June 9, 1964 H. WINTERS 3,135,976

BOAT HULL

Filed Aug. 15, 1962

2 Sheets-Sheet 1

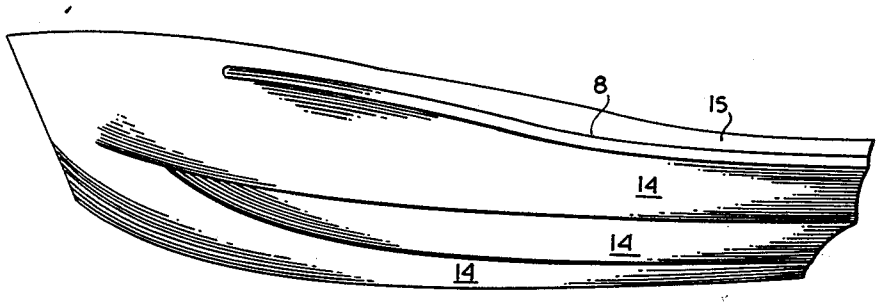

FIG. 1

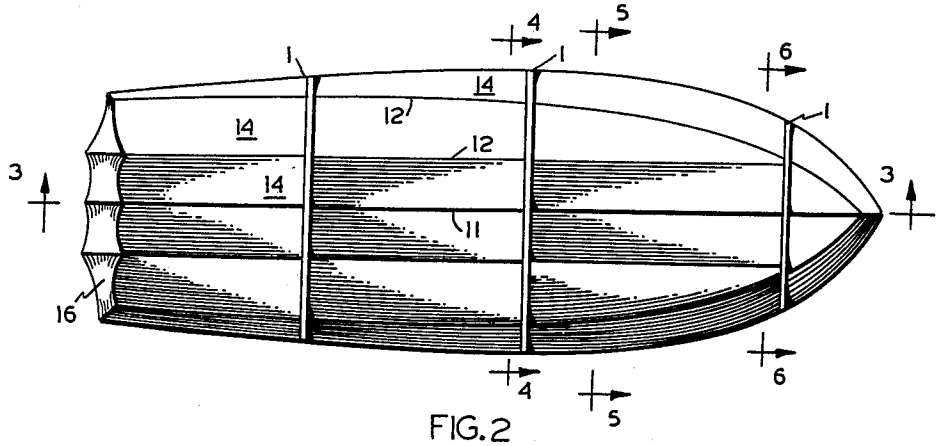

FIG. 2

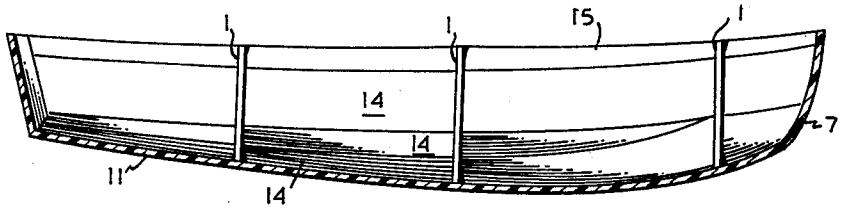

FIG. 3

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BOAT HULL

Filed Aug. 15, 1962 2 Sheets-Sheet 2

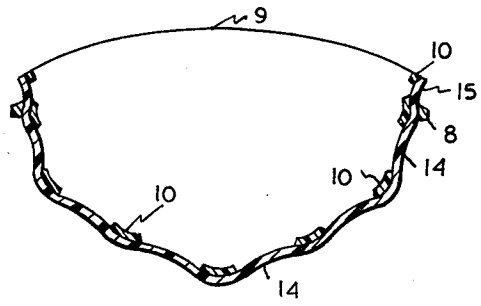

FIG.4

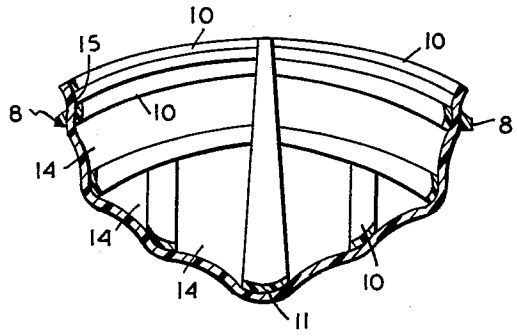

FIG.5

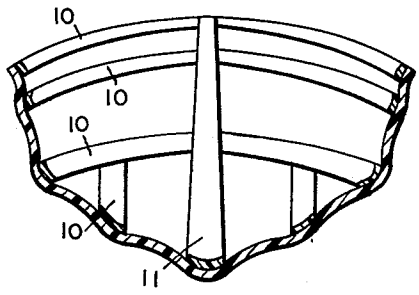

FIG.6

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3,135,976

BOAT HULL

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Filed Aug. 15, 1962, Ser. No. 217,001
10 Claims. (Cl. 9—6)

My invention relates to boat hulls, and more particularly to larger molded boat hulls formed of fiber glass and plastic, such as a suitable resin capable of forming a solid mass on curing.

Heretofore boat hulls made of fiber glass and plastic have been built along the lines and shape of the conventional boat formed of wood, plywood, or metals, such as steel and aluminum. Hulls thus constructed do not utilize the fiber glass-resin combination to the best advantage and in consequence are costlier to fabricate.

An object of my invention is to provide a molded fiber glass and plastic boat hull which is light and strong, and yet employs a minimum amount of plastic and fiber glass and a minimum amount of labor in its manufacture.

A further object of this invention is to provide a boat hull which utilizes the remarkable strength of the fiber glass reinforced plastic when under tension.

A further object of my invention is to provide a boat hull which will decrease the failure of boat hulls built of fiber glass reinforced plastic due to delamination, which delamination is frequently due to (1) local impact, (2) deflection from pressure loading on the bottom of the hull, (3) vibration of panels and/or (4) "panting" of bottom panels caused by wave action. Other aims and advantages of the invention will be shown in the following description of an embodiment which is illustrative of the invention, wherein:

FIGURE 1 is a perspective view of the boat hull.

FIGURE 2 is a top plan view of the boat hull.

FIGURE 3 is a cross sectional view of the boat hull taken on line **3**—**3** of FIGURE 2.

FIGURE 4 is a cross sectional view of the boat hull taken on line **4**—**4** of FIGURE 2, showing clearly the concave areas of the boat hull and the ends of the reinforcing fiber glass tapes, which give added strength to the boat hull.

