Jan. 9, 1923.

1,441,692.

G. E. McCREA.

REENFORCED CONCRETE SHIP.

FILED APR. 29, 1918.

Fig. 3

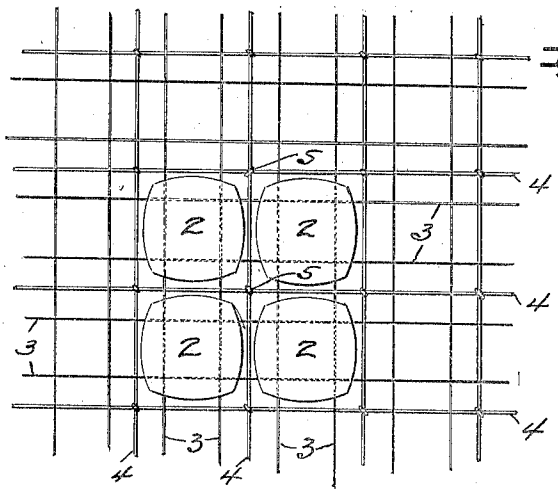



Fig. 2

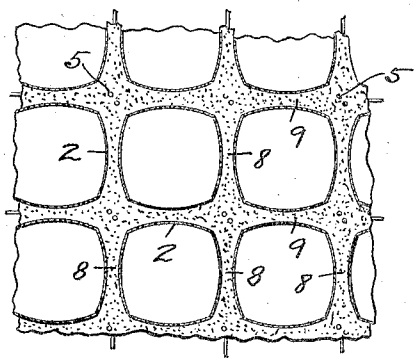






Fig. 1

WITNESS

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Patented Jan. 9, 1923. 1,441,692

# UNITED STATES PATENT OFFICE.

GEORGE E. McCREA, OF OAKLAND, CALIFORNIA.

## REENFORCED CONCRETE SHIP.

Application filed April 29, 1918. Serial No. 231,333.

*To all whom it may concern:*

Be it known that I, GEORGE E. McCREA, a citizen of the United States, and a resident of Oakland, county of Alameda, and State of California, have invented a certain new and useful Reenforced Concrete Ship, of which the following is a specification.

The invention relates to reenforced concrete ships and particularly to a reenforced concrete hull.

An object of the invention is to provide a reenforced concrete hull which possesses inherent structural strength and relative lightness.

Another object of the invention is to provide a reenforced concrete hull having the properties of a built up beam in all directions.

A further object of the invention is to provide a reenforced concrete hull having a double bottom of integral construction.

A further object of the invention is to provide an impervious concrete hull.

The invention possesses other advantageous features, some of which, with the foregoing, will be set forth at length in the following description where I shall outline in full, that form of the invention which I have selected for illustration in the drawings accompanying and forming part of the present specification. In said drawings I have shown one form of the construction of my invention, but it is to be understood that I do not limit myself to such form, since the invention, as expressed in the claims, may be embodied in a plurality of forms.

Referring to said drawings:

Figure 1 is a half midships section of a hull, showing the form of construction of my invention.

Figure 2 is a section taken on the line 2—2 Fig 1.

Figure 3 is a plan view of a portion of the bottom of the hull showing the arrangement of the members prior to placing the concrete.

In accordance with my invention I form the bottom and sides of the hull of reenforced concrete of cellular construction, thereby providing lightness and strength. The cellular construction produces a plurality of intersecting reenforced concrete beams extending longitudinally and transversely in the bottom and sides of the hull, and these beams are perpendicular to the exterior surface of the hull, producing a rigid and strong construction. The cells, which are quite large, occupy the larger part of the space enclosed by the inner and outer walls of the hull, thereby providing thick and light sides and bottom.

