Nov. 11, 1952 R. J. NEBESAR 2,617,126

MOLDED BOAT HULL

Filed Nov. 16, 1946

2 SHEETS—SHEET 1

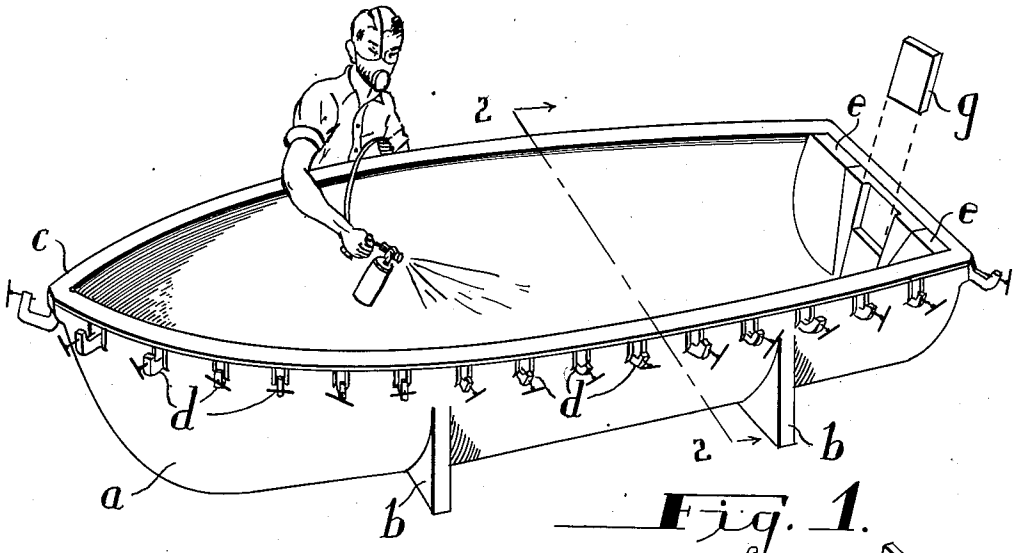


Fig. 1.

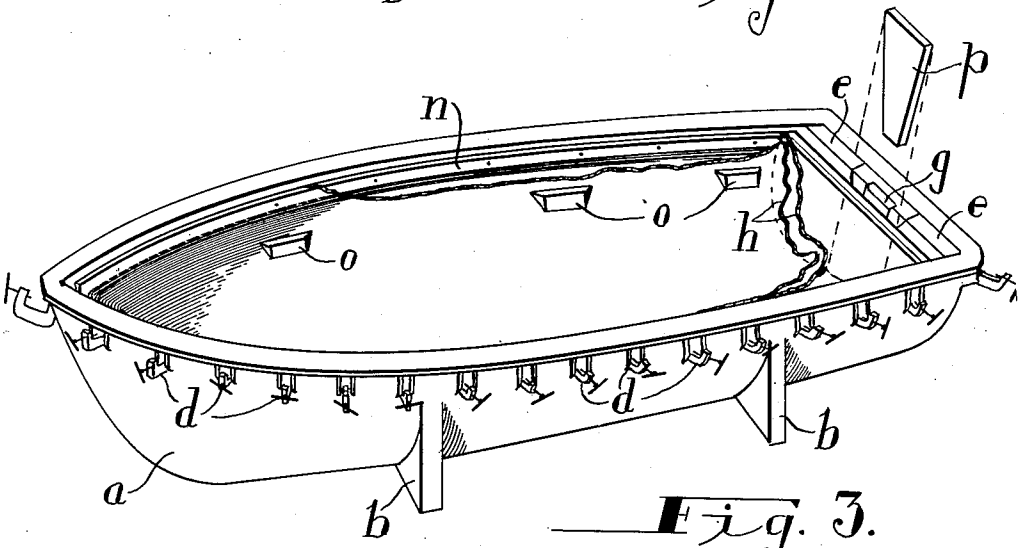


Fig. 3.

