R. A. CUMMINGS.

METHOD OF CONSTRUCTING REINFORCED CONCRETE HULLS FOR BOATS, &c.

APPLICATION FILED JUNE 28, 1918.

1,278,111. Patented Sept. 10, 1918.

FIG. 1.

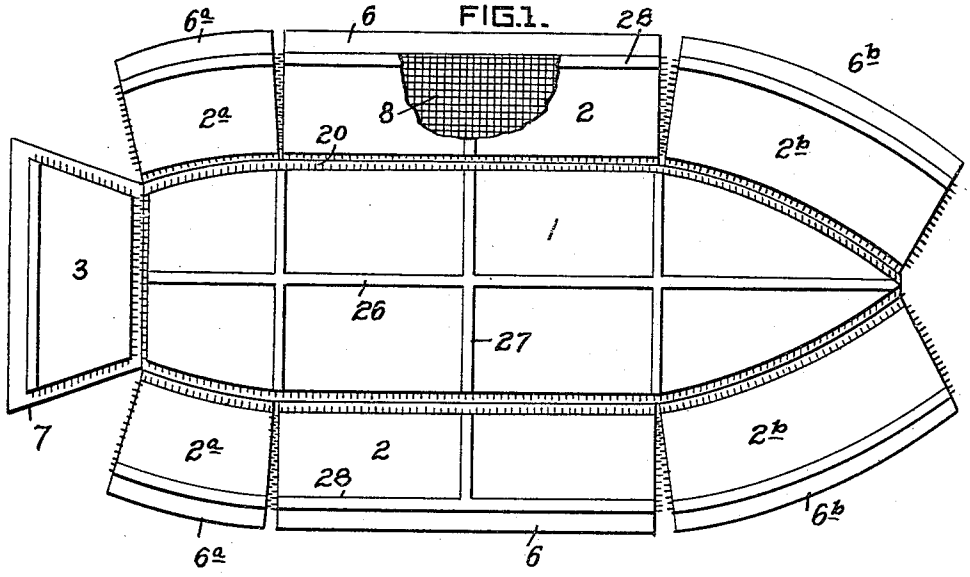


FIG. 2.

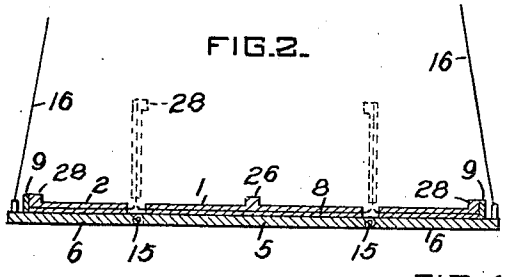


FIG. 5.

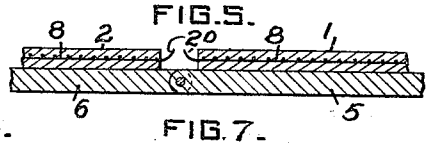


FIG. 4.

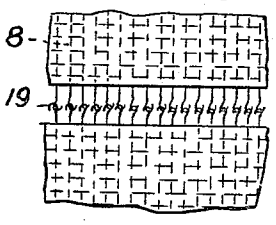


FIG. 7.

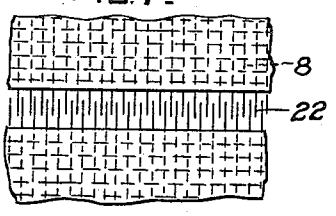


FIG. 6.

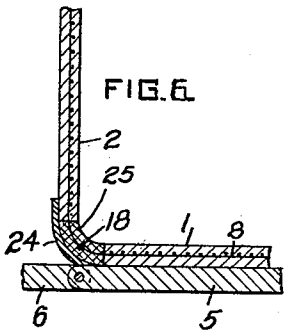
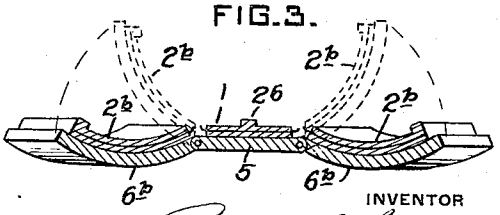


FIG. 3.



