April 1, 1969 L. M. KRENZLER 3,435,470

FOAM-FILLED BOAT HULL

Filed Aug. 7, 1967

FIG. 1

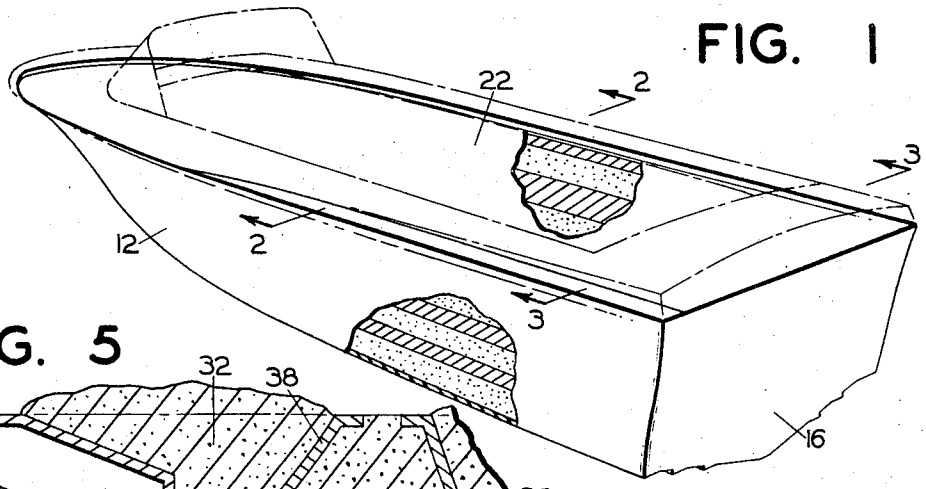
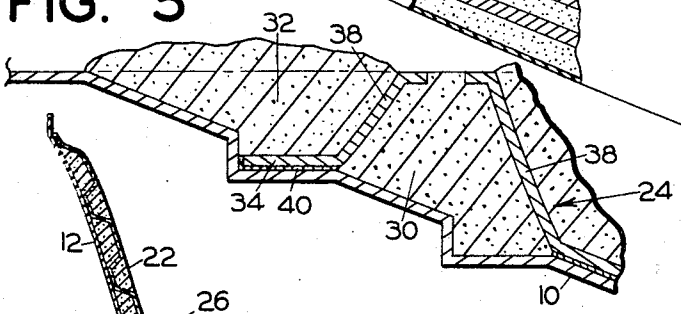