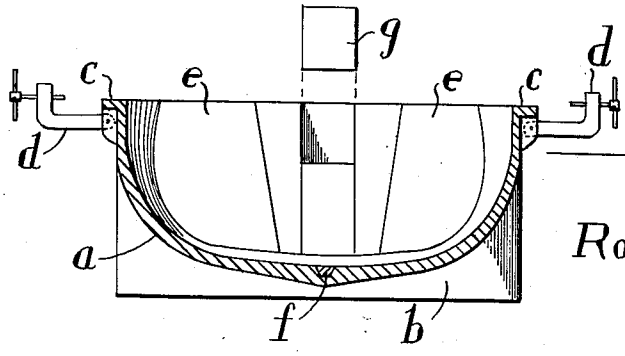


Fig. 2.

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MOLDED BOAT HULL

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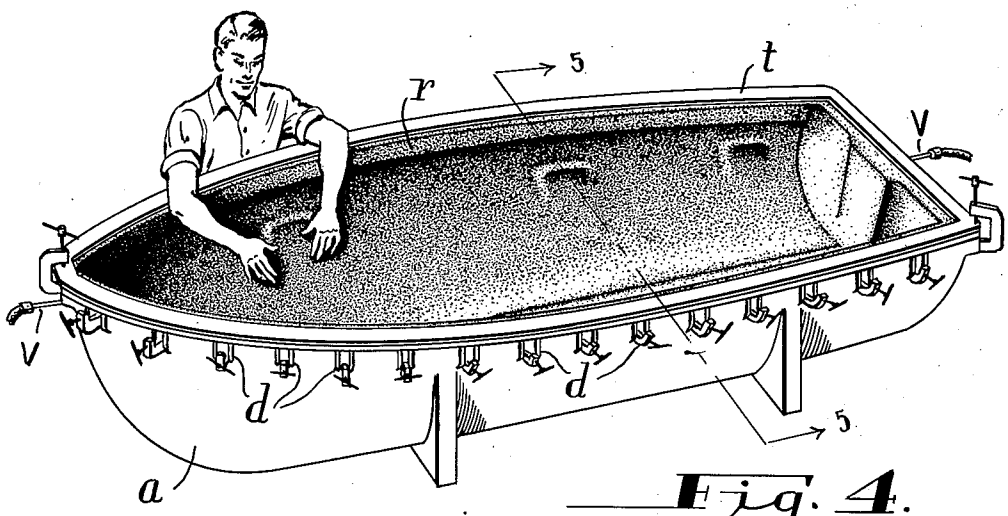


Fig. 4.

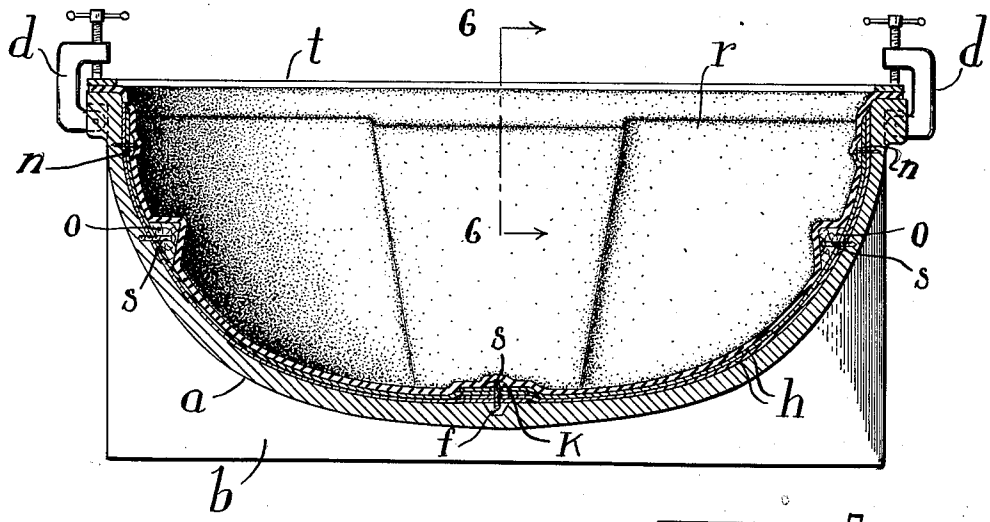


Fig. 5.

