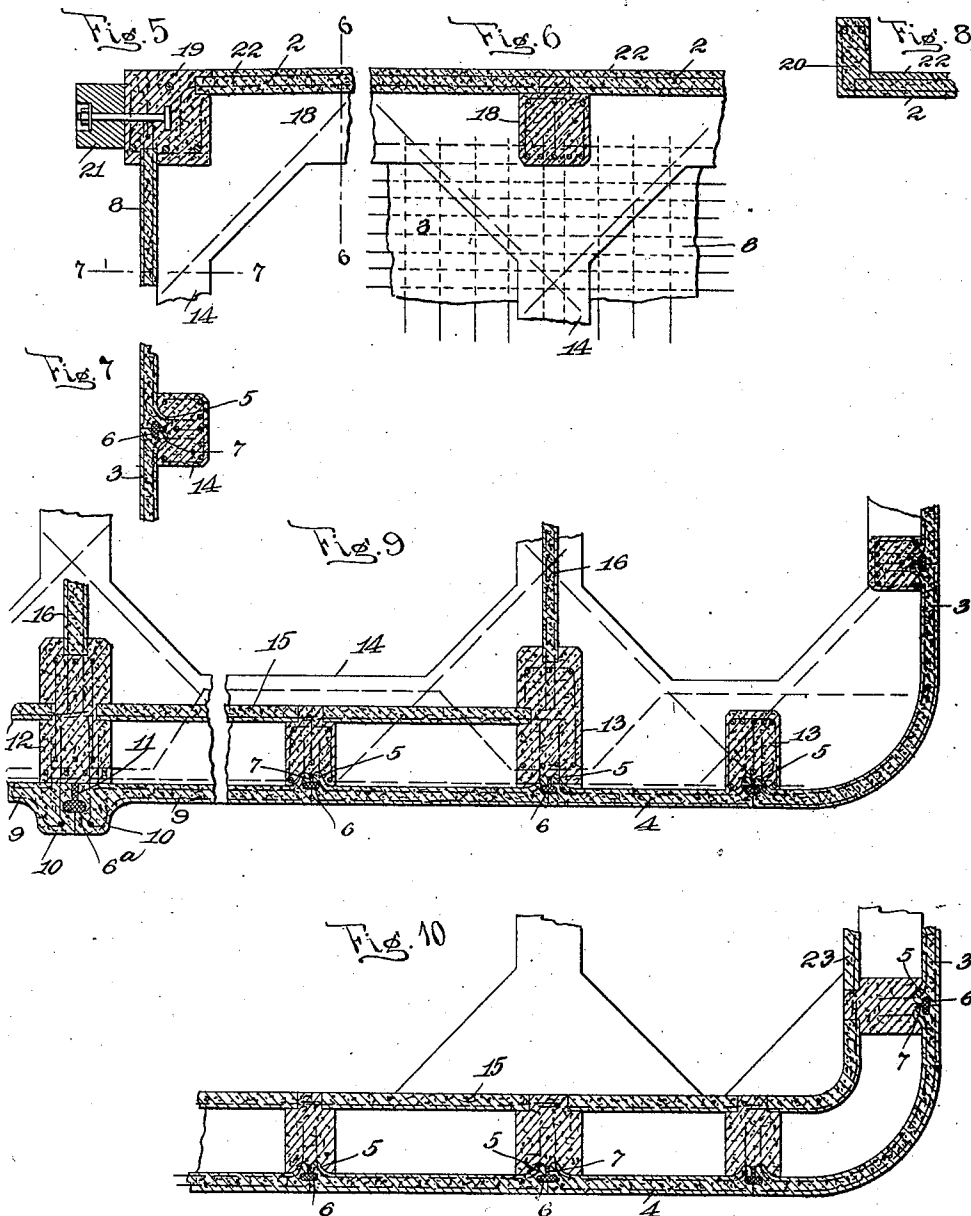
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REINFORCED CONCRETE VESSEL

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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE.

