R. A. CUMMINGS.

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

APPLICATION FILED MAY 20, 1918.

1,276,624. Patented Aug. 20, 1918.

FIG. 1.

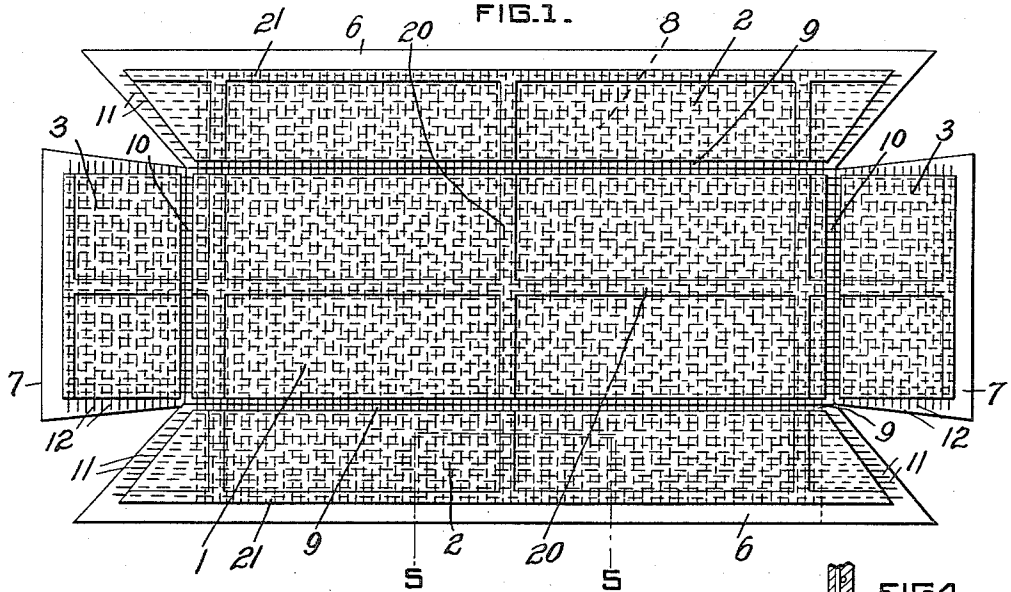


FIG. 2.

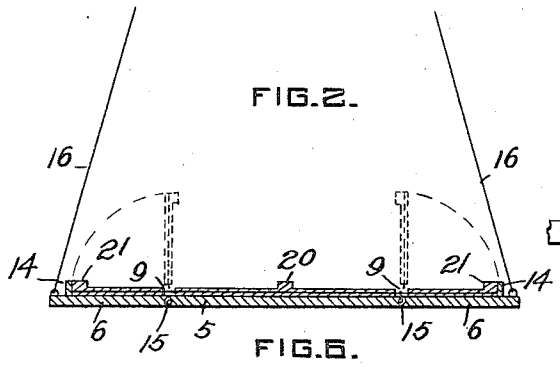


FIG. 3.

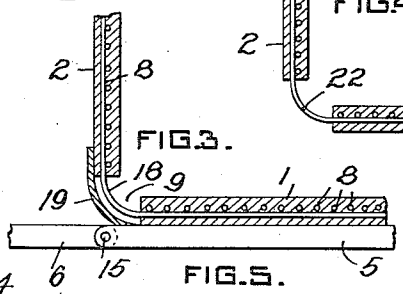


FIG. 4.

FIG. 5.

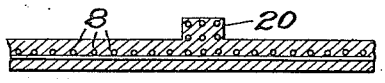


FIG. 6.

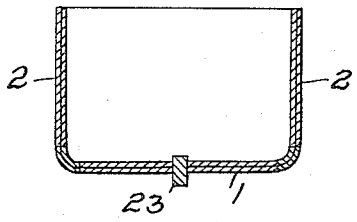


FIG. 8.

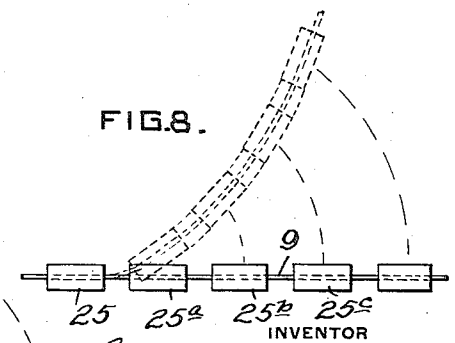
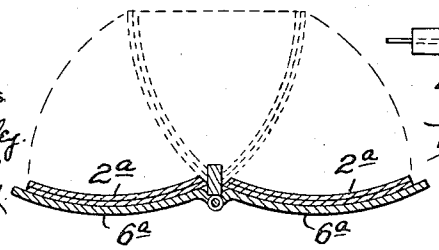


FIG. 7.



