Oct. 24, 1967 E. L. VIDAL 3,348,246

BOAT STRUCTURE

Filed Oct. 18, 1965 2 Sheets-Sheet 1

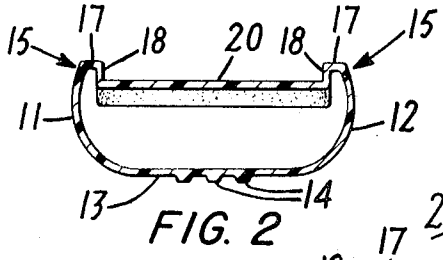

FIG. 2

FIG. 1

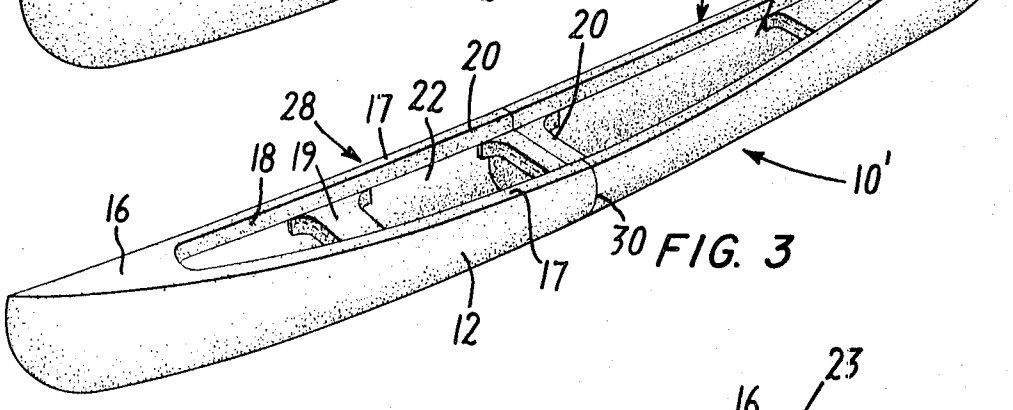

FIG. 3

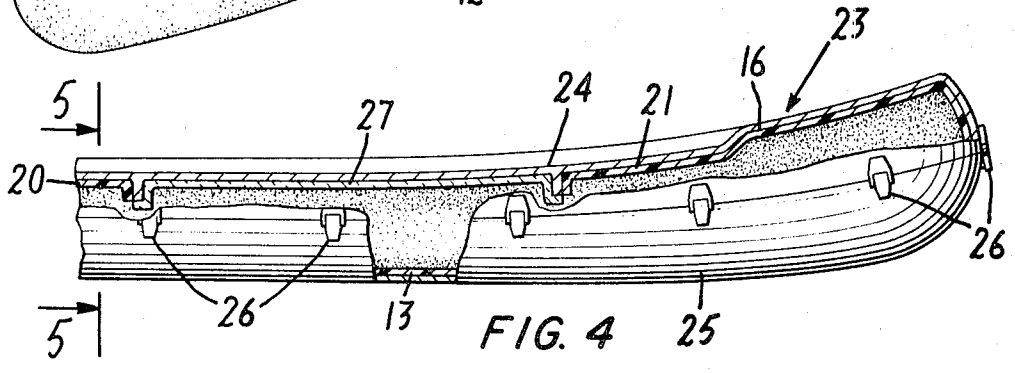

FIG. 4

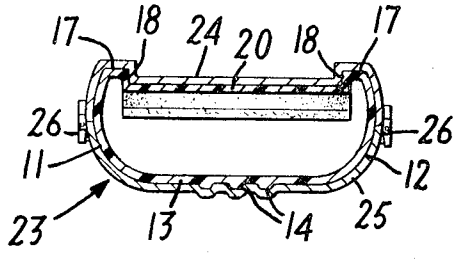

FIG. 5

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BOAT STRUCTURE

Filed Oct. 18, 1965 2 Sheets-Sheet 2

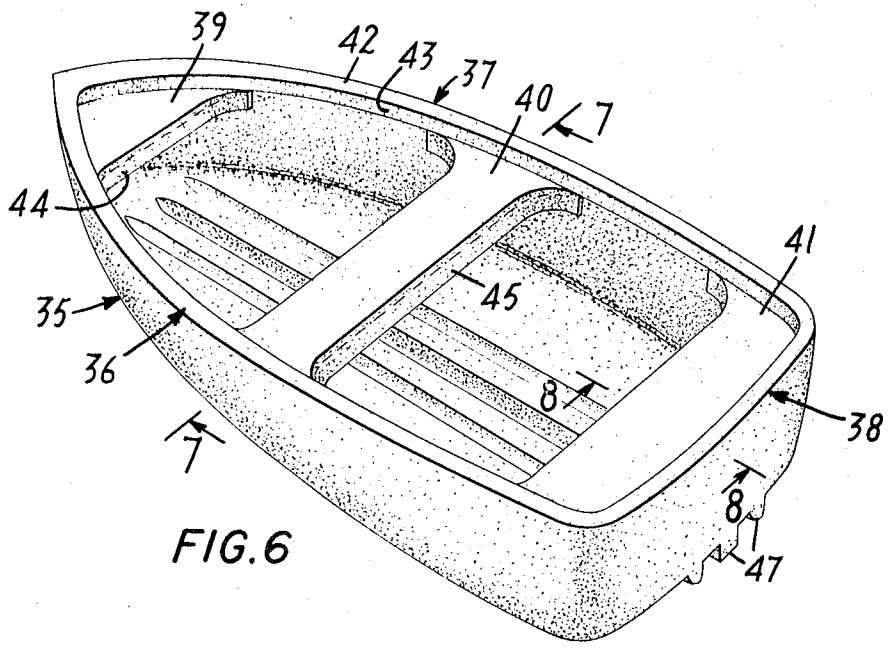

FIG. 6

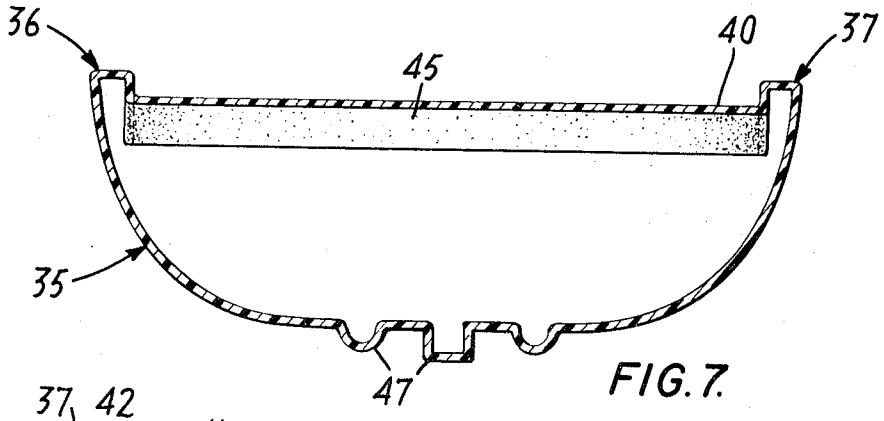

FIG. 7.

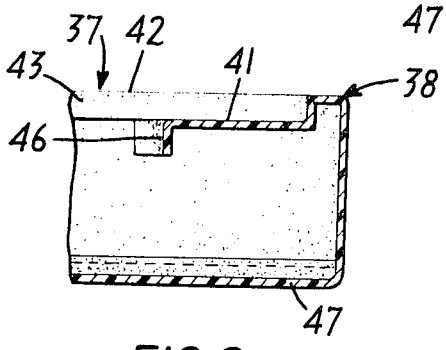

FIG. 8

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BOAT STRUCTURE

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13 Claims. (Cl. 9—2)

ABSTRACT OF THE DISCLOSURE

The specification describes a one-piece molded boat structure made of a continuum of relatively rigid synthetic plastic material, including a hull formed by a floatable monocoque shell open at the top, channel-like reinforcing gunwhales formed integrally with the shell and extending in fore-and-aft directions along both sides of the shell adjacent the inner sides of the shell, and at least one recessed seat integrally formed with and connecting opposite channel-like reinforcing gunwhales. The boat structure is illustrated and described both in the form of a canoe and a dinghy.

This invention relates to a novel structure for boats, for example, of the kayak, canoe, motor boat, dinghy or rowboat type, and particularly to a boat structure molded of plastic material in the form of one or more monocoque shells for greater rigidity and having integrally formed fore-and-aft and port-and-starboard reinforcements.

In recent years, considerable interest has been given to and various proposals have been made for making boat hulls and boat components from currently available lightweight, inexpensive, durable plastics which have high resistance to rot and marine growth. However, the design of an inexpensive, attractive, safe and sturdy plastic boat presents many problems. Conventional plastic boats are generally unattractive and/or lacking in the requisite fore-and-aft and port-and-starboard reinforcements. Moreover, in the construction of previously proposed plastic boats in which the various parts are made up separately and then assembled to complete the boat, the cost of assembly is high and the various cutting, drilling and fastening operations present problems when dealing with current plastic molding methods and designs.