FIGURE 5 is a sectional view of the boat hull taken on the line **5**—**5** of FIGURE 2, looking forward toward the bow of the boat to show the reinforcing fiber glass tapes extending forward toward the bow of the boat hull.

FIGURE 6 is a further sectional view of the boat hull taken on the line **6**—**6** of FIGURE 2, looking forward toward the bow of the boat and again showing the fiber glass reinforcing strips or tapes extending forward toward the bow of the boat hull.

In the illustrative boat hull as shown, engines, propellors, rudder and other accessories are not shown as the invention pertains to the boat hull, and suitable propelling machinery and other accessories may be installed as is desirable for the particular boat and speeds to be driven.

Referring to the drawings, the hull is made up of a plurality of concave areas **14**, forming the bottom and sides of the boat hull, which exhibit great strength due to the characteristics of the fiber glass when employed in such shapes. These concave areas, the curvature of which depend on the type of boat and use to which put, are reinforced at their junctions (the chine areas **12**) by reinforcing fiber glass tapes **10**. Generally for a one foot span the deflection is one inch. The bow of the boat hull is identified as **7**. The concave areas **14** extend to the rear of the boat hull, and at the stern are further extended to form the transom **16**. The transom is also preferably made up of concave areas as shown. The reinforcing tape **11** extends lengthwise of the boat hull and thence

upwards at **7** to form in the absence of a keel the keel-stem assembly. It will be noted that in this embodiment of the invention there is not a keel as is normally employed in boat hull construction. Due to the shape and construction of my boat hull a keel is not necessary. The concave areas **14** of my boat hull are reinforced crosswise by means of bulkheads **1**, the top of which is shown in FIGURE 4 as **9**. The boat hull is provided with guard rails **8**, which run lengthwise of the boat hull to a point somewhat short of the bow **7**. **15** is the sheer strake, the areas above the guard rails **8**.

In order to more completely illustrate my invention, the following is given as an embodiment of the invention showing the construction of a boat thirty feet in length.