JOHN T. SIMPSON, OF NEWARK, NEW JERSEY.

REENFORCED CONCRETE VESSEL.

Application filed January 2, 1918. Serial No. 209,817.

To all whom it may concern:

Be it known that I, JOHN T. SIMPSON, a citizen of the United States, residing at Newark, in the county of Essex and State of New Jersey, have invented a certain new and useful Improvement in Reenforced Concrete Vessels, of which the following is a specification.

My invention relates to reenforced concrete structures and more particularly to vessels for marine transportation. The object I have in view is the production of a boat composed of shop cast and field cast elements, the shop cast parts being in relatively small pieces whereby better and faster work may be accomplished and wherein defects will be easier to find, and rejected parts will be small and relatively inexpensive.

A further object is the production of standardized construction wherein the principal parts may be manufactured at convenient points and shipped in knock-down condition to the assembling point at the waterside.

Another object is the production of ship plates of reenforced concrete and to provide means for securing such plates to the ribs and beams of a vessel in such a manner as to prevent leakage between the plates and to prevent racking and breaking up of the plates and other parts of the structure.

These and further objects will more fully appear in the following specification and accompanying drawings considered together or separately.

I have illustrated my invention in the accompanying drawings in which similar reference characters are applied to corresponding parts in all of the several figures, and in which—

Figure 1 is a deck plan view of a barge or lighter embodying my invention,

Figure 2 is an inboard profile or longitudinal section of the same taken on the line 2—2 of Figure 1,

Figure 3 is a transverse section on an enlarged scale taken on the line 3—3 of Figure 1.

Figure 4 is a view similar to Figure 3 but showing the field molded elements only.

Figure 4^a is a section on the line *a—*a** of Figure 2,

Figure 5 is a greatly enlarged detail of that portion of the structure in the circle *a* of Figure 3,

Figure 6 is a section on the line 6—6 of Figure 5,

Figure 7 is a section on the line 7—7 of Figure 5,

Figure 8 is a detail section of a hatch combing,

Figure 9 is a greatly enlarged sectional view showing the bottom and side construction and

Figure 10 is a view similar to Figure 9 but showing a modification.

The invention comprises a buoyant structure having shop cast elements and field cast elements, the two being combined and permanently connected together to form a monolithic construction by the operation of molding the field cast members.

By "shop-cast" elements I mean those portions of the structure which are not molded during the construction of the vessel. These elements are manufactured in a factory which may be at a great distance from the point of assembly. They may be machine cast in a well equipped shop. Each of the different shapes required will be the exact counterpart of the other shapes of its size. The surfaces will be smooth. The parts may be artificially dried and seasoned thereby speeding up construction. The cost will be greatly reduced. One shop may turn out sufficient shapes to keep several assembling plants busy. The shop cast shapes are few in number and vessels of any size and tonnage may be constructed. The liability of producing defective work will be reduced to a minimum and inspection will be greatly facilitated.

By "field-cast" elements I mean those parts of the vessel which are molded during the operation of assembling the shop cast elements at the waterside in order that the finished structure may be launched. The elements are combined so that the field cast part will interlock with the reinforcements of the shop cast parts and form a unitary structure. The field cast and shop cast elements are further locked together to prevent separation of the parts due to strains.

The shop cast elements form part of the mold of the other elements and the wetted portion of the hull of the vessel is composed entirely of shop cast elements.

In the drawings 1 designates a decked barge or lighter which may be of any desired length, beam and depth of hold. The hull

is composed of deck plates 2, side plates 3 and bottom plates 4, all composed of shop cast reenforced concrete slabs. Each of the skin plates, except the 'midship rows extending lengthwise of the vessel from the deck line forward to the deck line aft and running along the bottom and the top row of plates, is provided with a flange 5 on one side thereof adjacent the edge thereof and surrounding the plate. Each of the flanged edges of the plate is provided with a recess 6 extending the entire edge of the plate. The recess 6 therefore forms a groove extending entirely around the plates mentioned. When the plates are placed side by side and end to end there will be a recess double the depth of each groove at the joining edges of the plates. The overall dimension of the flanged side of each plate being a trifle less than that of the plate, a slot 7 will be formed at each joint and the slots will communicate with the recesses.