The present invention provides an attractive, rigid, lightweight, watertight, inexpensive and seaworthy boat in which the hull (or monocoque shell-like sections thereof), decks (if any), fore-and-aft reinforcing gunwales, and transversely extending reinforcing seats are molded of plastic in a single piece. Essentially the boat is a hollow molded shell with cockpit openings at the top. More specifically, the plastic boat of the present invention is made up of one or more monocoque floatable shells which include a hull portion, internal channel-like reinforcing gunwales formed integrally with the hull and providing fore-and-aft reinforcing structures along the upper ends of both sides of the hull, and transverse recessed seats connecting and integrally formed with the gunwales of opposite sides of the boat and providing port-and-starboard reinforcing structures.

The internal fore-and-aft reinforcing gunwale formations are not only more effective than the usual external gunwales usually provided on conventional boats, but in addition, they provide supporting formations for the transversely extending seats so that the various components of the shell can be molded integrally in one piece. The fore-and-aft reinforcing gunwales and the transverse (i.e., port-and-starboard) reinforcing seats cooperate to define the cockpits of the boat. The recessed seats result inherently from the novel design which provides the internal fore-and-aft gunwales, but in addition they are desirable because they give the boat a lower center of gravity.

The unique design of the boat of the present invention

makes it capable of being molded in one piece or in composite floatable sections of an inexpensive plastic material, such as high density polyethylene, by conventional rotational molding techniques. Accordingly, the novel plastic boat of the present invention requires no assembly at all or at most a minimum amount of assembly required to attach the composite floatable sections together. The boat, nevertheless, possesses all of the desirable features with respect to strength, impact, rigidity, durability and water-tightness which small boats should possess.

For a more complete understanding of the present invention, reference can be had to the detailed description which follows, and to the accompanying drawings, in which:

FIGURE 1 is a perspective view of a one-piece plastic boat embodying the features of the present invention;

FIGURE 2 is a cross-sectional view taken along the line 2—2 of FIGURE 1 looking in the direction of the arrows;

FIGURE 3 is a perspective view of an assembled sectional plastic boat embodying the features of the present invention;

FIGURE 4 is a front view of a mold, partially broken away, which may be used for molding the plastic boats of FIGURES 1 and 3;

FIGURE 5 is a cross-sectional view taken along the line 5—5 of FIGURE 4 looking in the direction of the arrows;

FIGURE 6 is a perspective view of another embodiment of the plastic boat of the present invention;

FIGURE 7 is a cross-sectional view of the boat shown in FIGURE 6 taken along the lines 7—7 of FIGURE 6 looking in the direction of the arrows; and

FIGURE 8 is a cross-sectional view taken along the lines 8—8 of FIGURE 6 looking in the direction of the arrows.

In the embodiment illustrated in FIGURES 1 and 2 of the drawings, the plastic boat **10** of the present invention is of monocoque shell construction and shaped in the form of a canoe. The hull of the boat is defined by side walls **11** and **12** merging into a bottom **13**. The bottom **13** includes a plurality of spaced-apart, parallel reinforcing or stiffening formations **14** extending in fore-and-aft directions substantially the length of the boat.

Channel-like reinforcing gunwales **15** are formed integrally along the upper ends of the side walls **11** and **12** of the boat. These reinforcing gunwales extend in fore-and-aft directions the length of the entire shell intermediate bow and stern top decks **16**. The gunwales **15**, unlike conventional gunwales which are adjacent the outer surface of the hull, are adjacent but spaced apart from the inner surfaces of the hull. The bow and stern decks **16** are also formed integrally with both side walls and the channel-like gunwales and contribute to the rigidity and strength of the boat structure, but might be eliminated in a rowboat where the channel-like gunwales may extend the entire length of the boat and across the rear, as in the embodiment shown in FIGURES 6 through 8 of the drawings.

The channel-like reinforcing gunwales include an inwardly extending wall portion **17** integrally formed with and extending inwardly from the upper end of the side wall of the boat and a downwardly depending wall portion or flange **18** formed integrally with the inner end of the upper wall portion **17**.

The seats or thwarts **19**, **20** and **21** are formed integrally with and connect the lower ends of the depending flanges **18** of opposite gunwales, providing seats which are recessed from the tops of the side walls **11** and **12** of the boat. The seats provide transverse reinforcements intermediate the channel-like reinforcing gunwales **15** which extend across the cockpits **22** of the boat.

For increased reinforcement and rigidity, the edges of the seats are defined by depending lips or flanges so that they are of channel-like configuration when viewed in cross-section.

