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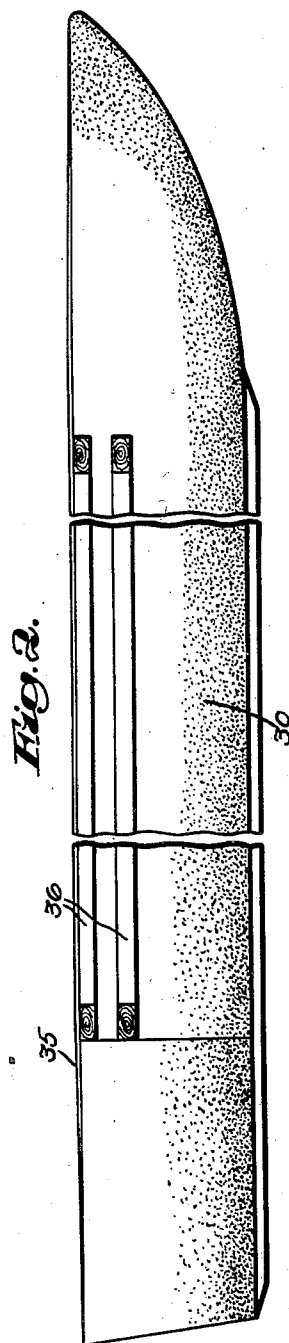
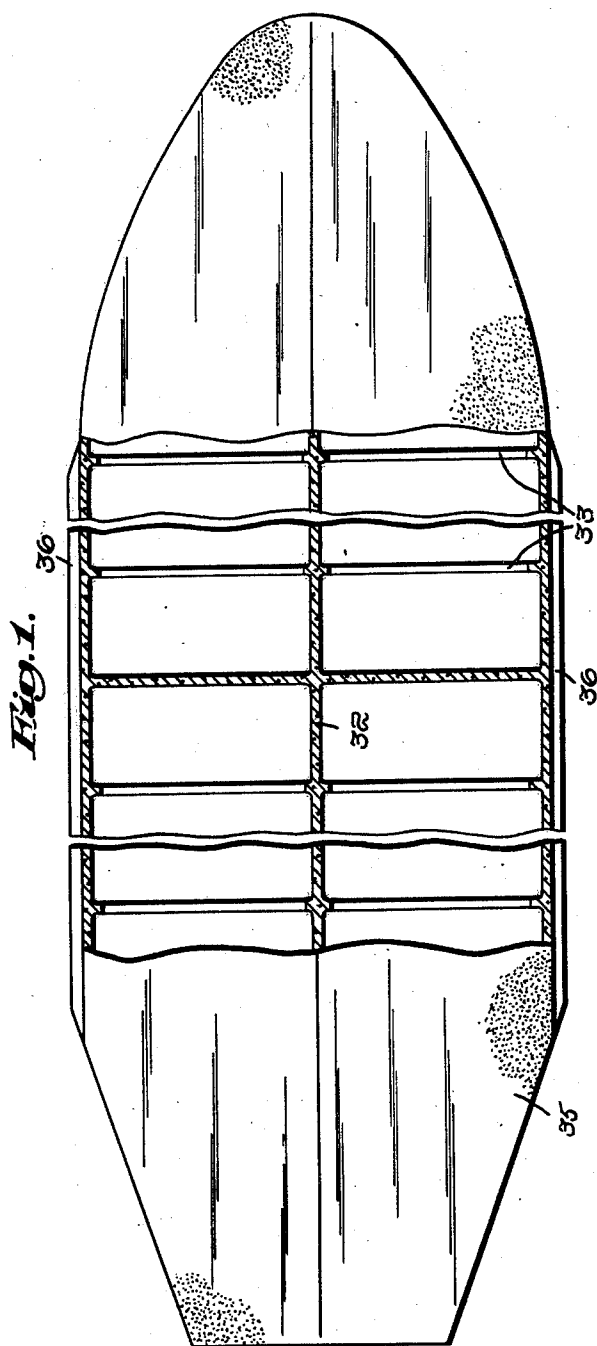
H. D. A. GANTEAUME

2,364,522

PROCESS OF AND EQUIPMENT FOR BUILDING CONCRETE SHIPS

Filed May 17, 1943

4 Sheets-Sheet 1



Inventor:

Henri D. A. Ganteaume -
by Henry & Witten.
Attorneys

Dec. 5, 1944.

