

Sept. 16, 1947.

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2,427,604

CONSTRUCTION OF HOLLOW ARTICLES IN REINFORCED CONCRETE

Filed July 12, 1943

3 Sheets-Sheet 1

FIG. 1.

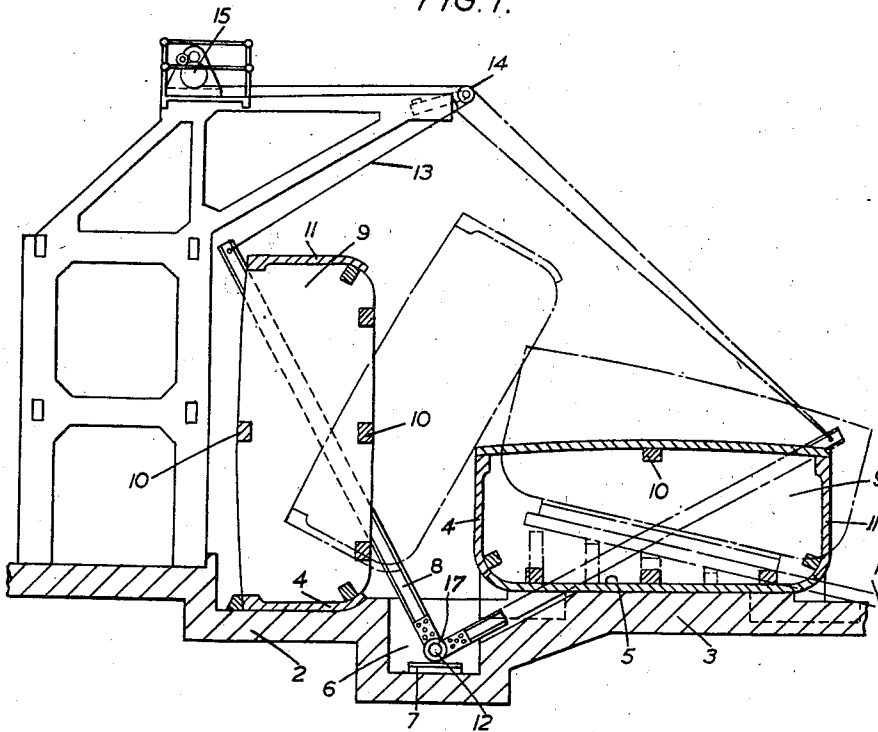
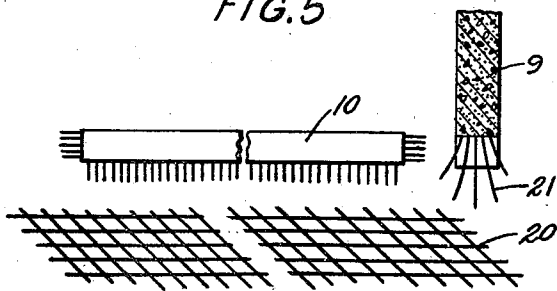