FIG. 5



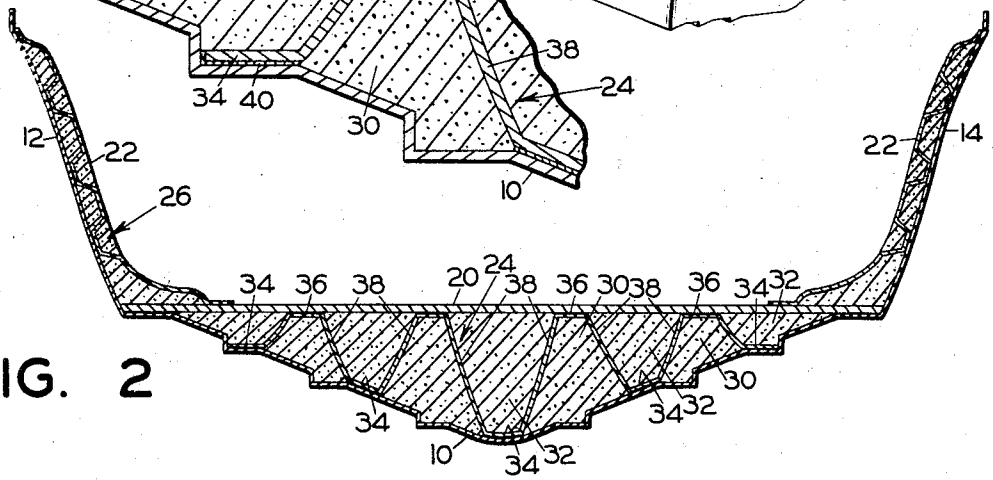


FIG. 2

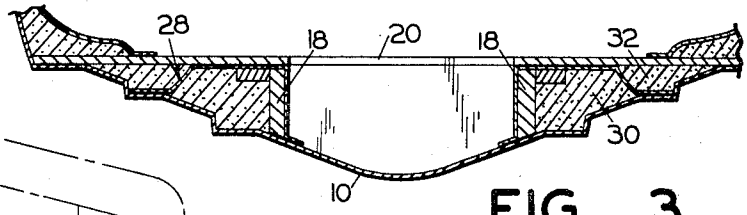


FIG. 3

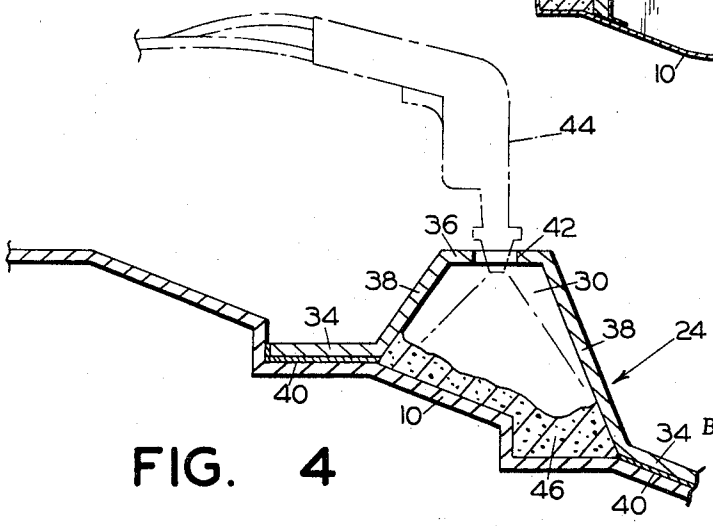


FIG. 4

INVENTOR.
LEO M. KRENZLER

BY Eugene D. Farley

ATTORNEY

United States Patent Office 3,435,470 Patented Apr. 1, 1969

3,435,470

FOAM-FILLED BOAT HULL

Leo M. Krenzler, 311 E. Alexander, Tacoma, Wash. 98421

Filed Aug. 7, 1967, Ser. No. 658,937
Int. Cl. B63b 3/06, 5/24; B32b 5/20
U.S. Cl. 9—6 2 Claims

ABSTRACT OF THE DISCLOSURE

A boat hull comprises an outer shell of structural material, a web of reversely contoured reinforcing material seated inside the outer shell to provide a plurality of closed and open cavities, and a quantity of foamed plastic filling the cavities.

This invention relates to boat hulls. It pertains particularly to fiberglass boat hulls having the bilge and side areas filled and stiffened with foamed plastic.

In the manufacture of boat hulls, it would be desirable to fill the bilge area and side walls with foamed plastic. This would have several significant advantages in that it would:

(1) prevent the collection of water in the bilge,
(2) add rigidity to the hull,
(3) add strength to the hull,
(4) dampen the noise and vibration from the engine as well as disturbing noises from outside the hull,
(5) prevent the collection of fumes under the floor,
(6) make the boat unsinkable,
(7) provide a solid floor without creaks and excessive flexibility,
(8) provide extra puncture protection,
(9) minimize the disturbing noise of wave slap, since there is no echo chamber in the double bottom.

However, filling the side walls and bilge areas of a boat with foamed plastic presents serious problems which heretofore have prevented the successful application of this technique.

Attempts to fill blind areas in the bilge and side walls with foam leaves air voids which eventually fill with water. The water is impossible to remove, freezes, and causes the foam to separate from the outer shell.

Dimensional changes occur during the setting of commercially available foamed plastics. The resultant forces permanently distort the hull shape, resulting in abnormal performance of the boat.

Some commercially available foamed plastics shrink during curing, with the result that it is difficult completely to fill the hull cavities with foam.

The foamed plastic after setting does not adhere permanently to the outer shell, but separates during use.

Accordingly, it is the general object of the present invention to provide a boat hull and a method of making the same which overcomes the foregoing disadvantages and provides a thick, strong hull having bilge and side wall areas filled with foamed plastic permanently united to the outer shell and free from the problems caused by dimensional changes occurring when the foamed plastic sets.