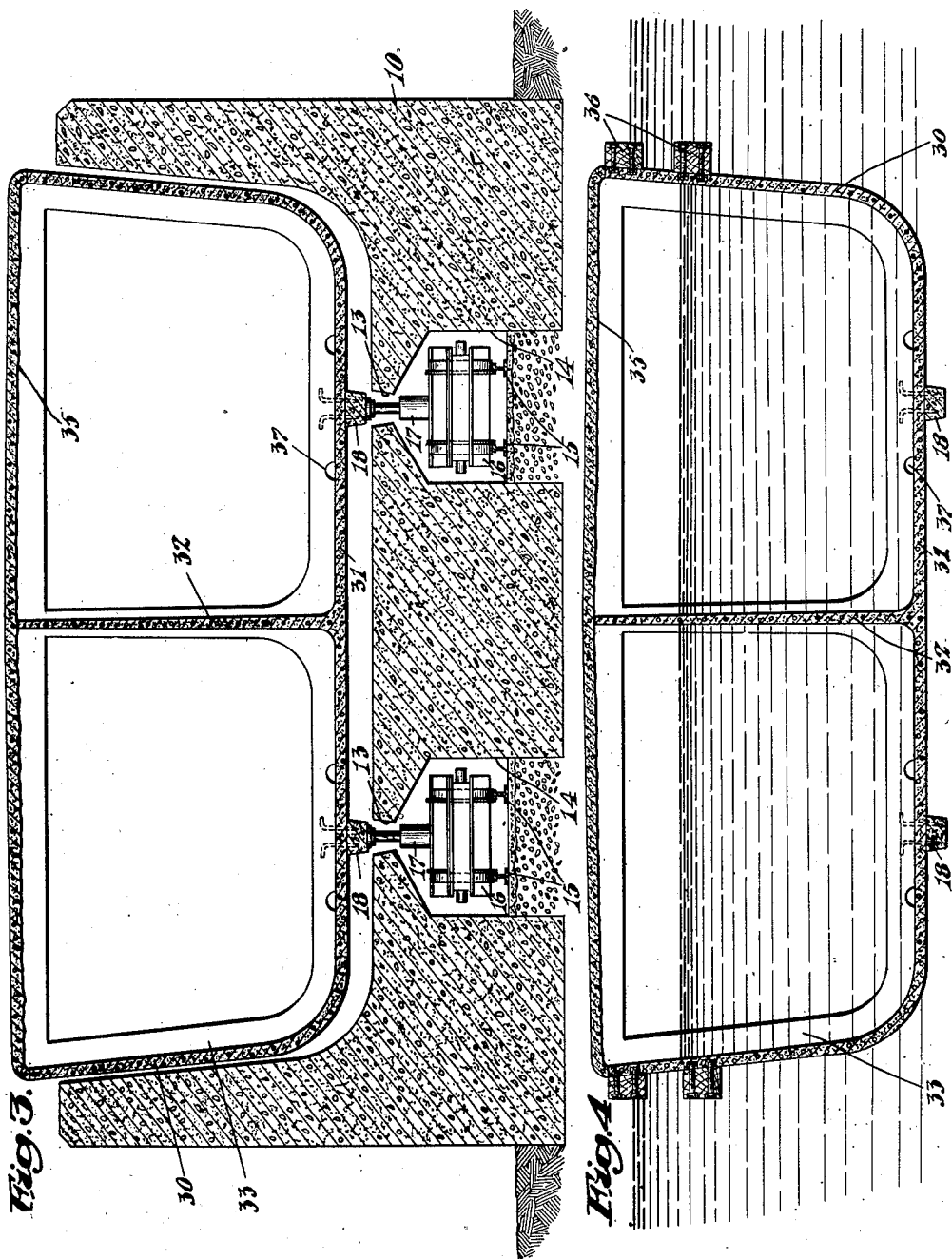
H. D. A. GANTEAUME

2,364,522

PROCESS OF AND EQUIPMENT FOR BUILDING CONCRETE SHIPS

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4 Sheets-Sheet 2



Inventor:
Henri D. A. Ganteaume.
by Henry W. Allen
Attorneys

Dec. 5, 1944.

H. D. A. GANTEAUME

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PROCESS OF AND EQUIPMENT FOR BUILDING CONCRETE SHIPS

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Fig. 6.