FIG. 5



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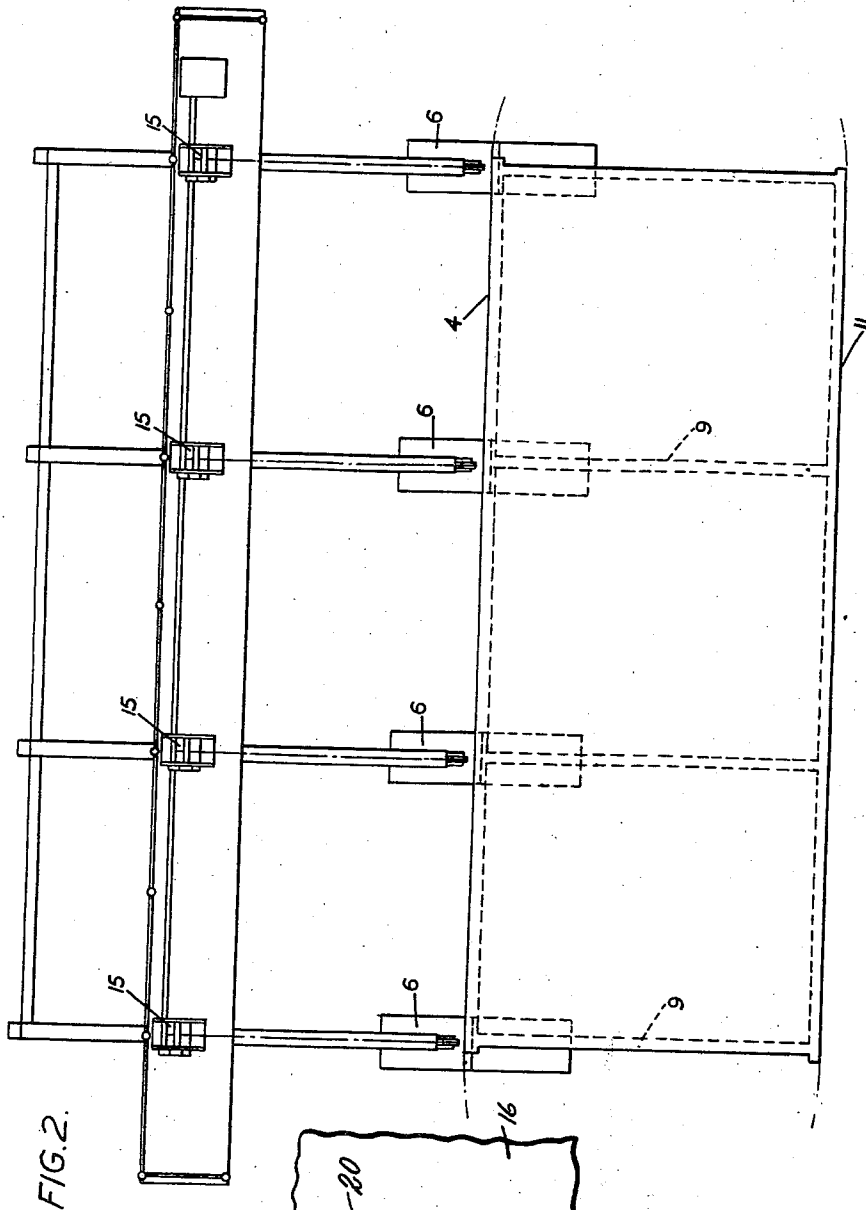
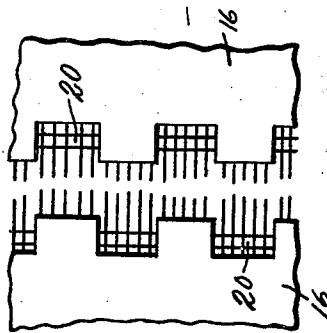


FIG. 6.



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FIG. 3.