The mold **23** for producing the one-piece boat illustrated in FIGURE 1 is shown in FIGURES 4 and 5 as comprising an upper mold section **24** and a lower mold section **25** locked together by clamps **26**. The proper amount of suitable plastic powder, for example, high density polyethylene, is placed in the mold before it is closed. The mold is then heated and rotated and/or rocked about multiple axes, as in conventional rotational molding techniques, to distribute the thermoplastic material over all of the surfaces of the mold. As in conventional rotational molding operations, the temperature of the mold is increased to the level necessary to fuse the plastic material, and then the mold is cooled to solidify the plastic material. The rotational molding casting operation is conventional, and it is shown and described herein only in such detail as is necessary for an understanding of how the boat or the monocoque shells comprising the boat can be molded in a single piece and still provide the desired channel-like reinforcing gunwales, the transverse reinforcing seats, and the fore-and-aft decks, if any.

The boat can be molded in the form of a hollow closed shell and the cockpits **22** can be provided by cutting out and discarding the appropriate portions of the shell. Preferably, however, an insert **27** (see FIG. 4) of insulating material, such as asbestos, is affixed within the mold to prevent the plastic from fusing on these areas so that material is saved and the cutout operations are unnecessary.

In the alternative embodiment of the plastic boat shown in FIGURE 3, the plastic boat **10'** comprises a floatable body cast in two separate monocoque shell sections, a forward section **28** and a rear section **29**. The stern wall of the forward shell and the forward wall of the stern shell are preferably in face-to-face relationship and of complementary shape so that fastening means, such as wing nuts, can be used to join them together tightly and cause the line **30** of junction between the shells to be barely noticeable.

In the embodiment shown in FIGURE 3, the complementary opposite ends of the respective shells each have part of the seat or thwart formed integrally therewith so that when the shells are fastened together the tops of the seat portions are co-planar.

The rowboat or dinghy boat structure shown in FIGURES 6 through 8 of the drawings also embodies features of the present invention. The boat in that embodiment comprises a shell-like hull **35** having a fore-and-aft channel-like gunwales **36** and **37** formed integrally with the upper side walls of the hull and extending from bow to stern, a transversely extending channel-like reinforcement **38** formed integrally along the rear wall or transom of the boat and forming continuous connection between the stern ends of the fore-and-aft gunwale reinforcements **36** and **37**, and integrally formed seats **38**, **39** and **40**. Both the fore-and-aft reinforcing gunwales **36** and **37** and the transversely extending reinforcement **38** at the stern are defined by a continuous upper wall **42** extending inwardly from the upper perimeter of the boat and a downwardly depending wall **43**, the walls **42** and **43** corresponding to the walls **17** and **18** in the embodiments shown in FIGURES 1 through 5.

The forward seat **39** is formed integrally with the lower ends of the downwardly depending bow portions of the wall **43**. The thwart seat **40** spans the cockpit of the boat and is integrally connected with the lower ends of intermediate portions of the wall **43** of opposite channel-like gunwales **36** and **37**. The rear seat **41** is formed integrally with the lower end of the portions of the wall **43** at the stern ends of the gunwales and along the transverse reinforcement **38**. Preferably, the rear end of the seat **39**, the front and rear ends of the thwart seat **40** and the front end of the seat **41** are defined by depending lips or flanges **44**, **45** and **46**, respectively, to provide added transverse reinforcement for the boat.

The bottom of the boat, as in the embodiments described above, includes a plurality of spaced-apart parallel reinforcements or stiffening walls **47** extending in fore-and-aft directions substantially the length of the boat.

The dinghy shown and described in connection with FIGURES 6 through 8 of the drawings is preferably molded in one piece by conventional rotational molding techniques with the entire shell-like hull, the fore-and-aft reinforcing gunwales, the transversely extending stern reinforcement and the recessed and reinforcing seats all integrally formed in the molding operation so that the boat does not require any assembling whatever.

The invention has been shown in preferred forms and by way of example only, and various modifications and variations may be made therein without departing from the spirit of the invention. The invention, therefore, is not to be limited to any particular form or embodiment except insofar as such limitations are expressly set forth in the claims.

I claim:

1. A one-piece plastic boat structure molded of a continuum of relatively rigid synthetic plastic material comprising a hull formed at least in part by a floatable monocoque shell open at the top, channel-like reinforcing gunwales formed integrally with the shell and extending in fore-and-aft directions along both sides of the shell adjacent the inner sides of the shell, and at least one recessed seat integrally formed with and connecting opposite channel-like reinforcing gunwales.

2. A molded plastic boat structure as set forth in claim **1** in which the hull is shaped as a canoe and including bow and stern decks formed integrally with the hull and the channel-like reinforcing gunwales.

