Feb. 23, 1965 K. HANEL 3,170,174

COLLAPSIBLE BOAT

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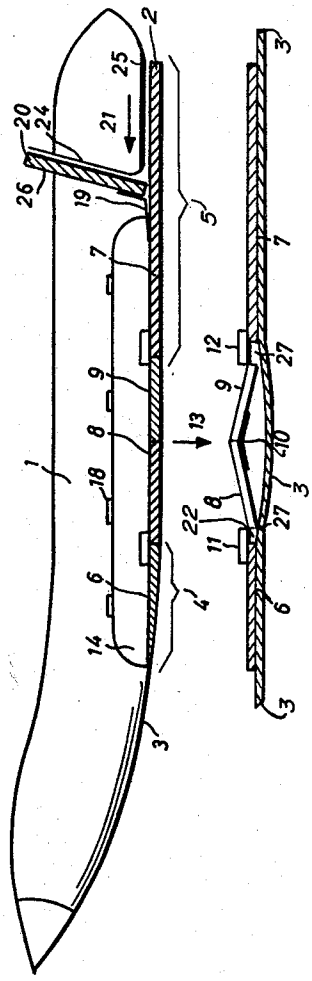

FIG. 1.

FIG. 2.

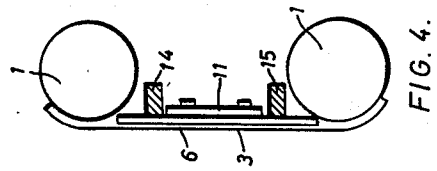

FIG. 4.

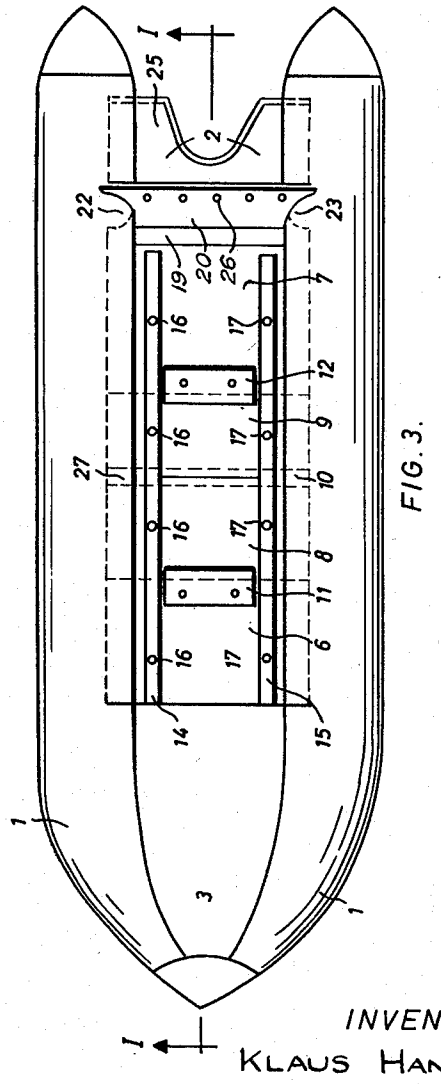

FIG. 3.

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COLLAPSIBLE BOAT

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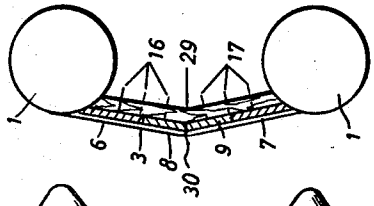

FIG. 6.