WITNESSES

J. Hekel Bradley

G. W. Gerecke

INVENTOR

Robert A. Cummings,

By Fred'k W. Hunter,

Attorney.

UNITED STATES PATENT OFFICE.

ROBERT A. CUMMINGS, OF PITTSBURGH, PENNSYLVANIA.

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

1,276,624. Specification of Letters Patent. Patented Aug. 20, 1918.

Application filed May 20, 1918. Serial No. 235,561.

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-Concret Hulls for Boats, &c., of which the following is a specification.

This invention relates to a method of casting or constructing reinforced concrete structures which are composed of or include a thin shell or sheathing of large area.

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 cannot 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 as 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 is 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 sections, in horizontal position, preferably with the reinforcement extending continuously between sections, leaving between the various sections joints at which the reinforcement is not embedded in concrete, and after the sections have set, moving the sections which are to constitute vertical or inclined portions of the structure, into proper position relative to each other and to the sections which are to remain in horizontal position, and in so lifting these sections to position, bending the exposed reinforcement at the joints, and then casting or filling in the angles or joints.

In the accompanying drawings the method is illustrated for casting 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 casting any other structure having thin shells or sheathings, such as before enumerated.

In the drawings, Figure 1 is a plan view showing the manner of casting the bottom, sides, and ends of a barge according to my invention; Fig. 2 is a diagrammatic view showing the manner of positioning the vertical portions relative to the bottom, preparatory to casting or filling in the angles or joints; Fig. 3 is a sectional view on an enlarged scale showing the method of forming a joint or angle connecting the bottom with one of the vertical portions; Fig. 4 is a similar view illustrating a modification; Fig. 5 is a section on the line 5—5, Fig. 1 showing the formation of a frame or rib member; Fig. 6 is a diagrammatic view showing the formation of the midship portion of a ship; Fig. 7 is a similar view showing the formation of the bow portion of such ship; and Fig. 8 is a diagrammatic view showing the method adapted to form a curved structure with the use of plane or flat casting platforms.

Figs. 1, 2 and 3 show the invention adapted for the formation of a barge having a flat bottom, vertical sides, and sloping ends, and showing the preferred way of forming the same. In forming such barges, the bottom 1, sides 2, and ends 3 are cast in separate sections and in horizontal position, upon suitable casting platforms or tables comprising a central stationary platform 5, tiltable side platforms 6, and tiltable end platforms 7. The reinforcing bars 8 are properly positioned upon these casting platforms, and in the preferred way are caused to extend continuously across the gaps between the bottom and sides and ends respectively. That is to say, the transverse reinforcing bars extend continuously across the spaces or gaps 9, and the longitudinal reinforcing bars extend continuously across the spaces or gaps 10. The longitudinal reinforcing bars in the side sections may be somewhat longer than said sides so that free ends 11 will project at the ends thereof, and similarly the horizontal reinforcing bars in the end sections have their ends 12 projecting beyond the ends of said end section; or short dowel rods may be cast in the ends of these sections. After the reinforcing bars are properly positioned on the casting 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 other than narrow vertical members 14 rising from the casting platforms and serving to define the side and end edges of the various sections being cast, thereby enabling the several sections to be cast of minimum thickness and insuring equal density and structure throughout.

These cast sections are then allowed to remain in the position in which cast until they are thoroughly set, after which the side and end sections are lifted at their outer edges, thus causing them to rotate substantially about their inner edges, and bringing them into proper positional relation with reference to the bottom. For this purpose the casting plate forms 6 and 7 will be hinged at their inner edges, as indicated at 15, Fig. 2, and their outer edges will be provided with suitable means for attaching thereto cables 16 or the like, running to derricks or other mechanism by means of which, through the cables 16, the outer edges of the sections 6 and 7 can be lifted to bring the side sections 2 and end sections 3 to their proper position, either vertical or inclined, as the case may be. This serves to bend the unembedded portions 18 of the reinforcing bars which extend across the open gaps or spaces 9 and 10. The projecting end portions 11 and 12 of the reinforcing bars are then suitably overlapped or united, mold sections 19 are formed around underneath the spaces 9 and 10, and also on the outside and inside of the corner joints, and these joints are then poured with concrete and allowed to set.