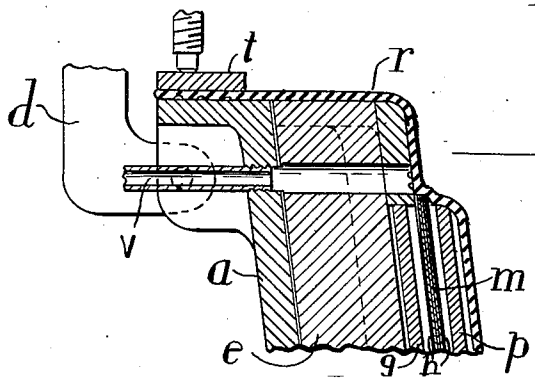


Fig. 6.

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UNITED STATES PATENT OFFICE

2,617,126

MOLDED BOAT HULL

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Application November 16, 1946, Serial No. 710,320

1 Claim. (Cl. 9—6)

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The object of my invention is to produce a one piece boat hull of any suitable, and desirably highly compressible, fibrous material, but more especially a boat hull composed mainly of what is commercially known as impregnated Fiberglas laminate.

One object of the invention is to effect the manufacture of the boat hull at the least possible expense, particularly so far as concerns labor cost. Another object of the invention is to produce a boat that will not be affected by weather conditions, that will develop no cracks or leaks that will require calking, that may be of any desired color although not required to be painted, and that will not deteriorate with passage of time regardless of how frequently it may be in actual use.

While my improved boat has characteristics which make it a new or improved article of manufacture, the process of producing it is of a high degree of importance. The invention, therefore, involves a new and improved process as well as a new construction of boat.

In the drawings:

Figs. 1, 3 and 4 are perspective views of the mandrel and other elements, showing progressive stages in the manufacture of the boat hull.

Fig. 2 is a cross-section on the line 2—2 of Fig. 1.

Fig. 5 is a cross-section on the line 5—5 of Fig. 4.

Fig. 6 is an enlarged section on the line 6—6 of Fig. 5.

The mandrel *a* is a female mold having the contour of the boat hull to be molded, but of slightly greater length at stern end. The mandrel is of polished cast iron or aluminum alloy or other metal of sufficient thickness and rigidity to resist distortion if subjected to unbalanced fluid pressure. It is substantially thicker along the bottom than along its side and is provided with feet *b*, which not only support, but also reinforce, the mandrel. Around its upper edge the mandrel is provided with an outwardly projecting flange *c*, to which are secured hinged clamps *d*.

In the stern end of the mandrel is inserted one or more sectional cast iron or other metal end plates *e* which are virtually elements of the mold and impart a substantially greater thickness to the mold at this end, their main purpose, however, being to provide a removable mold element which, at the conclusion of the molding and after cure, is slipped out, leaving some clearance at the transom of the hull and the transom end of

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the mandrel proper to facilitate removal of the molded hull.

Inserted into a groove formed in the inner face of the bottom of the mandrel along its longitudinal center is a strip *f*, the upper face of which is coated with a thermosetting resin and ultimately forms an integral part, namely, the keel, of the hull. Inserted into a recess in one of the end plates *e* is a wooden board or block *g* which is also coated on its inner face with a thermosetting resin and ultimately forms an integral part of the hull, namely, the motor clamp block.

Layers *h* of a suitable fibrous material, preferably glass fibres formed into sheets and known commercially as Fiberglas, are impregnated with thermosetting resin, and are laid into the mandrel. There may be one layer but preferably there are two or more layers. For example, two layers are shown. They are laid into the mandrel in the form of wide sheets. The sheets may have a fairly wide overlap along the region of the keel, so as to impart a greater thickness to the hull in a zone of selected width along the keel region. Overlying this thicker zone of Fiberglas is a keel reinforcement *k*, which is covered with one or more layers (one is shown) of Fiberglas.

In the transom also there is an added layer or layers of Fiberglas and confined between layers is a transom reinforcement *m*, preferably of plywood.

The two layers of Fiberglas are spaced apart at their outer edges to receive between them a wooden inwale reinforcement *n*. Or, alternatively, the inwale reinforcement may be confined between the two layers of Fiberglas and an added layer or layers of Fiberglas.