The top line 8 of plates have the flanges 5 extending around three sides only, the fourth or top side being unflanged for a purpose to be hereinafter specified. The two 'midship rows 9 of plates are provided with a flange 5 and a recess 6 on three sides only. The fourth side of each plate 9 is provided with an enlargement 10 on the side opposite the flange 5. The enlargement 10 extends along one side of the plate and the edge of the enlargement is provided with a recess 6^a. The edge of the enlargement extends a short distance beyond that edge of the plate. When the plates 9 are assembled with the edges of the enlargements 10 in contact a slot 11 will be formed and will permit access to the recess 6^a.

The flanges 5 are rounded at their crests and the sides thereof merge into the surfaces of the plates in curved lines as shown.

The plates 6, 8 and 9 are of the shape desired. In a barge, as illustrated, most of them are flat. Those joining the side and bottom plates may be angular or curved and the plates at the corners are curved to give the vessel a rounded form fore and aft. It will be understood that the plates may be made of any shape in order that the vessel may have the conventional shapes of bows and stern.

The plates are reenforced by means of two layers of galvanized wire netting of large mesh and the wires project beyond the edges of the plates and inward at right angles to the surface of the plate.

In assembling, the 'midship rows of plates including the curved plates forming the lowermost parts of the forward and after ends of the structure are placed in position on the ways from which the vessel is to be launched. The flanges 10 of the plates will form the false keel. The recess 6^a and slot 11 extending fore and aft and the recesses 6 and slots

7 between the individual plates of the rows are then tightly caulked preferably with a mixture of pitch and oakum. The bottom plates 4 and the curved plates forming partly bottom and partly side, bow and stern plates are placed in position and the recesses 6 and slots 7 are caulked as before.

A pair of mold boards properly spaced apart and enclosing the slot 11 are placed in position extending the entire length of the vessel. This mold will be carried upward at the ends to form the lower portions of the stem and stern post. This mold will define the keel 12 of the vessel as well as the stem and sternpost. A similar mold will be placed over each longitudinal seam between plates to form longitudinal braces 13.

The athwartship seams are enclosed by similar molds which at the beam ends extend upward. The last mentioned molds will define the ribs 14.

The mold boards are comparatively narrow so that a series of relatively shallow troughs crossing each other at right angles will be formed. It will be understood that the mold boards are not continuous but are interrupted at the junction of the longitudinal and lateral members.

Reinforcing members of approved shape and construction are now placed in position in the troughs extending lengthwise of the same. The reinforcements at the ends of the troughs are extended upward to the ultimate height of the vessel. At the junctions of the troughs vertical reinforcing members extending to the ultimate height of the boat are placed in position and interlocked with the horizontal reinforcing members. The projecting reinforcements of the shop cast plates are bent upward into the troughs and are more or less interlocked, to the members in the troughs.

Concrete is now poured into the troughs embedding the reinforcements therein. When the concrete has reached the tops of the troughs floor plates 15 are placed in position with their edges resting on the tops of those ribs and longitudinals which are included in the space which is to become the hold of the vessel. The floor plates are composed of slabs of reenforced concrete with the reinforcements projecting from the edges thereof so that when the plates are in position the said reinforcements will project into the spaces between the plates. Concrete is now poured into the spaces between the edges of the plates to embed the projecting reinforcements and make a flush floor surface.