3. A molded plastic boat structure as set forth in claim **1** in which the hull is shaped as a dinghy with integrally formed side walls and a rear wall and including a channel-like reinforcement extending transversely along and inside the rear wall and integrally formed with and connecting the fore-and-aft channel-like reinforcing gunwales.

4. A molded plastic boat structure as set forth in claim **1** in which the hull comprises at least two such shells having complementary ends which fit together, and fastening means joining the complementary ends.

5. A one-piece boat structure molded of a continuum of relatively rigid synthetic plastic material comprising a hull formed by at least one floatable monocoque shell open at the top and having a bottom section and integrally formed side walls merging into the bottom section, a reinforcing channel-like gunwale formed integrally along each of the upper, inner sides of the shell, each channel-like gunwale including an inwardly extending wall formed integrally with the upper end of each side wall of the hull and a downwardly depending wall spaced apart from the respective side wall of the hull and extending continuously in a fore-and-aft direction substantially the length of the shell, a transversely extending recessed seat formed integrally with and connecting the lower ends of the depending walls of opposite reinforcing channel-like gunwales, and bow and stern decks formed integrally with the said side inwardly extending and depending walls and forming continuations of the said inwardly extending walls.

6. A plastic boat structure as set forth in claim **5** in which the hull includes at least two shells each having complementary ends which fit together, the complementary ends each including a thwart portion formed integrally with the lower ends of opposite depending walls of the gunwales on opposite sides of the boat, and fastening means joining the complementary ends.

7. A plastic boat structure as set forth in claim **6** in

which the top surfaces of the thwart portions are coplanar so that they serve as a seat.

8. A one-piece boat structure molded of a continuum of relatively rigid synthetic plastic material comprising a hull formed by at least one floatable monocoque shell open at the top and having a bottom, side walls and a rear wall all integrally connected and forming parts of the shell, a channel-like reinforcement formed integrally with and extending continuously along each of the upper inner sides of the shell and along the rear wall thereof, the channel-like reinforcement including an inwardly extending wall formed integrally with the upper end of each side wall and the rear wall of the shell and a downwardly depending wall formed integrally with the inwardly extending wall and spaced apart from the respective side and rear walls of the shell, and a transversely extending recessed seat formed integrally with and connecting the lower ends of the depending walls of the reinforcements on opposite sides of the boat.

9. A one-piece boat structure molded of a continuum of relatively rigid synthetic plastic material comprising a floatable hull including at least one monocoque shell open at the top and having side walls and a rear wall, a reinforcing channel-like gunwale formed integrally along each of the upper, inner sides of the shell, each gunwale including an inwardly extending wall formed integrally with the upper end of each side wall of the hull and a downwardly depending wall formed integrally with the inwardly extending wall and spaced apart from the respective side wall of the hull, the gunwales extending in fore-and-aft directions substantially the length of the shell, a channel-like reinforcement extending transversely along and inside the rear wall and integrally formed with and connecting the rear ends of the fore-and-aft channel-like reinforcing gunwales, and a seat formed integrally with and connecting the lower ends of the depending walls of opposite gunwales.

10. A plastic boat structure as set forth in claim **9** in which the transverse channel-like reinforcement includes an inwardly extending wall formed integrally with the upper end of the rear wall and a downwardly depending wall integrally formed with inwardly extending wall and spaced apart from the rear wall and in which the seat is

formed integrally with and connects the lower ends of the depending walls of opposite gunwales and also with the lower end of the depending wall of the transverse channel-like reinforcement.

11. A one-piece molded boat structure made of a continuum of relatively rigid synthetic plastic material comprising a hull portion formed at least in part by a floatable monocoque shell open at the top, channel-like reinforcing gunwhales formed integrally along the upper portions of the shell and extending in fore-and-aft directions along both sides of the shell adjacent the inner sides of the shell, each gunwhale including an inwardly extending wall integrally formed with the upper end of the shell and a downwardly extending wall integrally formed with the inner end of the inwardly extending wall, and at least one recessed seat extending transversely across the open portion of the shell and integrally connected with the lower ends of the downwardly extending walls of the opposite gunwhales.

12. A boat structure as set forth in claim **11** including downwardly extending walls integrally formed on the front and rear ends of said seat to provide transverse reinforcements for the boat.

13. A boat structurue as set forth in claim **11** including a bow deck formed as an integral part of the monocoque shell enclosing and reinforcing the front end of the boat, and a downwardly extending wall integrally formed with the rear end of the bow deck and formed integrally with and connecting the downwardly extending walls of both gunwhales.

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