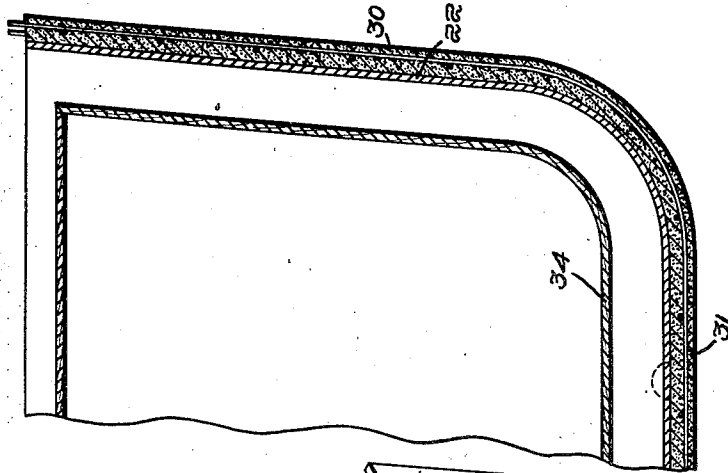
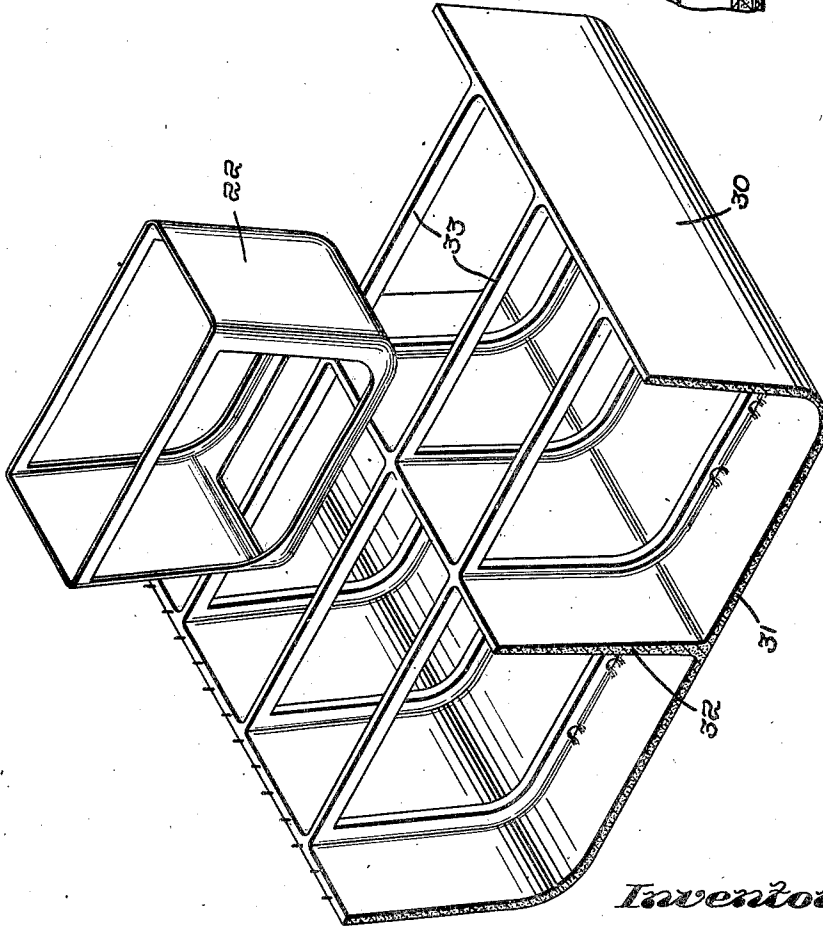


Fig. 5.



Inventor:

H. D. A. Ganteaume.
by Newway & Witter.
Attorneys

Dec. 5, 1944.