The result is a hull of reinforced concrete of minimum thickness and of substantially uniform density or structure throughout, and without the necessity of building up expensive forms or molds.

In building the hull the same can be provided with either transverse or longitudinal, or both, reinforcing frame or rib members, such as shown at 20, and also with thickened and strengthened gunwales as shown at 21, without in the least modifying the method.

Instead of having the reinforcing members extending continuously across the spaces 9 and 10, short dowel sections may be cast therein, or the rods may merely have their ends projecting into such spaces, and after the vertical portions and bottom are brought into proper positional relation with each other, the projecting ends can be suitably united, such as by welding, as indicated at 22 in Fig. 4. When this procedure is followed, it is not necessary that the sides be cast in immediate proximity to the bottom. This latter method is preferable where the intermediate section is not of uniform width from end to end and where the side sections are joined to the intermediate section on curved lines. This modification is not specifically claimed herein, but is claimed in my application filed June 28, 1918, Serial No. 242,393.

In casting the hulls of boats other than those of the barge type, the complete hull cannot be formed at one time. Fig. 6 shows the method above described applied to the casting of the center or mid-ship portion of an ordinary ship and is identical with that illustrated in Figs. 1, 2 and 3. The keel 23 will be formed in the casting of the bottom. Fig. 7 shows the method applied to the formation of the bow portion of the ship, that is, where there is practically no bottom, but the sides 2^a are joined substantially directly to the keel 23. The casting platforms 6^a in this case are formed concaved so that the side portions when cast thereon are of such form that when elevated to position they form the proper contour for the bow of the ship. After the mid-ship portion and bow and stern portions of the hull of the vessel are completed, the portions uniting the same will be built in by the use of forms or molds in the ordinary way of connecting such hulls.

Fig. 8 illustrates another way of casting a structure having a curved or like form. As here shown, the structure is cast on plane or flat platforms in a plurality of sections 25, 25^a, 25^b, 25^c, etc., with the reinforcement extending continuously across at the joints 9, and after these sections have thoroughly set, the various sections are lifted into their

proper positions, as indicated by the dotted lines, after which the joints are closed in the manner above described.

Obviously, the method will be modified according to the shape, size and other conditions of the structure to be built.

The method described is much more economical than the methods now in vogue for building similar structures, as it does not involve the use and waste of a large amount of lumber and timber for forming the molds; it enables the shell or sheathing to be made thinner than has heretofore been possible, thus not only saving weight but also saving material and adding to the economy of the method, but at the same time insures a structure of uniform density throughout. It is also more expeditious than prior methods.

What I claim is:

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 extending continuously between said sections, moving some of said sections relative to others and thereby bending the reinforcement between the sections, and then casting in the joints or angles.

2. The method of constructing reinforced concrete structures comprising thin shells of considerable area, consisting in casting the horizontal and side portions of said structures in separate sections in horizontal position with continuous reinforcement between said sections, lifting the side portions and thereby bending the reinforcement at the joints, and then casting in the joints or angles.

3. The method of constructing reinforced concrete bins, tanks, hulls or boats, and the like, consisting in casting the bottom and side portions thereof as separate sections in horizontal position with continuous reinforcement between the same, lifting the outer edges of the sections which are to form the sides of said structure and thereby rotating them around their inner edges and bending the unembedded portions of the reinforcement, and then casting in 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 extending into the spaces between adjacent sections, lifting some of said sections and rotating the same about their edges contiguous to adjacent sections and thereby bending the reinforcement at the joints, and then closing the joints or angles.

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 extending into the spaces between adjacent sections, lifting some of said sections and rotating them about their edges contiguous to adjacent sections and thereby bending the reinforcement between the sections, and then casting in the joints or angles and closing the same and embedding the 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 and providing reinforcement extending from some of said sections into adjacent sections, moving some of said sections relative to others and rotating the same about their edges contiguous to adjacent sections and thereby bending the reinforcement between said sections and closing the joints.

7. 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 extending into the spaces between adjacent sections, the reinforcement in adjacent sections being united in said spaces, moving some of said sections relative to others and rotating them about their edges contiguous to the adjacent sections, and closing the joints or angles.

In testimony whereof, I have hereunto set my hand.

ROBERT A. CUMMINGS.

Witness:

GLENN H. LERESCHE.