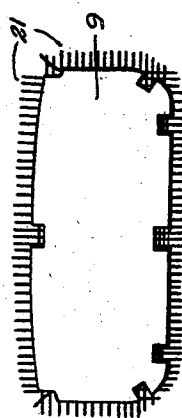
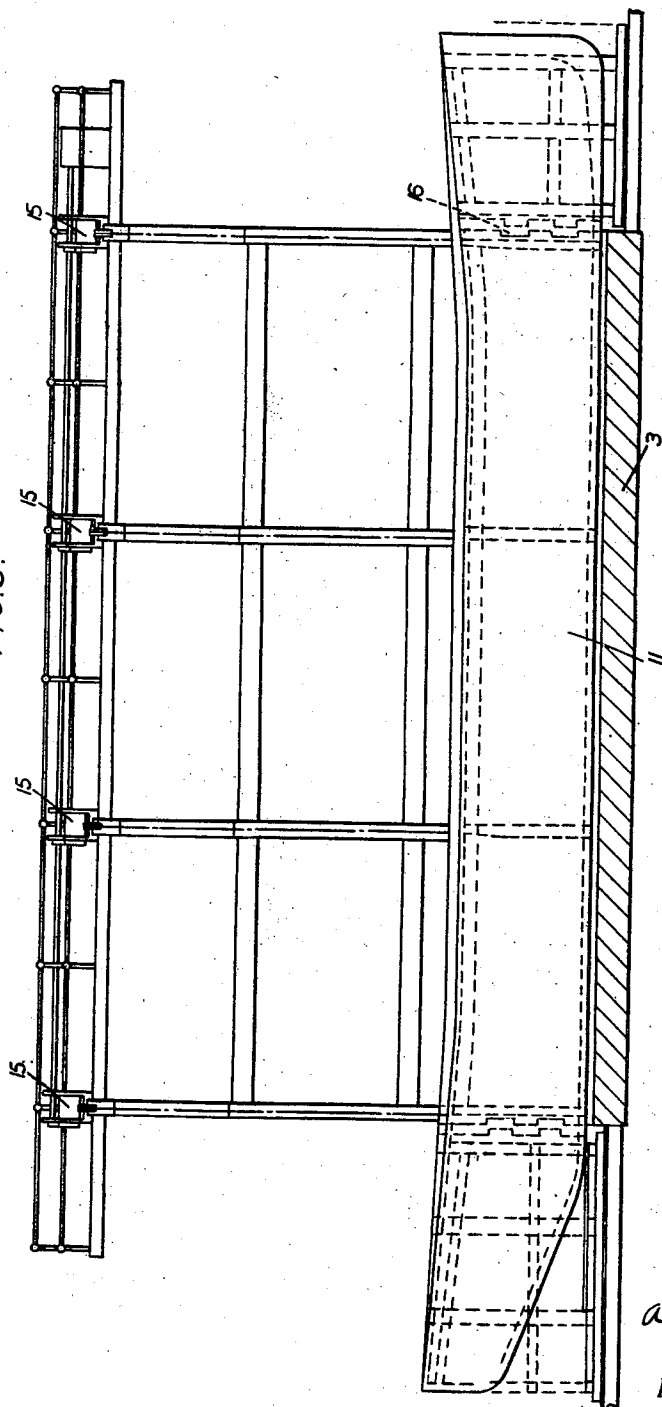


FIG. 4.

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CONSTRUCTION OF HOLLOW ARTICLES IN
REINFORCED CONCRETE

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11 Claims. (Cl. 114—65)

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This invention relates to the construction of hollow articles in reinforced concrete, particularly reinforced concrete vessels such as barges and pontoons.

The chief object of the present invention is to evolve a new or improved method of making reinforced concrete articles of a more or less rectangular section particularly such articles for example, as barges or pontoons which are required to have a somewhat squat or shallow form in transverse section.

According to the present invention a method of constructing a hollow article of reinforced concrete comprises the steps of casting part of the wall of the article on a horizontally disposed casting form or forms, mounting the partly formed article for swinging or pivotal movement, and then swinging or pivoting the same over into another position and casting another part or the remainder of the wall of the article on another horizontally disposed casting form or forms.

As applied to the construction of a vessel such as a barge or pontoon, it is preferred that the bow and stern shall be constructed separately and subsequently united to the main or cargo carrying part constructed in accordance with the above method. Furthermore, it is preferred that during the initial casting stages the vessel shall occupy a position in which it lies on one side, the vessel being moved into a normal position for completion of the casting operation.

In the case of a vessel having internally arranged bulkheads and longitudinally arranged stringers, one side of the main or cargo carrying part of the vessel is first cast on a horizontally arranged form, and the bulkheads erected and stringers inserted, the bulkheads and stringers having been pre-cast. After the bulkheads and stringers have been placed in position, the opposite side of the vessel is cast on with the aid of suitable built up shuttering and when the concrete has been given sufficient time to harden and set, the partly completed hull is then swung on to a further horizontally arranged form on which the bottom of the vessel is cast, and united with the already cast sides, bulkheads, and stringers. The deck of the vessel is finally cast on to the partly completed hull, and the bow and stern which have been pre-cast as individual units are then united to the central or cargo carrying part of the hull. The vessel is then ready for launching and from the point of view of economy of space it is preferred that launching shall take place sideways down a suitably arranged inclined slipway.