H. D. A. GANTEAUME

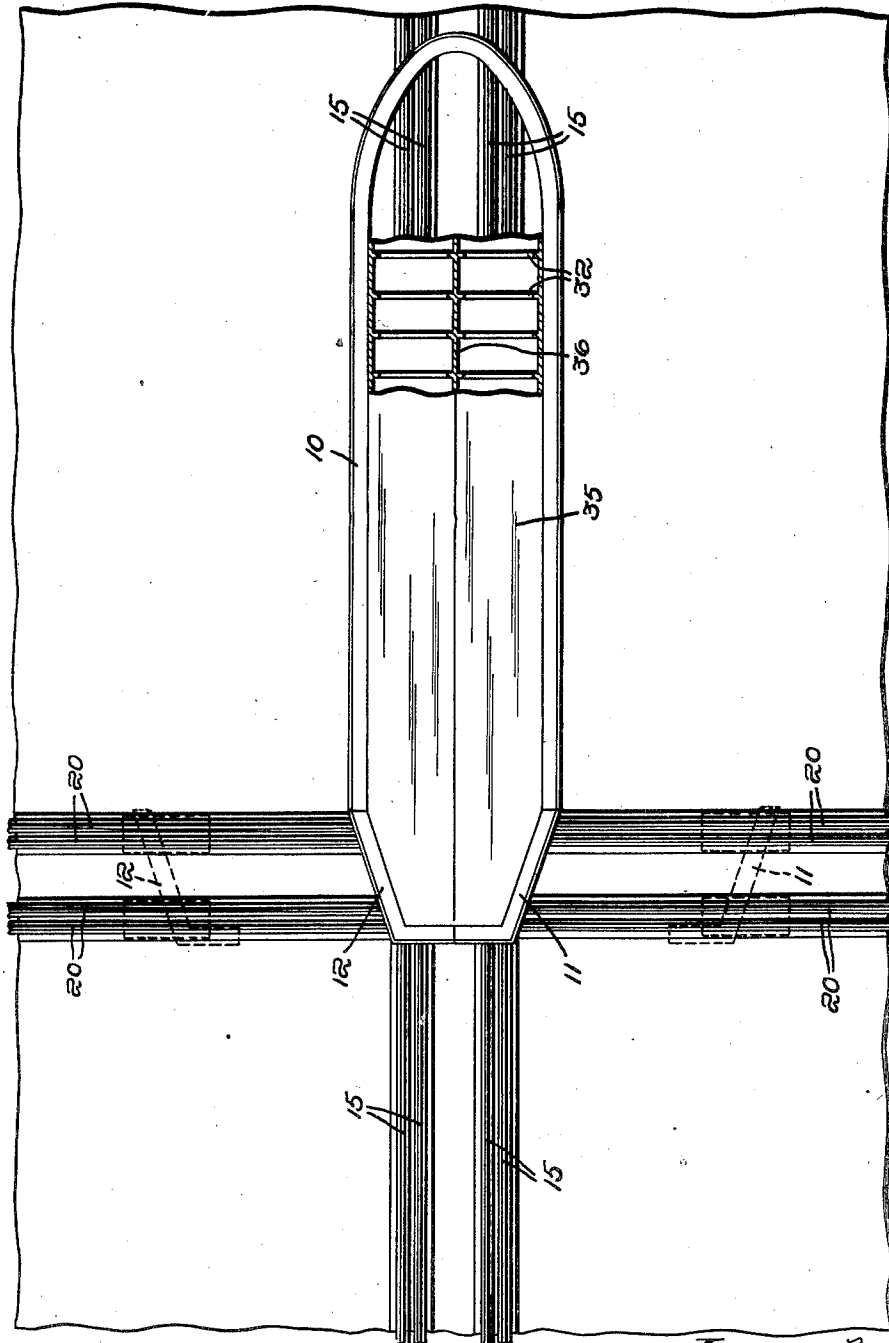
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Fig. 2.



Inventor:

Henri D. A. Ganteaume -

by Newway Wither.
Attorneys

UNITED STATES PATENT OFFICE

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PROCESS OF AND EQUIPMENT FOR
BUILDING CONCRETE SHIPS

Henri D. A. Ganteaume, Newtonville, Mass.

Application May 17, 1943, Serial No. 487,302

8 Claims. (Cl. 25—130)

This invention consists in a new and improved process of building concrete ships or vessels in mass production. An object of the invention is to speed up the production of concrete hulls and to make available a process which will tie up only for the shortest possible time the major units of equipment. The invention includes within its scope the novel equipment or apparatus herein shown as designed for use in carrying out the process of my invention.

My novel process is characterized by the employment of a permanent outer mold having side walls and a bottom of a shape which will impart the desired exterior contour to the hull of the vessel, and a set of individual cells which may be located within the outer mold in properly spaced relation to determine the interior contour of the hull complete with the necessary ribs and bulkheads. The employment of such permanent molds for the construction of any substantial number of hulls results in a very great saving of time and expense in the form work.

The outer mold and the removable set of cells for shaping the interior of the hull constitute the complete mold equipment required in carrying out the process of my invention. The outer mold has important and novel features facilitating the prompt removal of the hull as soon as the concrete has set so that work may be immediately begun upon a new hull. To this end the outboard section of the mold is made removable to permit the complete hull to be withdrawn by endwise movement, it being necessary for this step to lift the hull only sufficiently to clear it from the bottom and sides of the mold. As herein shown the outer mold is provided with parallel longitudinal slots in its bottom giving access to the hull for suitable lifting and transporting mechanism. I have shown these slots as opening into longitudinal passages beneath the mold bottom and in these passages may be provided tracks for trucks equipped with hydraulic jacks. Any desired number of slots and tracks may be provided in the mold bottom depending on the size of the hull to be constructed.