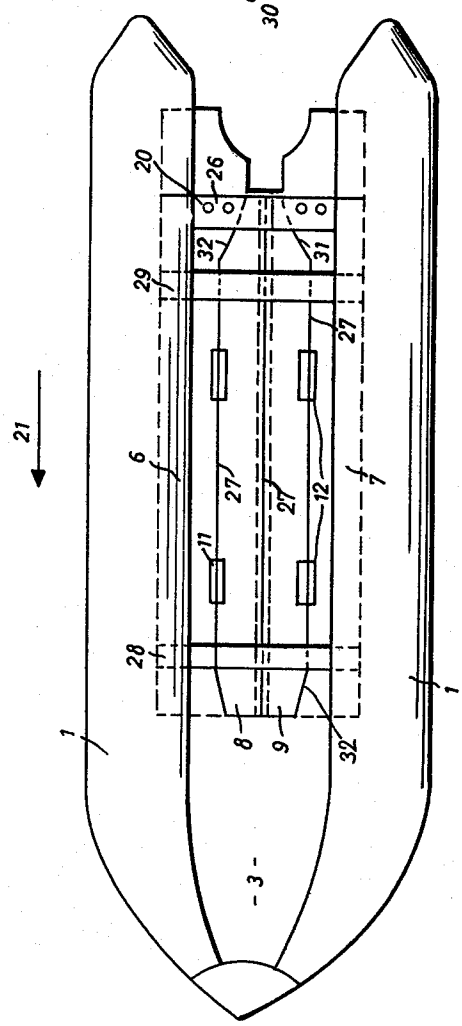

FIG. 5.

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COLLAPSIBLE BOAT

Filed Sept. 1, 1961 3 Sheets-Sheet 3

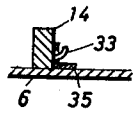

FIG. 7.

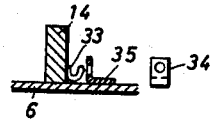

FIG. 8.

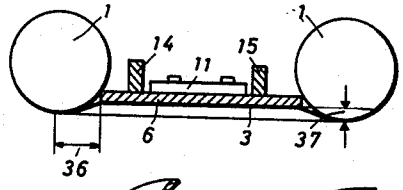

FIG. 9.

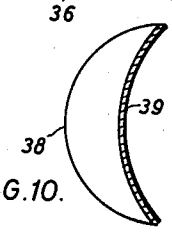

FIG. 10.

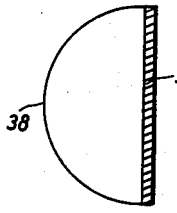

FIG. 11.

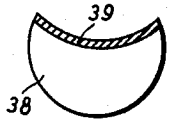

FIG. 12.

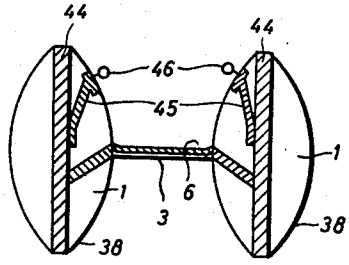

FIG. 14.

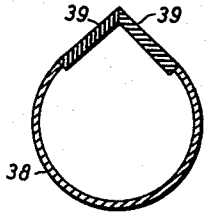

FIG. 13.

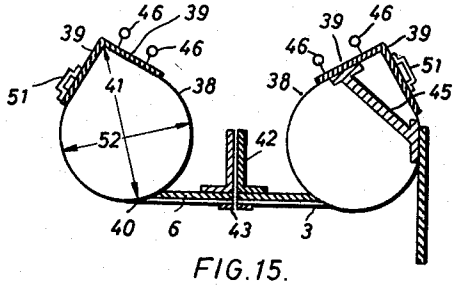

FIG. 15.

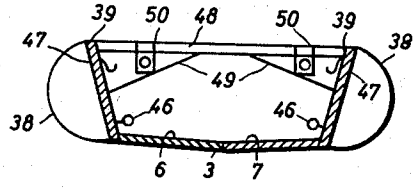

FIG. 16.

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United States Patent Office 3,170,174
Patented Feb. 23, 1965

3,170,174

COLLAPSIBLE BOAT

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Filed Sept. 1, 1961, Ser. No. 136,698
Claims priority, application Germany, Mar. 8, 1961, H 41,950
16 Claims. (Cl. 9—2)

The invention concerns an inflatable boat having lateral side buoyancy tubes, a transom for mounting a motor thereon, stern fins and possibly a mounting for a set of sails.

The object of this invention is to provide an inflatable boat with bracing and mounting components suitable for rapid assembly. Collapsing to pack size should be readily effected. It is important, moreover, that the boat has great durability, so that the skin of the boat should not be stretched excessively. Furthermore it is important that the boat can be adapted readily and rapidly to the intended use, e.g. for rowing, motor or sailing. A further object of the invention is to impart greater stability and a good cornering characteristic even when the water is choppy.

Inflatable boats with lateral buoyancy tubes and stern fins are known. In one of these known embodiments floor boards are inserted in the boat and braced. The disadvantage of this design is that the skin of the boat fits against the floor boards only by adhesive friction and longitudinal play is still possible.