A mold, which may be either a split mold or a one-piece mold, is constructed by a conventional method. The shape of the mold is such so as to produce concave areas **14** shown in the drawings, and the concave areas shown at the transom **16**.

As a first step in the construction of my boat hull, the mold is suitably waxed and sprayed with a "parting" agent (a mold release), such as for example polyvinyl alcohol. A gel coat comprising a suitably activated liquid polyester resin plus filler and pigment is then sprayed into the inside of the mold to form a thin film and completely cured by a convenient means. A mat formed of fiber glass is treated or saturated with a liquid polyester resin containing suitable activating agents and added to the inside of the mold adjacent the previously added polyester resin film. The mat is laid up from sheer to sheer of the boat hull in one continuous length. Thus, at the junction of the concave areas **14**, which form the chine areas **12**, there is no break in the construction of the boat hull. Following the lay-up of the fiber glass mat, as described above, there are added four layers of fiber glass woven roving, each layer being treated with a liquid polyester resin, likewise containing suitable activating agents, and added from sheer to sheer of the boat hull in a continuous length as described for the addition of the fiber glass mat above. The thicknesses of the fiber glass mat layer and the fiber glass woven roving layers are each about $\frac{1}{16}$ inch respectively. In the lay-up of the boat hull, the fiber glass should be so treated with the liquid polyester resin so that there is approximately fifty percent fiber glass and fifty percent of liquid polyester resin. As stated above, the fiber glass mat and the fiber glass woven roving are applied from sheer to sheer. The transom **16** of the boat hull is laid-up in a manner similar to that employed for sides and bottom of the boat hull. The shell so formed is then allowed to cure. When so cured, the junction of the concave areas **14**, said junction being herein described as the chine areas **12**, are then sanded roughly on the inside of the hull. Tapes or strips **10** and **11** of fiber glass woven roving, each about $\frac{1}{16}$ inch thick treated with liquid polyester resin suitably activated are then laid-up in continuous lengths against the inside of the chine areas **12** of the boat hull and cured by convenient means. If convenient or desirable, these tapes or strips **10** and **11** may comprise an epoxy resin. When the reinforcing tapes or strips **10** and **11** are completely cured and become integral with the adjacent areas **14**, bulkheads **1** are installed. These may be made up of a suitable plastic or plywood and the like, and are bonded to the concave areas **14** by means of fiber glass tapes treated with a suitable bonding resin, such as for example an epoxy resin.

When the bulkheads **1** are cured and securely bonded to the concave areas **14**, the boat hull is removed from the mold. Engine beds and other equipment necessary for the propelling of the boat may be installed.

A boat hull constructed as described above has excep-

tional strength and durability, and is relatively cheap to manufacture.

In the manufacture of boat hulls according to my invention, other resins or plastic materials than those described herein may be employed in place of the polyester resins and the epoxy resins. Thus, if convenient or desireable, phenolic aldehyde resins, urea aldehyde resins, acrylic resins and the like may be so employed. I am not limited to any particular resin for such use, although I have found that polyester resins and epoxy resins are in particular desirable for the use given herein. Furthermore, other thicknesses of the fiber glass mat and woven roving than those specifically shown may be employed. Also, the number of layers of fiber glass mat and woven roving may be varied depending on the type of boat hull and the use to which it is put. Thus, it is obvious that while a single embodiment of this invention is shown herein, it is obvious to those skilled in the art that modifications can be made within the scope of the appended claims.

What is claimed is:

1. A boat hull comprising a plurality of concave areas consisting essentially of fiber glass reinforced cured resin and being in the form of a continuous layup from sheer to sheer and stern to bow of the boat, said concave areas extending forwards of the boat hull and forming the bow of the boat hull, said concave areas being reinforced on the inner surfaces at their junctions by means of a reinforcing means comprising continuous fiber glass reinforced resin extending lengthwise of the said junctions.

2. A boat hull comprising a plurality of concave areas consisting essentially of fiber glass reinforced cured resin and being in the form of a continuous layup from sheer to sheer and stern to bow of the boat to form the sides and bottom of the boat hull, said concave areas extending forwards of the boat hull and forming the bow of the boat hull, said concave areas being reinforced on the inner surfaces at their junctions by means of a reinforcing means comprising continuous strips of fiber glass reinforced resin extending lengthwise of the said junctions.