Shallow troughs open at top and bottom are now placed on the floor members over the ribs thus far cast and over the keel and certain of the other longitudinal members. These troughs are now filled with concrete to a predetermined level. Fore and aft bulkheads 16 are now placed in position resting

on the field cast members so far cast. Athwartship bulkheads 17 are similarly placed in position on certain of the ribs 14.

These bulkheads are slabs of reinforced concrete with the reinforcements projecting from their edges. The troughs are now filled with concrete which will embed the lower edges of the bulkheads and the reinforcements projecting from those edges. The vertical edges of the bulkheads are not in contact with each other but there are spaces between them into which the reinforcements project.

At each of the junctions of the ribs and the longitudinal field cast members a vertical mold is constructed to define a stanchion which will embed the contiguous vertical edges of the bulkheads and their projecting reinforcements and the vertical reinforcements standing at such junctions.

Side, bow and stern plates up to the first seam above the bottom are placed in position and the seams are caulked as before. The vertical seams will come opposite the ribs and longitudinals and the troughs of these members will be extended up almost to the horizontal seam between the plates. A trough comprising a bottom member and a side member opposite the plates is now placed in position entirely around the inside of the vessel and communicates with the ribs and longitudinal troughs. Reinforcements are placed in this trough and it is filled with concrete embedding the reinforcements and covering the caulked seam and forming a ribbon entirely around the ship. This operation is repeated until the sides, bows and stern have reached the desired height. As the sides rise the concrete is poured into the stanchion, rib and longitudinal molds to keep pace with the growth of the sides. The top row of plates has no interior rib along the top edge but is plain with its reinforcement projecting in the plane of the plates.

A sill mold is now built entirely around the vessel enclosing the top edges of the upper row of plates and their projecting reinforcements. Troughs corresponding in position to the ribs are placed in position across the vessel and other troughs corresponding in position to the keel and other longitudinals are placed in position running fore and aft. These troughs all communicate at their junctions. At the points where the troughs communicate with stanchion troughs they are deepened to form triangular bracing members with the stanchions. The bulkheads project through the bottoms of the longitudinal and lateral troughs. Reinforcements are placed in all of the troughs and the reinforcements engage at crossings.

At certain points hatch combing molds are secured in position in line with the tops of the deck beam troughs. The lower, outer

edges of the combing molds terminate short of the bottom of the molds.

The deck plates 2 are now placed in position resting under the outer edges of the combing troughs and upon the other troughs but with spaces between contiguous edges and with their reinforcements projecting into such spaces. Bolts are spaced in the sill trough with their shanks projecting outward through the sides of the trough. The outer side of the sill trough is higher than the inner side.

Concrete is now poured into all of the troughs and filling the same, embedding the upper edges of the bulkheads and side plates and their projecting reinforcements and the reinforcements of the ribs and longitudinals. The concrete in the longitudinal and lateral troughs will form deck beams 18. The concrete in the sill troughs will form a heavy sill 19 extending entirely around the vessel and embedding the reinforcements of all of the vertical elements. Concrete is also poured into the combing troughs embedding the reinforcements of the combing and the projecting reinforcements of the deck plates and forming a raised hatch combing 20.

A wear strip 21 of wood is placed around the outside of the sill and is secured in position on the bolts projecting therefrom.

A dressing 22 of concrete is placed over the entire deck to give it a finished appearance.

The central bulkhead extends the entire length of the vessel to form a collision bulkhead. The lateral bulkheads extend entirely across the boat to increase the strength. The bulkheads form watertight compartments for cargo space.

In the modification shown in Figure 10 the floor is extended to cover the entire interior of the vessel and an inner skin 23 is secured in place to the inner sides of the ribs and longitudinals in the same manner that the floor plates are positioned.

It will be seen that the skin surface of the vessel is composed entirely of shop cast elements and being shop cast they may be constructed in much better manner than is possible with the rough work done in the field. The molds from which they are made need not be temporary structures such as are necessary in field work. The plates may be made under pressure whereby a more homogeneous structure will be produced. Vessels of any size may be built without changing the plant by simply using a greater or smaller number of plates.