In another known embodiment a grating is placed on the boat floor. The disadvantage of this embodiment is that boats are not stable and include the inherent disadvantages of inflatable boats, i.e. when waves are high the boat flexes thus increasing the risk of capsizing.

It is an object of the invention to avoid these disadvantages and to associate with the inflatable boat the advantages of a rigid boat, without losing the benefits of rapid assembly, and dismantling and folding the collapsed boat to a small size.

The solution of the problem according to the invention consists in that the collapsible parts partly have reinforcing and fixing plates cemented thereto, which together with inserted detachable reinforcing and fixing plates and their bracing form the inflatable boat.

This embodiment is based on the idea of inserting in the inflatable boat only removable solid components. In this embodiment the inflatable and collapsible parts, which generally consist of plastics material or rubber, are always connected with the solid parts, e.g. wooden panels, by non-positive means.

The fixed parts are cemented on the fabric and the detachable parts are supported against these. Thereby only few parts without support are present which fit against the inserted detachable parts by adhesive friction. These detachably inserted parts are necessary to permit easy collapsing to small size.

It is most important to form the boat floor or the parts of the boat lying in the water so as to be rigid.

A convenient embodiment consists in that the bracing of the bottom is effected by means of individual floor boards which are rigidly connected with the skin of the floor by cementing in spaced relationship from one another. Other intermediate boards fill the space between these floor boards ledges detachably connected with the floor boards and intermediate boards form a static supporting unit.

The floor skin surfaces which are rigidly cemented to the floor boards are no longer able to become extended or stretch. Changes in length are possible only in the spacing between the floor boards cemented in position.

The intermediate boards inserted between the spaced floor boards and which are supported against the floor boards cemented in position, possibly can produce a certain bracing effect, but excessive changes in length are minimized.

Ledges which are placed in position and connect the floor boards with the intermediate boards result in a static supporting unit. Moreover, rapid assembly is ensured. The free space available has also been enlarged, since bulky fastening means are no longer required which in known embodiments had to fit the floor boards against the floor skin under tension.

A preferred embodiment consists in that a front and rear floor board are cemented in position and arranged between them two intermediate boards hingedly connected with one another and engaging beneath two holding members fixed on the floor boards.

The size of the floor boards cemented in position will be selected so as to allow the boat to be collapsed to form a portable size. The intermediate boards, which are articulated by means of a rubber band are thus safe from being lost and also permit a more rapid assembly.

It is expedient for two ledges extending parallel in the proximity of the buoyancy tubes, the floor boards and intermediate boards are connected by bolts which are fixed in the floor boards and the intermediate boards and project through the ledges and at the top press the ledges in position by means of nuts.

In this embodiment bolts may be equidistantly arranged and on inserting the intermediate boards ledges are placed in position, the bolts penetrating the bores in the ledges. The ledges are then pressed against their base, i.e. against the floor boards and intermediate boards by means of nuts. By this means a static loadable unit is obtained. It is essential that the ledges are adapted to be laterally fitted so that a free usable space is available in the centre, which, contrary to known embodiments is free from fastening devices.

When using the new embodiment in inflatable boats having stern fins it is important that the rear floor board, projecting into the stern fin is cemented therewith and carries a supporting bracket for the transom.

This arrangement prevents water from getting into the inner space of the boat and into the stern fin and causing the wood to rot. Floor board and stern fin are now pressed together to form an integral unit. Since this floor board also carries the support for the transom there is ensured a particularly good and reliable power transmission when an outboard motor is mounted on the transom of the boat.

To simplify assembly, it is advantageous for the skin of the boat wrapped around the stern fin and cemented to the rear floor board to be passed vertically along the loosely inserted transom supported against supporting bulges and fixed to the transom by means of a detachable connection, such as eyelets.

The assembly of the boat becomes very simple by means of this arrangement. It is no longer necessary to insert the transom under tension, but it is simply inserted loosely and the skin of the boat forming the rear closure is led upwards from the stern fin and secured in any manner on the transom. The transom then transmits its load laterally to the buoyancy tubes and at the bottom to the floor board. The transmission to the buoyancy tubes is effected by means of bulges which are cemented on the buoyancy tubes and supported on both sides against the stern board.

It is also possible for the ledges to have devices known per se for supporting a mast for sailing.