3. A boat hull comprising a plurality of concave areas consisting essentially of fiber glass reinforced cured resin and being in the form of a continuous layup from sheer to sheer and stern to bow of the boat and forming the sides and bottom of the boat hull, said concave areas extending forwards of the boat hull and forming the bow of the boat hull, said concave areas being reinforced on the inner surfaces at their junctions by means of a reinforcing means comprising continuous strips of fiber glass reinforced cured resin extending lengthwise of the said junctions, said boat hull having a transom comprising fiber glass reinforced cured resin.

4. A boat hull comprising a plurality of concave areas consisting essentially of fiber glass reinforced cured resin and being in the form of a continuous layup from sheer to sheer and stern to bow of the boat, said concave areas extending forwards of the boat hull and forming the bow of the boat hull, said concave areas being reinforced on their inner surfaces at their junctions by means of a reinforcing tape comprising fiber glass reinforced cured resin extending lengthwise of the said junctions, said boat hull having a transom integral with the sides and bottom of the boat hull.

5. A boat hull comprising a plurality of concave areas consisting essentially of fiber glass reinforced cured resin and being in the form of a continuous layup from sheer to sheer and stern to bow of the boat, said concave areas extending forwards of the boat hull and forming the bow of the boat hull, said concave areas being reinforced on their inner surfaces at their junctions by means of a reinforcing tape comprising fiber glass reinforced cured resin extending lengthwise of the said junctions, said boat hull having a transom integral with the sides and bottom of the boat hull and formed of fiber glass reinforced cured resin.

6. A boat hull comprising a plurality of concave areas consisting essentially of fiber glass reinforced cured resin and being in the form of a continuous layup from sheer to sheer and stern to bow of the boat and forming the sides and bottom of the boat hull, said concave areas extending forwards of the boat hull and forming the bow of the boat hull, said concave areas being reinforced on their inner surfaces at their junctions by means of a reinforcing means comprising continuous strips of fiber glass reinforced cured resin extending lengthwise of the said junctions, said boat hull having a transom integral with the sides and bottom of the boat hull comprising fiber glass reinforced cured resin.

7. A boat hull comprising a plurality of concave areas consisting essentially of fiber glass reinforced cured polyester resin and being in the form of a continuous layup from sheer to sheer and stern to bow of the boat and forming the sides and bottom of the boat hull, said concave areas extending forwards of the boat hull and forming the bow of the boat hull, said concave areas being reinforced on their inner surfaces at their junctions by means of a reinforcing tape comprising fiber glass reinforced cured epoxy resin extending lengthwise of the said junctions, said boat hull having a transom in the form of a plurality of concave surfaces and comprising fiber glass reinforced cured resin.

8. A boat hull comprising a plurality of concave areas consisting essentially of fiber glass reinforced cured polyester resin and being in the form of a continuous layup from sheer to sheer and stern to bow of the boat and forming the sides and bottom of the boat hull, said concave areas extending forwards of the boat hull and forming the bow of the boat hull, said concave areas being reinforced on their inner surfaces at their junctions by means of a reinforcing tape comprising fiber glass reinforced cured epoxy resin extending lengthwise of the said junctions, said boat hull having a transom integral with the sides and bottom of the said boat hull and in the form of a plurality of concave surfaces and comprising fiber glass reinforced cured polyester resin.

9. A boat hull having the sides and bottom in the form of a plurality of concave surfaces consisting essentially of fiber glass reinforced cured resin and being in the form of a continuous layup from sheer to sheer and stern to bow of the boat, reinforced on the inner surfaces of the concave surfaces at their junctions by a reinforcing means comprising a cured resin, and having a transom joining the sides and bottom of the boat hull comprising fiber glass reinforced cured resin.

10. A boat hull having the sides and bottom in the form of a plurality of concave surfaces consisting essentially of fiber glass reinforced cured resin and being in the form of a continuous layup from sheer to sheer and stern to bow of the boat and reinforced on the inner surfaces of the concave surfaces at their junctions by a reinforcing means comprising a cured resin, and having a transom joining the sides and bottom of the boat hull and integral therewith comprising fiber glass reinforced cured resin, said transom being in the form of a plurality of concave surfaces.

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