The manner in which the foregoing and other objects of this invention are accomplished will be apparent from the accompanying specification and claims considered together with the drawings wherein:

FIG. 1 is a perspective view of the boat hull of the present invention, partly broken away to show the interior bilge and side wall construction;

FIGS. 2 and 3 are transverse sectional views taken along lines 2—2, 3—3 and illustrating the construction of the boat hull at locations amidships and across the stern engine compartment, respectively;

FIG. 4 is a fragmentary, detail, sectional view illustrating the manner of filling the boat hull with foamed plastic; and

FIG. 5 is a fragmentary, detail sectional view similar to FIG. 4 and further illustrating the manner of filling the boat hull with foamed plastic.

In essence, the boat hull of my invention comprises an outer shell of structural material, a web of reversely-contoured reinforcing material seated inside the outer shell and providing therewith closed and open cavities, and a quantity of foamed plastic filling both classes of cavities.

The method of making the hereindescribed boat hull in essence comprises providing an outer shell of stiff, structural material and an inner web of flexible, reversely-contoured reinforcing material. The web is seated inside the shell, providing dividers which form a sequence of closed and open cavities.

The cavities are filled sequentially with foamed plastic, first the closed cavities and then the open cavities. Dimensional changes of the foamed plastic occurring during filling of the closed cavities is accommodated by displacement of the flexible cavity side walls, without distortion of the hull. Stress inherently is not applied to the hull during filling of the open cavities. Accordingly the bilge and side wall areas of the hull may be completely filled with foamed plastic in the desired manner.

Considering the foregoing in greater detail and with particular reference to the drawings:

FIG. 1 illustrates the hull of a boat of the runabout class, popularly fabricated from fiberglass and driven by an inboard-outboard motor.

The hull includes a shell comprising a bottom section **10**, two side wall sections **12**, **14** and a transom section **16**. These all are appropriately contoured according to the selected design and are formed integrally of molded fiberglass by known techniques.

The hull also is provided with structural plates **18** which define the engine compartment, with a floor **20**, and with inner side walls **22**. Bottom shell segment **10** and floor **20** define the bilge area, and outer shell segment **12** and inner side walls **22** define the side wall areas, which it is desired to fill with foamed plastic for the reasons enumerated above.

In accordance with my invention, these areas may be filled uniformly and successfully by providing a plurality of webs of reversely contoured reinforcing material dimensioned to seat in the various parts of the hull. One such web is indicated generally at **24** in FIG. 2; another at **26** in the same figure, and another at **28** in FIG. 3.

These all may be fabricated from flexible sheets of molded, translucent fiber glass contoured to seat in the hull sections for which they are designed. They share the common structural property of being reversely contoured or folded to provide, when placed in the hull, a plurality of closed cavities **80** and a plurality of open cavities **32**.

It further is characteristic of the webs that they are arranged to provide the open cavities with tapered side walls flared outwardly so that the top of each cavity is wider than the bottom.

Thus web member **24** is contoured to form flat anchoring segments **34**, flat floorboard-supporting segments **36**, and interconnecting, tapered, side wall segments **38**.

Anchoring segments **34** are adapted to be glued to outer shell section **10** by an adhesive layer **40**. In fiber glass construction this may be accomplished by laminating anchoring segments **34** directly to the underlying shell.

Floorboard-support segments **36** are substantially coplanar, and arranged so that they provide adequate support for floor boards **20**.

Similarly the side wall webs **26** and engine compartment webs **28** are provided with anchoring and support sections.

The effect thus is to provide, in all sections of the hull, long stringers, defined by the open and closed cavities, which stiffen and reinforce the hull and support the superimposed structural components. At spaced intervals along the closed cavity stringers there are provided access openings **42**, FIG. 4. These are employed to fill the closed cavities by means of a conventional foam plastic applicator **44**.

In the manufacture of the boat hulls of the inventions the prefabricated web members, for example web member **24**, are seated in the companion shell section, for example bottom section **10**. The anchor segments **34** of the web member are laminated to, or otherwise united with, the inner surface of the shell segment. This forms closed cavities **30** and open cavities **32**.