Another feature of my improved process is the employment of continuous beams for temporarily closing the slots in the mold bottom, these beams being preferably incorporated as chafing strips in the bottom of the hull. The beams are also useful as pressure-receiving and distributing members in the lifting step of my process; for example, the lifting pressure of the jacks may be applied directly to the beams and the hull lifted and transported out of the mold while thus supported.

The cells forming collectively the inner mold may be readily lifted individually by a crane and accurately placed within the outer mold, being spaced from the bottom and side walls of the

outer mold by the thickness desired in the corresponding parts of the hull and from each other by the thickness desired in its ribs and bulkheads. Preferably and as herein shown the transverse walls of the cells are of skeleton construction and in completing the contour of the assembled inner mold the spaces between these skeleton walls are temporarily stopped off to define the inner edge surfaces of the ribs.

These and other features, advantages and characteristics of my invention will be best understood and appreciated from the following description of the preferred manner of carrying out my novel process in connection with one suitable type of equipment selected for purposes of illustration and shown in the accompanying drawings, in which—

Fig. 1 is a plan view, partly in section, of a typical hull produced by my process,

Fig. 2 is a corresponding view in side elevation,

Fig. 3 is a view in transverse section of the hull and outer mold,

Fig. 4 is a view in transverse section of the completed hull, as it floats containing a cargo of oil or the like,

Fig. 5 is a view in perspective of a portion of the completed hull showing one of the cells in process of removal,

Fig. 6 is a sectional view on an enlarged scale illustrating the relation of the two mold members, and

Fig. 7 is a plan view on a reduced scale of a completed hull, shown with portions broken away, in position within the outer mold of the equipment.

For purposes of illustration I have selected a flat bottom oil barge and the permanent molds are shaped to produce the hull of this particular vessel, although it will be understood that my novel process is not by any means limited to this or to any particular type of vessel.

The outer mold as shown in Figs. 3 and 7 is permanently constructed of concrete, steel or the like and comprises a main section 10 and a removable outboard stern section comprising members 11 and 12. The main section has longitudinally parallel side walls which in the illustrative example, converge longitudinally at the inner end of the mold to form the bow of the hull and these walls diverge upwardly so that the sides of the hull may be cleared from them by a relatively short lifting movement. The bottom of the outer mold is substantially flat and in it are formed two longitudinal grooves 13 which extend the full length of the mold bottom and open out through the stern section. The grooves 13 open downwardly into longitudinal passages 14 beneath the mold bottom and in these passages are provided tracks 15 for a series of trucks 16 each equipped with an hydraulic jack 17.

Initially the longitudinal grooves 13 in the mold bottom are closed by continuous beams 18. The walls of the grooves 13 converge downwardly and the beams 18 which may be of wood or iron are correspondingly shaped. They are provided with upstanding bolts or other metal anchoring means extending upwardly where they may be embedded in the bottom and ribs and so permanently built into the bottom of the hull and removed from their grooves when the hull is lifted forming chafing strips for the vessel.

The members 11 and 12 of the stern section of the mold are mounted on rollers or trucks, not shown, which run on tracks 20 and extending transversely to the main axis of the hull. These mold sections may be brought into place to complete the periphery of the outer mold, as suggested in Fig. 7, and then when the hull is completed they may be shifted transversely in opposite directions to their dotted line positions in order to open the outboard end of the main outer mold and permit removal of the hull through it.

The inner mold comprises an assembly of individual cells 22 one of which is shown in Fig. 5. Each cell has solid inner and outer end walls, an open top and skeleton transverse or side walls and a solid bottom. These cells may be swung into place in the outer mold by a crane and located by suitable stops in spaced relation to the bottom of the outer mold and to its side walls. They are also spaced from each other to provide mold space for the ribs and the bulkheads of the hull. The hull, as shown in Fig. 5, is an integral structure, having side walls 30, a bottom 31, an integral central longitudinal rib 32 and skeleton transverse ribs 33. After the cells 22 have been positioned within the outer mold the space between their adjacent skeleton walls may be sealed temporarily by planking 34 extending across or between their inner transverse edges and this space will define the inner edge of the transverse ribs in the finished hull. This planking 34 is, of course, removed when the concrete of the hull has set so that the cells may be hoisted one by one from the interior of the hull.