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In order that the said invention may be clearly understood and readily carried into effect, the same will now be further described with reference to the accompanying drawings, in which:

Figure 1 is a sectional end elevation illustrating the construction of a reinforced concrete shallow draft barge in accordance with the invention.

Figure 2 is a plan view of the same.

Figure 3 is a side elevation, the bow and stern having been placed in position and united to the central or cargo carrying part of the hull.

Fig. 4 is a detail view showing reinforcement projecting from the edges of the pre-cast bulkhead.

Fig. 5 is an unassembled view showing in detail portions of a pre-cast stringer and a pre-cast bulkhead, with reinforcement projecting therefrom, together with a mat-like slab reinforcement for the side, bottom, or deck of the hull.

Fig. 6 is an unassembled enlarged detail of the castellated edges 16 of Fig. 3, showing the reinforcement projecting therefrom and adapted to be interlocked and embedded in concrete.

A suitable construction yard for the manufacture of barges constructed in accordance with the invention would be alongside a water front and comprise a launching slope 1, at the top of which slope at an appropriate elevation above sea level, would be constructed a reinforced concrete base having two casting forms 2 and 3 permanently erected thereon. The inner casting form 2, remote from the water, might be relatively narrow but suitable for casting a side 4 of the barge, while the other or outer form 3 situated at the top of the launching slope 1 is wider and shaped appropriately for casting the bottom 5 of the barge.

Intermediate the forms 2 and 3 is a shallow recess or pit 6 for the mounting on a suitable base 7 of a series of swingable or pivotal transfer members 8 to be used in swinging or pivoting the partly completed hull from the position in which it rests on the form 2, into a position in which it rests on the form 3.

The various operations may be conveniently carried out in four stages, and the method adopted is to construct the hull in three sections namely, a middle or cargo carrying section, and two end sections constituting the bow and stern. The method of construction forming the subject of the present invention is applicable to the construction of the centre section, the general structure of the end sections being hereinafter described.

In the first stage, after appropriate reinforcements 20 which may be prepared in ready made mat-like form (see Fig. 5), have been placed in

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position on the casting form 2, precast bulkheads 9 are transported and placed in position on the form by suitable overhead gantries or other hoisting gear, the bulkheads being connected together by longitudinally arranged precast stringers 10. The bulkheads are constructed with their reinforcements 21 protruding at the edges thereof, as shown in Figs. 4 and 5, and after such reinforcement 21 has been connected with the reinforcement 20 for the side wall 4, and like reinforcement for the oppositely arranged side wall 11, which reinforcement has likewise been placed in position, both side walls 4 and 11 may be concreted in.

The particular details of arrangement of the reinforcement in the hull framing members and hull slab, and the particular manner of connecting the reinforcing elements of the various members together, as by twisting and bending the bars into interlocking engagement, may follow the conventional practice in the art of assembling reinforced concrete structures.

When in the first stage the concrete has set sufficiently for example, after two or three days' hardening, the part of the hull so far cast is swung or pivoted over from the first to the second stage position with the assistance of the pivotal transfer members 8. The members or arms 8 are introduced between the stringers 10 and are then arranged angularly across the bulkheads 9. The arms 8 may then be bolted or otherwise secured to the bulkheads. The lower ends of the arms 8 may then be connected to the bearing members 17 which are rotatable on the shaft 12.

Although in the arrangement shown, hawsers 13 are provided attached to the upper ends of the members 8, and passing over pulleys 14 to a suitable winding gear 15, it is preferred that the swinging movement of the partly completed hull shall be effected with the aid of an overhead gantry which can be moved along to any position on the waterfront where a partially completed hull is ready for moving into the second stage position.