WITNESSES

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METHOD OF CONSTRUCTING REINFORCED-CONCRETE HULLS FOR BOATS, &c.

1,278,111. Specification of Letters Patent. Patented Sept. 10, 1918.

Original application filed May 20, 1918, Serial No. 235,561. Divided and this application filed June 28, 1918. Serial No. 242,393.

To all whom it may concern:

Be it known that I, ROBERT A. CUMMINGS, a resident of Pittsburgh, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Methods of Constructing Reinforced-Concrete Hulls for Boats, &c., of which the following is a specification.

This invention relates to casting or constructing reinforced concrete structures which are composed of or include a thin shell or sheathing of large area. The present application is in part a division of my application filed May 20, 1918, Serial No. 235,561.

The object of the invention is to provide a method of casting such structures whereby the cost, as compared with existing methods, is much reduced, and by means of which a thin shell or sheathing can be cast or poured monolithically or not and can be made thinner than has heretofore been possible and of any desired thickness and at the same time be of uniform density throughout.

The invention is applicable to the casting or pouring of various structures comprising or including relatively thin shell or sheathing portions, such as the hulls of boats, barges and the like, bins, tanks and vats for various purposes, the facing or outside sheathing of walls, and the like.

In the casting of hulls for concrete boats, barges and the like, bins, tanks and other structures having thin walls, it is the practice to build up forms or molds of wood or metal in the form and position of the finished structure, with the metallic reinforcement contained in such forms or molds, and then pour the concrete thereinto. Since concrete can not be poured or rammed effectively in a very narrow form or mold, it is necessary to make the shells of such structures of considerable thickness in order to provide the necessary space for efficiently pouring or ramming the concrete thereinto, and since, for certain uses, such for instance for the hulls of boats, barges, and the like, the shells must be kept reasonably thin in order to avoid excessive weight, it frequently happens that the density of the concrete shell is not uniform throughout, but spots occur in which the concrete is loose and porous. Furthermore, on account of the narrow or restricted space in the forms or molds, it has not been found reliable to cast such thin concrete shells to a height of more than a few feet at a single pouring, and then build up a further section of form or mold, pour this, and so on until the structure is completed. The building of these forms or molds is expensive and on account of having to pour the structure in sections, as described, the process is quite slow, and, also, the resultant structure is not uniform throughout.

These objections are overcome by the present method, in which forms or molds are substantially entirely dispensed with and a thin shell or sheathing of more uniform density and structure throughout and of thinner section is produced. This is accomplished by casting the various parts in separate sections, in horizontal position, with the reinforcement projecting beyond edges of said sections, and after the sections have set, moving the sections which are to constitute inclined or vertical portions of the structure, into proper position relative to each other and to the sections which are to remain in horizontal position, thereby bringing the unembedded projecting portions of the reinforcement on contiguous edges of adjacent sections into position to be united, and then casting in or otherwise closing the joints or angles.

In the accompanying drawings the method is illustrated more particularly for the casting of the hulls of boats, barges, and the like, but it will be understood that this is merely illustrative of one application thereof, and that the method can be adapted for the casting of any other structure having thin shells or sheathings, such as before enumerated.

In the drawings, Figure 1 is a plan view showing diagrammatically one manner of casting the bottom, sides and ends of a boat according to the invention; Fig. 2 is a diagrammatic sectional view illustrating one manner of positioning the side or vertical

portions relative to the bottom, at the mid-ship portion of the boat, approximately on the line 2—2, Fig. 1, preparatory to closing the angles or joints; Fig. 3 is a similar view showing the method of forming the bow portion of the boat, approximately on the line 3—3, Fig. 1; Figs. 4, 5, 6 and 7 are detail sectional views showing several ways of forming the joint or angle connecting the bottom with one of the side sections.