These keel-, transom-, and inwale-reinforcements may all be resin-coated before insertion between the layers of Fiberglas. They all ultimately form integral parts of the completed hull.

After the Fiberglas mat with its enveloped reinforcements just described is laid into the hull certain wooden parts are applied to the inner face of the mat; that is, the face opposite that which contacts with the mold. These parts are the seat supporting blocks *o* (usually three on each side) and the motor board *p*. Before these elements are laid against the Fiberglas they are coated on their inner face with thermosetting resin and are held in place by screws *s* which tap into, but do not extend completely through, the mandrel.

The inner (exposed) face of Fiberglas and the wood parts *o* and *p* are then coated with thermosetting resin and covered with cellophane.

A blanket *r* of flexible material, preferably of uncured rubber so as to be elastic as well as flexible, is beforehand moulded in the mandrel in which all the protruding wood parts are located and held in place so that when cured this material would have the shape of the inside of the boat with edges of the blanket *r* extending over the flange *c* of the mandrel. In the moulding operation of the boat such blanket *r* is then placed over the mandrel into which all the elements, including the Fiberglas mat with resin, are laid in, the edge of the blanket extending over the flange *c* of the mandrel, and a steel clamping ring *t* having approximately the contour and dimensions of the flange *c* is laid over the edge of the blanket *r* overlying the flange *c* and is secured in place by the clamps *d*, the mould being thus made air-tight.

Vacuum pipes *v* are connected to and extend through the mandrel, and air confined between the mandrel and the blanket is exhausted. The mold side of the blanket is provided with a multitude of little depressions which form a multitude of complementary projections on the inner face of the mat. Thereby venting is facilitated.

The entire assembly is then rolled into an autoclave (not shown) wherein fluid pressure is applied by means of steam and air. During the cure the vacuum through line *v* may be maintained, or the vacuum line may merely function as a vent to discharge outside of the autoclave any vapor that may be created inside the mold during cure.

After cure the clamping ring *t* and the blanket *r* are removed, the filling pieces *e* are slipped out, and the hull is removed. The edge of the hull is trimmed, preferably so as to cut through the inwale reinforcement.

By the described process, there is produced a smooth one-piece rigid hull, with all primary wood members securely bonded to, or sandwiched in, the impregnated Fiberglas laminate.

An important feature of the process is the molding of the rubber blanket, before application of fluid pressure, to the metal mold and particularly to the wood parts assembled in it. This preliminary molding of the rubber blanket is of importance, as otherwise the blanket, under fluid pressure, would not stretch sufficiently to make it closely conform to these sharply projecting seat supporting blocks and motor board and voids would be formed, thereby producing a defective hull.

Other important features of the process are: the reinforcement of the Fiberglas mat by embedding therein the hull reinforcement, the transom reinforcement and the inwale reinforcement, and the application of the seat supporting blocks and motor board (and any other desired element) to the mat—all before the application of vacuum, heat and fluid pressure. Fluid pressure is not mainly relied upon to conform the mat and the attached parts to the mold, the main function of the fluid pressure being to consolidate and densify the Fiberglas so as to form a rigid hull. The sheets of Fiberglas mat are not dense and when subjected to pneumatic pressure the mat is reduced in thickness to approximately 25% of its original thickness.

A one piece boat hull formed by the described process has maximum durability. It is not adversely affected by heat or other weather conditions. It develops no cracks or leaks that require calking. It does not require painting. A dye of any color may be mixed with the thermosetting resin and the plastic material impregnated with both; and the completed boat will have the color of the dye, and the color will not be superficial but will permeate the entire hull.

A very practical advantage is that the whole process may be performed expeditiously by labor that is not highly skilled, the labor cost being a decidedly minor factor of the total cost, which in turn is much below the cost of boats built by conventional methods.

What I claim and desire to protect by Letters Patent is:

A boat hull the main body of which consists of highly compressed and densified layers of fibrous material having integrally united therewith on its outer face a keel and a motor clamp block and on its inner face a seat supporting block and a motor board and having confined between layers of said fibrous material a keel reinforcement, a transom reinforcement and an inwale reinforcement.

ROBERT J. NEBESAR.

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