Figures 1 and 2 show the hull on one side and in position on the form 2, and in the second stage position in which the hull rests on form 3, the two positions being indicated by full lines, the intermediate position through which the hull passes being indicated by chain dotted lines. A final fourth position is also indicated by chain dotted lines in which the hull has been jacked up into an inclined position ready for launching.

After the partially completed hull has been swung from the first stage position into the second stage position, suitable longitudinal reinforcement material is laid on the form 3, and the requisite amount of concrete applied to the form 3 to construct the bottom of the barge. The deck of the barge is finally concreted after the erection of suitable shuttering and the placing in position of suitable reinforcement. As is conventional in the art of reinforced concrete, the reinforcing material placed to be embedded in concrete to form an added element of the structure is suitably united to reinforcement protruding from the adjacent edges of previously cast parts of the structure.

The bow and stern which have been cast as separate units, are then connected to the side walls 4 and 11, and bottom and deck portions, as by interconnection of their reinforcing elements in any of the manners well known in the reinforced concrete art, the side walls at their

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ends and also the ends of the bow and the stern, being formed with interengaging castellated edges 16 as shown clearly in Figs. 3 and 6, to form a sort of wave-form space between the castellated edges for receiving connecting cement or concrete.

The hull which is now substantially complete is then ready for launching down the inclined slipway 1, and to enable the hull to be launched sideways, down the slipway, it is raised into the inclined position shown in Figure 1, a temporary triangular slipway path and a launching skid having been placed in position beneath the hull in line with the launching slope. The hull is then launched sideways down the slipway into the water.

It will be appreciated from the foregoing description that the members 8, after the hull has been swung into the second stage position, are disconnected from the bulkheads. The arms 8 are then detached from the bearing members 17 after which these arms may be withdrawn from positions between the stringers 10. Thereafter the arms 8 may be attached to the bulkheads for another hull that has been partly cast on the form 2. The method is therefore such that two barges can be under construction on the forms 2 and 3, the sides of the first barge being constructed and bulkheads and stringers erected while the bottom and deck of the barge resting on form 3 are being formed. In this way neither of the casting forms 2 or 3, will be vacant for more than a short period of time, thus expediting manufacture.

I claim:

1. A method of constructing a reinforced concrete vessel on two horizontally disposed casting forms which comprises, arranging bulkheads and stringers on the first casting form, casting a side wall for the vessel on the first casting form so as to join the bulkheads, lifting bodily and swinging the bulkheads along with the cast side wall through approximately 90° and into a position where the side wall of the vessel is upright and adjacent the second horizontal casting form, and casting a bottom for the vessel joined to said side wall and to the bulkheads and stringers.

2. A method of constructing a reinforced concrete vessel in two stages on horizontally disposed casting forms which comprises erecting a framework of pre-cast reinforced concrete bulkheads and stringers on a first form, placing in position reinforcing material for incorporation in the sides of the vessel, uniting said reinforcing material to the reinforcing material of the bulkheads, casting on the sides of the vessel when the framework is lying on its side on said first form, swinging the partially completed hull through an angle of substantially ninety degrees into a position in which it rests in an upright position on a second form, placing in position reinforcing material for the bottom and deck of the vessel and uniting it to the framework, and casting the bottom and deck onto the last mentioned reinforcing material.

3. A method of constructing a reinforced concrete vessel which comprises, placing pre-cast bulkheads in a substantially vertical position, casting two opposite sides of the vessel in a substantially horizontal position with one side spaced from and substantially parallel to the other side and with one side united with the upper portions of the bulkheads and the other side united with the lower ends of said bulkheads, swinging the assembly of sides and bulkheads through an an-

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gle of substantially 90 degrees, and casting onto said sides and bulkheads a bottom for said vessel.