Figs. 1 and 2 illustrate in a diagrammatic way the application of the method in forming a relatively simple form of hull for a boat having a substantially flat bottom and relatively vertical sides and ends. In forming such structures according to the present invention the various parts are formed separately in sections, each section being as large as feasible and still be substantially plain or with only such curvatures as make it possible to cast and handle. In the construction illustrated, the bottom 1 is substantially flat, the mid-ship side portions 2 are substantially straight or curved only to such extent as to permit their being cast in a single section, while the stern and bow side portions 2^a, 2^b are curved, and stern end portion 3 is substantially flat. Each of these sections is cast as a separate unit and in substantially horizontal position, upon suitable casting platforms or tables comprising a stationary platform 5 for the bottom, and movable tiltable platforms 6, 6^a, 6^b and 7 for the side and end sections. These various platforms can be located in any suitable positions relative to each other, but preferably are so located that the various sections will be in their proper positional relation to each other, in order to reduce to a minimum the distance the various movable sections must be moved when assembling. In casting the sections reinforcing bars 8 of suitable size and number and properly arranged to take care of the stresses, are positioned upon the casting platforms, and narrow vertical mold members 9 are erected upon the platforms to define and form the edges of the various sections being cast. The ends of the reinforced bars are allowed to project beyond these edge portions, or short dowel rods may be cast in the concrete so as to project or protrude beyond the edges thereof. After the reinforcing bars are properly positioned on the platforms, the concrete is poured in place and can be smoothed and tamped down with the usual instruments without the use of forms or mold sections beyond the use of the vertical members 9, as a consequence the several sections can be cast of a minimum thickness and in a manner to assure equal density and uniformity in structure throughout.

These cast sections are then allowed to remain in the position in which cast until the concrete has thoroughly set. Then the casting platforms on which the relatively vertical sections are cast are lifted at their outer edge and moved into such positions as to bring their inner edges into proper positional relation with reference to the corresponding edge of the bottom. For this purpose the casting platforms 6, 6^a, 6^b and 7 are themselves made movable and provided with suitable means for the attachment of lifting means thereto. It will be found convenient to have these platforms hinged at their inner edges, as indicated at 15, Fig. 2, and have their outer edges provided with suitable means for attaching thereto cables 16, or the like, running to derricks or other means by which, through the cables 16, the outer edges of the sections 6, 6^a, 6^b and 7 can be lifted to bring the side and end sections 2, 2^a, 2^b and 3 to their proper position, either vertical or inclined, as the case may be, and bring the protruding ends of the reinforcement members of these sections into unitable relation to the corresponding ends of the protruding reinforcement of the bottom, so that a suitable union can be made between the same, and the joints between the various sections closed in a suitable way.

The projecting ends of the reinforcement can be united in various ways, either before or after the vertical sections are lifted to their proper position. When the several sections are cast in proper contiguous relation to each other, as shown in Figs. 1 and 2, and the corresponding edges of the bottom are approximately straight, the projecting ends of the reinforcement can be interlocked while the sections are still in horizontal position, such as by providing said projecting ends with hook portions, as indicated at 19, Fig. 4.

When it is inconvenient to cast the section in proper contiguous relation, or in the event that the joints between the bottom and side portions are materially curved, it will be necessary to first lift the side and end portions to their proper positions before uniting the projecting ends of the reinforcements. In such case these projecting ends will be initially bent to their final form, as shown in Fig. 2 and at 20, Fig. 6, and when the sections are brought into their proper relation these projecting ends may be united either by welding, as indicated at 18, Fig. 6, or by interlocking the same in the manner shown in Fig. 4; or said projecting ends may merely be caused to overlap each other, as indicated at 22, Fig. 7, and the union formed by the concrete cast into the joint.

Whichever method is followed, after the sections are properly positioned and the projecting ends of the reinforcement either united by welding or interlocked or merely assembled in interlaced relation to each

other, the joint is then closed. This is conveniently done by building underneath this joint a suitable mold, as shown at 24, Fig. 6, and then casting concrete into the joint, as shown at 25, thus uniting the bottom to the sides and ends and embedding the formerly projecting portions of the reinforcement.