By employing relatively small plates in the construction, a certain amount of flexibility is imparted to the vessel. The caulking in the seams will permit slight movement of the plates and will prevent leakage even when the plates are not in actual con-

tact. This flexibility of the hull is important as it permits the vessel to "work" in a seaway without fracturing the skin or any other portion of the structure.

5 In accordance with the provisions of the patent statutes I have described the principle of my invention, together with the apparatus which I now consider to represent the best embodiment thereof, but I desire to have it understood that the apparatus shown is merely illustrative, and that the invention may be carried out in other ways.

10 Having now described what I claim as new and desire to secure by Letters Patent is:

1. A vessel comprising field molded reinforced concrete field cast elements, and shop cast reinforced concrete plates of relatively small size, said members and plates being united to form a monolithic structure said plates forming the skin surface of the vessel, the exterior keel of the vessel being formed on the shop cast plates.

2. A vessel comprising field molded reinforced concrete field cast elements, and reinforced concrete plates of relatively small size, said members and plates being united to form a monolithic structure, said plates forming the skin surface of the vessel, contiguous edges of the plates having grooves for the reception of a caulking material to prevent leakage at the seams, there being slots between the plates permitting access to the grooves, the field cast members covering said slots.

3. A vessel comprising field molded reinforced concrete field cast elements and reinforced concrete plates of relatively small size, said members and plates being united to form a monolithic structure, said plates forming the skin surface of the vessel, contiguous edges of the plates having grooves for the reception of a caulking material to prevent leakage at the seams, there being slots between the plates permitting access to the grooves, the said slots being covered by said field cast members, flanges on said plates, the reinforcements of the plates projecting through the flanges and into the field cast elements.

4. A vessel comprising field molded reinforced concrete elements, and shop cast reinforced concrete plates of relatively small size and of rectangular shape, said elements and plates being molded to form a monolithic structure, said plates forming the entire skin surface of the vessel, contiguous edges of the plates having grooves therein, one side of each plate being of less area than the

other whereby when the plates are assembled edge-to-edge slots permitting access to the grooves from one side of the plates will be formed, flanges on that side of each plate having the smaller area and contiguous to the edges of the plate, the said slots and flanges being covered by the field molded elements, the reinforcements of the plates extending into the elements.

5. A vessel comprising field molded reinforced concrete elements, and shop cast reinforced concrete plates of relatively small size and of rectangular shape, said elements and plates being molded to form a monolithic structure, said plates forming the entire skin surface of the vessel, contiguous edges of the plates having grooves therein, one side of each plate being of less area than the other whereby when the plates are assembled edge-to-edge slots permitting access to the grooves from one side of the plates will be formed, flanges on that side of each plate having the smaller area and contiguous to the edges of the plate, the said flanges being rounded, the said slots and flanges being covered by the field molded elements, the reinforcements of the plates extending into the elements.

6. A vessel comprising field cast reinforced concrete longitudinal, lateral and vertical elements, and shop cast reinforced concrete plates of relatively small area, flanges on the inner sides of the plates, said plates forming the entire outer skin of the vessel, means for caulking the seams between the plates, said seams being covered by the field cast elements, reinforced concrete deck plates having hatches therein, field cast combings for said hatches and permanently united with said deck plates, water-tight bulkheads within the hull, an inner skin for the vessel spaced from the outer skin to form a double hull, said inner skin being of plates of reinforced concrete of approximately the same size as the outer plates, said field cast elements lying between the inner and outer plates and covering the seams between the plates, the edges of the last mentioned plates being embedded in the field cast elements, said field cast elements, inner and outer skin plates, deck plates, bulkheads and hatch combings being united to form a monolithic structure.

This specification signed and witnessed this 31st day of December, 1917.

JOHN T. SIMPSON.

Witnesses:

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