4. A method of constructing a reinforced concrete vessel which comprises, placing pre-cast reinforced concrete bulkheads in a substantially vertical position with reinforcement protruding from the ends of the bulkheads, placing in a substantially horizontal position adjacent the upper and lower ends respectively of said bulkheads reinforcing material for two opposite sides of the vessel, attaching the reinforcement of the bulkheads to the reinforcement for the sides, casting the sides, swinging the partially completed hull through an angle of 90° so that it rests with its sides upright, placing in position reinforcing material for the bottom of the vessel, uniting said bottom reinforcement to the reinforcement of the sides and bulkheads, and casting the bottom on to said bottom reinforcement.

5. A method of constructing a reinforced concrete vessel which comprises, placing pre-cast reinforced concrete bulkheads in a substantially vertical position with the reinforcement protruding from the ends of the bulkheads, placing in a substantially horizontal position adjacent the upper and lower ends respectively of said bulkheads reinforcing material for two opposite sides of the vessel, attaching the reinforcement of the bulkheads to the reinforcement for the sides, casting the sides, swinging the thus partially completed hull through an angle of 90° so that it rests with its sides upright, placing in position reinforcing material for the bottom and deck of the vessel, uniting said bottom and deck reinforcement to the reinforcement of the sides and bulkheads, and casting the bottom and deck on to said bottom and deck reinforcement respectively.

6. A method of constructing a reinforced concrete vessel which comprises, placing pre-cast bulkheads in a substantially vertical position, casting two opposite sides of the vessel in a substantially horizontal position with one side spaced from and substantially parallel to the other side and with one side united with the upper portions of the bulkheads and the other side united with the lower ends of said bulkheads, swinging the assembly of sides and bulkheads through an angle of substantially 90 degrees, and casting on to said sides and bulkheads a bottom and a deck.

7. A method of constructing a reinforced concrete vessel which comprises, placing pre-cast bulkheads in a substantially vertical position, casting two opposite sides of the vessel in a substantially horizontal position with one side spaced from and substantially parallel to the other side and with one side united with the upper portions of the bulkheads and the other side united with the lower ends of said bulkheads, lifting and swinging the assembly of sides and bulkheads through an angle of substantially 90 degrees, casting onto said sides and bulkheads a bottom for said vessel, and uniting a pre-cast bow and a pre-cast stern to the thus partially completed vessel.

8. A method of constructing a reinforced con-

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crete vessel which comprises, placing pre-cast reinforced concrete bulkheads in a substantially vertical position with the reinforcement protruding from the ends of the bulkheads, placing in a substantially horizontal position adjacent the upper and lower ends respectively of said bulkheads reinforcing material for two opposite sides of the vessel, attaching the reinforcement of the bulkheads to the reinforcement for the sides, casting the sides, lifting and swinging the thus partially completed hull through an angle of 90° so that it rests with its sides upright, placing in position reinforcing material for the bottom of the vessel, uniting said bottom reinforcement to the reinforcement of the sides and bulkheads, casting the bottom onto said bottom reinforcement, and uniting a pre-cast bow and a pre-cast stern to the thus partially completed vessel.

9. A method of constructing a concrete vessel as claimed in claim 3 wherein the sides of the vessel are cast with castellated ends and a pre-cast bow and a precast stern with castellated ends are placed in position adjacent said side ends and are united therewith by pouring concrete to unite the castellated ends of the sides with the bow and stern respectively.

10. A method of constructing a reinforced concrete vessel on two horizontally disposed casting forms which comprises, arranging bulkheads on the first casting form, casting a side wall for the vessel on the first casting form so as to join the bulkheads, lifting bodily and swinging the bulkheads along with the cast side wall into a position where the side wall of the vessel is upright and adjacent the second horizontal casting form, and casting a bottom for the vessel joined to said side wall and bulkheads.

11. A method of constructing a reinforced concrete vessel on two horizontally disposed casting forms which comprises, arranging hull framing members on the first casting form, casting a side wall for the vessel on the first casting form so as to join the hull framing members, lifting bodily and swinging the hull framing members along with the cast side wall into a position where the side wall of the vessel is upright and adjacent the second horizontal casting form, and casting a bottom for the vessel joined to said side wall and hull framing members.

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