After the ledges have been connected to the floor and intermediate boards a good power transmission from the

wind pressure against the floor of the boat is thereby ensured.

Further possibilities consist in that in front in the bow a floor board is cemented in position, the space between the floor board next cemented in position also being bridged by intermediate insertable boards. Ledges then connect all these components. The same measures which are used for connecting the front and rear floor board can also be used at other points of the boat. Such a measure is possible in the same way when bracing the bow.

The floor and intermediate boards may be of varied construction. A favorable structural embodiment is that the pivotal axis of rotation of the flexibly connected intermediate boards filling the space between the floor boards is situated at right angles to the direction of travel.

This embodiment leads to a flat floor of the boat. A boat constructed in this manner will have a low drag coefficient.

An alternative embodiment is that the axis of rotation of the articulated connected intermediate boards filling the spaces between the floor boards lies parallel to the direction of travel. In this embodiment it is important that the floor boards extending parallel to the buoyancy tubes and cemented beneath these to the skin of the boat are supported by the intermediate boards adapted to fill the spaces, the ledges extending parallel to one another at right angles to the direction of travel are curved downwardly like spars and thereby form one or more keels.

This embodiment forms one keel underneath on the inflatable boat and the ledges arranged at right angles to the direction of travel and connecting the intermediate and floor board are of rib-like construction. Great stability is thereby imparted to the boat and is rendered suitable particularly for a high sail plan.

With regard to the floor boards the floor boards may have bevelled edges along their mutually parallel edges against which the intermediate boards are supported. The intermediate boards are thereby supported by the floor boards both longitudinally and at right angles relative to the direction of travel, so that the ledges ensure that a good stability is obtained and course holding effected by the suitably constructed shape of the floor and boards.

To obtain a still smaller size of pack it is expedient for the long floor boards to be flexibly interconnected, after assembly the hinges being locked by catches.

In a similar way it is possible for hinges to be formed in the floor boards by the fact that the boards are provided at such a distance from one another that it is possible for an axis of rotation to be formed. The hinge is then formed by the skin of the floor. It is possible for the distance to be so dimensioned that a transverse or longitudinal ledge engages in this distance so that sufficient stability is provided and the skin of the floor also supported at this point.

The floor boards which are now non-positively connected with the skin of the floor result in further advantages.

For the sail fitting it is expedient for the step to be provided on a floor board cemented to the fabric and at the same time for a lee board or center board penetrating the skin of the boat to be provided.

Power transmission is particularly favorable thereby. The lee board box ensures that the boat has lateral resistance due to the lee board penetrating through the skin of the boat into the water. Hitherto it was impossible to use such lee board boxes or lee boards owing to sealing problems.

An alternative possibility to secure the ledges consist in that the ledges locating the floor boards have hooks on the side which engage in eyelets arranged on the floor boards.

A further method of fixing is that the floor boards have aligned rubber profiles which permit the ledges to be inserted.

With reference to the width of the floor boards it is

expedient to maintain a distance between the floor boards and the lateral supporting tubes, so that these form lateral depending keels.

The travelling properties are improved by the fact that the weight of the buoyancy tubes is not absorbed by the floor boards and that lateral runners or keels are formed.

It is possible for the buoyancy tubes to have bracing or fastening boards.

A further embodiment also provides for the fixing boards to form a part of the buoyancy tubes and support fixing devices.

A further embodiment is that a fixing board forming the defining surface of the buoyancy tubes is adapted to extend concavely or rectilinearly.

It is possible, moreover, that two fixing boards arranged at an angle to one another to form the cross-section of the buoyancy tubes which has a round cross-section per se so as to be streamlined.

Another embodiment involves the transom being fixed on the longitudinally extending fixing boards.

These fixing boards are not visible from the outside and alter the shape of the buoyancy tubes in accordance with improving the travelling properties. By means of longitudinally extending fixing boards, which abut against the transom, there is obtained a transmission of the motor power from the transom to the whole boat. This ensures greater durability and stability of the boat. By varying the cross-sectional shape of the buoyancy tubes, the tendency to tilt is reduced. The pear-shape increases the resistance to tilting the more the boat keels over to turn, as the surface about which the boat would have to tilt, is increased.

Additionally to the outside boards cemented to the skin of the boat it is possible for bracing boards to be arranged in the buoyancy tubes.