In a similar way where the ends of the side sections 2, 2^a and 2^b and end section 3 come together, the horizontal reinforcement in these sections projecting beyond the ends thereof, are either united, interlocked or interlaced, and molds or forms are built up underneath the same, and the joint then closed, preferably by pouring concrete into the same.

In building up a hull in the manner described, it can be provided with a keel 26 and suitable transverse or longitudinal, or both, reinforcing frame or rib members, such as shown at 27, and also with thickened and strengthened gunwales as shown at 28, without in the least modifying the method.

The result is a structure of reinforced concrete of minimum thickness and substantially uniform density of structure throughout, formed without the necessity of building expensive forms or molds. The casting platforms obviously may be made of permanent construction and used for casting any other structures of the same form.

The method can obviously be adapted for the casting of any hull, either of a plain barge type, or one in which the complete sides cannot be formed at one time, by merely dividing the sides into such number of sections as will permit each section to be cast on a substantially plane platform or one which has only such a curvature or concavity as will permit proper positioning of the reinforcement and the casting of the concrete. The method obviously will be modified depending on the shape, size and other conditions of the structure to be built. It is much more economical than the methods now in vogue for building similar structures, as it does not require the use and waste of a large amount of lumber and timber for forming molds, and enables the shell or sheath to be made thinner than heretofore possible, thus not only saving weight, but saving material and thus adding to the economy of the method, and at the same time insures a structure of uniform density throughout. It is also much more expeditious than prior methods.

I claim:

1. The method of constructing reinforced concrete structures of thin section and large area, consisting in casting the same in sections separately and in substantially horizontal position with reinforcement projecting beyond edges thereof, moving some of said sections and positioning them relative to others with the projecting reinforcement in interconnecting relation, and then closing the joints or angles.

2. The method of constructing reinforced concrete structures of thin section and large area, consisting in casting the same in sections separately and in substantially horizontal position with reinforcement projecting beyond edges thereof, moving some of said sections and positioning them relative to others, connecting the projecting reinforcement of adjacent sections, and then closing the joints or angles.

3. The method of constructing reinforced concrete structures of thin section and large area, consisting in casting the same in sections separately and in substantially horizontal position with reinforcement projecting beyond edges thereof, moving some of said sections and positioning them relative to others, uniting the projecting reinforcement of adjacent sections, and then closing the joints or angles.

4. The method of constructing reinforced concrete structures of thin section and large area, consisting in casting the same in sections separately and in substantially horizontal position with reinforcement projecting beyond edges thereof, moving some of said sections and positioning them relative to others with the projecting reinforcement in inter-connecting relation, and then casting in the joints or angles and thereby closing the same and embedding the projecting reinforcement.

5. The method of constructing reinforced concrete structures of thin section and large area, consisting in casting the same in sections separately and in substantially horizontal position with reinforcement projecting from edges of said sections, moving some of said sections and positioning them relative to others and bringing the projecting reinforcements of adjacent sections into connecting relation, uniting said projecting reinforcements, and then casting in the joints or angles and thereby closing the joints and embedding said protruding reinforcement.

6. The method of constructing reinforced concrete structures of thin section and large area, consisting in casting the same in sections separately and in substantially horizontal position with reinforcement projecting from some edges of said sections and bent from the plane thereof, moving some of said sections and positioning them relative to others and thereby bringing said reinforcement into inter-connecting relation, and then casting in the joints or angles and thereby closing the same and embedding said projecting reinforcement.

7. The method of constructing reinforced concrete structures of thin section and large area, consisting in casting the same in section separately and in substantially hori-

zontal position with reinforcement extending into the spaces between sections and in inter-connecting relation to each other, lifting some of said sections and rotating them about their edges contiguous to adjacent sections and thereby positioning said sections relative to each other, and then casting in the joints or angles and thereby closing the same and embedding the projecting reinforcement.

In testimony whereof, I have hereunto set my hand.

ROBERT A. CUMMINGS.

Witness:
GLENN H. LERESCHE.

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