These are filled sequentially with foamed plastic **46** by means of applicator **44**. The closed cavities are filled first.

Since the web members may be made of clear or translucent material, the operator visually can inspect his work to verify that all corners of the cavities are filled completely.

Also, since the web member is relatively flexible, as compared to the stiff outer shell, any dimensional changes occurring in the foamed plastic during setting merely result in alteration of the contour of the member without deforming the outer shell. For example, if the foamed plastic shrinks during setting, the side walls **38** of the web member are sucked in and become arcuate, as indicated in FIG. 5, without affecting the contour of the hull.

After the closed cavities have been filled completely with foamed plastic and the plastic has set, open cavities **32** are filled with foamed plastic. Since the cavities are open, no problem of deformation of either web member or outer shell is encountered. In addition, compensation can be made for dimensional changes of the plastic during setting so that the open cavities are filled completely. Thus if the foamed plastic shrinks during setting, the open cavities may be overfilled by the predetermined amount, also as indicated in FIG. 5. Then when the plastic sets, it shrinks to the plane of floor-supporting segments **36**. If an excess of plastic is used, the surplus may be shaved off to the plane of floor-supporting segments **36**.

In certain instances it may be desired to fill the "open" cavities after filling the closed cavities, and after laying floor **20**, thereby simplifying the procedure. This is possible if the open cavities are filled in short segments and if the floor is provided with openings or ports at intervals of predetermined spacing. These serve the dual functions of permitting the escape of excess plastic and of affording look openings through which it may be ascertained that the cavities have been filled completely.

Thus the present hull construction and fabricating method overcome all of the problems which heretofore have hindered solid core boat construction. No voids are present, since the operator can see to fill the cavities completely. Distortion of the hull cannot occur since dimensional changes occurring during setting of the foamed plastic filler are compensated for by flexing of the web during the two stage filling operation. Permanent adhesion of the foam to the hull components is made possible by

providing large contact areas including not only the hull components but also the web members. Also, the strength of the hull assembly is greatly increased against impact from the side or bottom by the stringer system provided by the foam-filled webs.

Having thus described my invention, I claim:

1. The method of making boat hulls which comprises:
(a) providing an outer shell of stiff, structural material and an inner web of flexible, reversely contoured reinforcing material,
(b) seating the web inside the shell,
(c) adherently uniting the web to the shell at the points of contact therewith, thereby providing a sequence of closed and open cavities,
(d) providing access ports to the closed cavities,
(e) filling the closed cavities through the ports with liquid, uncured foamed plastic,
(f) permitting the foamed plastic to set, the flexible web altering its shape to accommodate the dimensional changes of the foamed plastic with setting,
(g) filling the open cavities with uncured foamed plastic, and
(h) permitting the uncured foamed plastic to set.

2. The method of making boat hulls which comprises:
(a) providing an outer shell of stiff, structural material and an inner web of flexible, reversely contoured reinforcing material,
(b) seating the web inside the shell,
(c) adherently uniting the web to the shell at the points of contact therewith thereby providing a sequence of closed and open cavities,
(d) providing access ports to the closed cavities,
(e) filling the closed cavities through the ports with liquid, uncured foamed plastic,
(f) permitting the foamed plastic to set, the flexible web altering its shape to accommodate the dimensional changes of the foamed plastic with setting,
(g) laying a floor across the web, the filled closed cavities and the unfilled open cavities,
(h) the floor having spaced openings therethrough registering with the open cavities,
(i) filling the open cavities with uncured foamed plastic introduced through the openings and
(j) permitting the uncured foamed plastic to set.

References Cited

UNITED STATES PATENTS

2,816,298	12/1957	Foster	9—6
2,744,042	5/1956	Pace	264—45
2,956,292	10/1960	Newsome	9—6
3,013,922	12/1961	Fisher	18—59
3,078,202	2/1963	Bellanca et al.	9—6.5 X
3,150,386	9/1964	Bastien	9—6
3,315,284	4/1967	Ludlow	9—6

FOREIGN PATENTS

1,324,015	3/1963	France.

MILTON BUCHLER, *Primary Examiner.*

RICHARD A. DORNON, *Assistant Examiner.*

U.S. Cl. X.R.

156—79