Suitable reinforcing rods are embedded in the walls and bottom of the hull and such reinforcements may be left projecting in the side walls of the hull as suggested in Fig. 5 to facilitate bonding the decks to the side walls. The deck may be constructed in any conventional manner, for example, it may be supported on a corrugated sheet 35 which remains an integral part of the finished hull. Fig. 4 represents the completed hull in cross section with chafing strips 36 secured to its side walls in the vicinity of the water line. To adapt the hull for use as an oil barge the transverse ribs 33 are provided with perforations 37 adjacent to the bottom 31 to permit the free flow of liquid from one section to another of the hull.

Having poured the completed hull, removed the cells 22 and completed the deck 35, the stern sections 11 and 12 are moved transversely into inoperative position and lifting pressure is applied to the hull through the beams 18 by the hydraulic jacks 17. The bottom of the hull is lifted sufficiently to clear it from the bottom of the mold, to remove the beams 18 from their slots 13 and to clear the side walls of the hull from the side walls of the outer mold all as suggested in Fig. 3. The hull, supported upon the trucks 16, may now be transported bodily on the trucks, stern first, out of the mold and launched. The members 11 and 12 of the stern section may at

once be restored to their operative position and the equipment is ready for immediate use in the construction of a new hull.

It will be apparent that the hull may be of such shape that it may be launched more conveniently bow first and in that case the outer mold will be correspondingly modified from the shape shown herein. If desired, also the number of slots in the mold bottom and corresponding tracks may be increased for handling large hulls. While I referred to concrete only as the material of the hulls it is within the scope of my invention to employ any other suitable plastic material.

Having thus disclosed my invention and described in detail one specific manner of putting it into practice, I claim as new and desire to secure by Letters Patent:

1. The process of building concrete vessels, which consists in providing an outside mold having parallel longitudinal channels in its floor, placing a continuous beam in each channel thereby temporarily closing the same, pouring the bottom and sides of the vessel within said outside mold and incorporating said beams in the bottom, and subsequently lifting the vessel to clear the floor of the mold by pressure exerted on said beams.

2. The process of building concrete vessels which includes the steps of providing an outside mold comprising a permanent main section and a removable outboard end section, pouring the bottom and sides of the vessel within the mold, subsequently removing said end section, clearing the bottom of the vessel from the floor of the main section of the mold, and moving the vessel out through the open end of the mold while the main section remains undisturbed.

3. The process of building concrete vessels which includes the steps of providing an outside mold with longitudinal passages beneath its floor which open through the same in parallel slots, temporarily closing the slots, pouring the bottom and sides of the vessel, subsequently lifting the bottom of the vessel from the floor of the mold by pressure exerted through the slots, and transporting the vessel out of the mold by trucks movable in said passages.

4. Equipment for building concrete ships, comprising a permanently installed external mold having downwardly converging walls and a bottom having parallel longitudinal slots opening into passages beneath the mold bottom, and jack-carrying trucks movable in said passages to transport a ship endwise from the mold.

5. Equipment for building concrete ships, comprising a permanently installed external mold having downwardly converging side walls and a bottom having parallel slots therein opening into passages beneath the mold bottom, said slots being adapted temporarily to be filled by pressure receiving beams, and jack-carrying trucks movable in said passages to lift a ship through the medium of beams thus supplied and transport it out of the mold.

6. Equipment for building concrete ships, comprising a permanently installed external mold having side walls and a substantially flat bottom extending from one side wall to the other and having spaced apertures therein which are temporarily filled, a sectional outboard wall movable transversely to open the mold at one end, lifting mechanism operating through said apertures to release a ship from the mold surfaces, and means for transporting the ship out through the open end of the mold.

7. Equipment for building concrete vessels comprising a permanently installed external mold having side walls, a bottom and a removable end section, the bottom having longitudinal slots therein opening out through the end normally closed by said removable section, means operating through said slots for lifting the vessel to free it from the mold surfaces, and means for transporting the vessel endwise out of the mold after the end section has been removed.

8. Equipment for building concrete hulls, comprising an outer mold having side walls of per-

manent construction and a bottom extending from wall to wall, tracks extending longitudinally of the mold and beneath the bottom thereof, the bottom having temporarily closed slots therein above said tracks, an outboard section having converging side walls registering at their inner ends with the permanent side walls of the mold, and tracks for supporting said outboard section and guiding it for movement transversely to open the mold.

HENRI D. A. GANTEAUME.