The cells or shells 2 are preferably made of sheet metal plates, stamped into pans of substantially rectangular shape preferably with somewhat convex sides and welded or otherwise secured together along their edges to produce tight containers or shells having convex sides, and are preferably coated with a water-proofing material, such as asphalt or tar. The cells are arranged in spaced relation in parallel longitudinal and transverse rows and are held from the forms by suitable means, such as the metallic bars or strips 3, which also serve as reinforcement for the concrete. By spacing the cells apart, a channel is provided between each two successive cells, which forms the mold for the beam. Arranged in the channels between the cells and preferably at the top and bottom of the channels, are reinforcing members or bars 4, which are arranged longitudinally and transversely and disposed parallel to the outer surface of the hull, so that they occur along the top and bottom of the beam. Perpendicular reinforcing members 5 are also arranged in the space formed by the intersection of two channels, and in some instances these reinforcing members 5 extend from the wall of the hull. The cells are spaced from the inner and outer forms, so that when the concrete is poured, it fills the spaces between the cells and between the cells and the forms, producing a cellular wall comprising an outer wall 6, an inner wall 7 and longitudinal and transverse beams 8 and 9 connecting the inner and outer walls. By forming the cells convex, the beams are of greater cross section at the top and bottom than they are at the center, thereby producing a beam having the maximum strength for a given weight. Where decks or bulkheads are to be formed, the spacing of the cells along the line of the deck or bulkhead is increased, producing a beam of greater width and the reinforcing members 5 embedded in the intersections of the broader beams with the cross beams, extend into the concrete of the deck or bulkhead, securely tying these structures to the sides and bottom.

The bottom is impervious to water at those parts at which the shells are disposed and

leakage can take place only through the beams, but on account of the depth of the beams leakage is prevented. The depth of the beams will vary with different sizes of hulls, but for ordinary hulls, I prefer to make them at least two feet deep, although this dimension may be varied.

The shells may have an internal diameter taken between any opposed walls thereof which is greater than one half the width of the wall. In the drawing the shells are relatively large and produce large voids but the beams formed between the shells lend the necessary strength to the wall and thus I am able to use relatively materially less concrete without sacrificing strength.

I claim:

1. A monolithic ship hull having concrete sides and bottom molded about a layer of wholly spaced, closed shells arranged in transverse and longitudinal rows coextensive with the hull to form cellular bottom the sides.

2. A monolithic ship hull consisting of concrete sides and bottom molded about substantially cubical shells each spaced from the other in a layer like arrangement.

3. A monolithic ship hull having concrete sides and bottom molded about substantially cubical shells each separated from the other in a layer-like arrangement, the cells having no diameter equal to the thickness of the side or bottom.

4. A monolithic cellular ship hull having concrete sides and bottom, a reinforcing fabrication embedded in the concrete, and an arrangement of individually spaced, closed shells forming a layer on the reinforcement and each individually cemented in place and encompassed by the concrete.

5. The method of producing a cellular, monolithic concrete ship hull, which consists of arranging shells in a layer conforming to the respective portion of the hull and spacing each shell from the others to form relatively narrow lateral spaces thereabout and then applying cementitious material to fully enclose the shells in a concrete body having a thickness over the ends about equal to the spacing of the shells.

6. The method of producing a cellular monolithic, concrete ship hull, consisting of fabricating a reinforcing system in conformity with the hull structure, arranging closed shells in spaced relation from each other on supporting portions of the fabrication, and then embedding the shells and fabrication in concrete.

7. The method of producing a cellular monolithic, concrete ship hull, consisting of fabricating a reinforcing system in conformity with the hull structure, arranging closed shells, of less diameter than the desired thickness of hull wall, in spaced relation from each other on supporting portions of the fabrication, and then embedding the shells and fabrication in concrete.

8. The method of producing a cellular monolithic, concrete ship hull, consisting of fabricating a reinforcing system in conformity with the hull structure, arranging closed, waterproofed shells in spaced relation from each other on supporting portion of the fabrication, and then embedding the shells and fabrication in concrete.

9. The method of forming a cellular, concrete ship hull having transverse and longitudinal beam-like webs in the wall structure, which consists of molding the concrete to encompass longitudinal and transverse rows of substantially cubical, relatively spaced bodies in a mold.

10. A hull comprising a concrete wall and hollow metallic shells embedded in spaced relation to one another within said wall, each of said shells being convex on all of its faces.

In testimony whereof, I have hereunto set my hand at San Francisco, California, this 22nd day of April, 1918.

GEORGE E. McCREA.

In presence of—
H. G. PROST.