These boards are invisible and brace the buoyancy tubes in the desired loading directions and moreover permit fixing eyelets, hooks and so forth to be fitted thereon.

The internally disposed bracing boards too can alter the cross-sectional shape of the buoyancy tubes. One embodiment consists in that the bracing boards are arranged only in a portion of the buoyancy tubes and thereby caused to form keels or runners.

In these embodiments there occurs a deformation of the circular cross-section of the buoyancy tubes, so that without substantial effort for sail fittings an effective keel or lee board is provided.

Moreover it is conceivable that the outside fixing boards are supported by struts or bracing boards arranged in the buoyancy tubes.

This measure makes it possible to attribute static properties to the boat which otherwise are provided only in a rigid boat.

It is thus important that the bracing and fixing boards are arranged in pieces, or connected by hinges which permit collapsing to pack size.

Such hinges may consist of rubber band which therefore requires no maintenance and is resistant to corrosion.

It is also essential that floor components such as lee boards, stern plates, transom, seats, hooks, eyelets and so forth are detachably provided on the fixing or bracing board.

Hitherto it was possible for parts to be fixed to the tubes only in a limited manner. Now is is possible to provide connecting surfaces at any part of the boat.

Depending upon the required travelling properties it is possible for the fixing or bracing boards to urge the buoyancy tubes to form a stable hull section.

In other embodiments there may be obtained a displacement of the center of gravity.

The invention will be described further, by way of example, with reference to the accompanying drawings, in which:

FIG. 1 is a section along line I—I of FIG. 3 showing

the inflatable boat with floor and intermediate boards in the assembled state;

FIG. 2 shows schematically a phase of the assembly of floor and intermediate boards;

FIG. 3 shows schematically the plan view of FIG. 1;

FIG. 4 shows schematically the rear view of FIG. 3 in section with the transom removed;

FIG. 5 is another embodiment in a view corresponding to FIG. 3 showing a plan view of floor and intermediate boards the separating gaps thereof disposed in the direction of travel;

FIG. 6 corresponds to a side elevation of FIG. 5 in section without transom;

FIG. 7 shows schematically an alternative method of connecting the ledges with the floor boards;

FIG. 8 shows schematically how the ledge is latched into eyelets and the eyelet in side elevation;

FIG. 9 shows schematically the forming of lateral keels by having the buoyancy tubes disposed downwardly;

FIG. 10 shows a cross-sectional shape of the buoyancy tubes with fixing boards;

FIG. 11 shows an alternative cross-sectional shape to FIG. 10;

FIG. 12 shows an alternative cross-sectional shape to FIG. 10;

FIG. 13 shows an alternative cross-sectional shape to FIG. 10;

FIG. 14 shows the use of bracing boards in the buoyancy tubes;

FIG. 15 shows the use of a cross-sectional shape of FIG. 13 with a possibility of fitting a lee board box or fitting lee boards outside on the buoyancy tube; and

FIG. 16 shows the use of a cross-sectional shape according to FIG. 11.

FIG. 1 shows buoyancy tubes 1 which have stern fins 2. Floor boards 6, 7 are rigidly cemented to the floor skin 3 in the shaded regions 4, 5 and are therefore undetachable. The intermediate boards 8, 9 are flexibly interconnected by means of a rubber band 10. Supporting members 11, 12, which are rigidly connected with the floor boards 6, 7, permit rapid assembly when by moving in the direction of the arrow 13 the intermediate boards 8, 9 flushly fill the space between the floor boards and are removable. The ledges 14, 15 are subsequently fitted. Bolts 16, 17 fixed in the floor and intermediate boards project through the ledges 14, 15. Nuts 18 fitted thereon then press the ledges 14, 15 against the base i.e. against the floor boards 6, 7 and intermediate boards 8, 9. By this means there is obtained a statically loadable unit.

An angle bracket 19 is rigidly mounted on the rear floor board 7. A transom 20 is supported on the angle bracket 19 when pushed in the direction of the arrow 21, which at the same time indicates the direction of travel. The buoyancy tubes have bulges (not shown in the drawings) at the points 22, 23 so that the transom can transmit the drive of an outboard motor to the buoyancy tubes and the floor boards. The skin 3 of the floor is passed over the stern fin 2 as cover 25 and rigidly cemented to the rear floor board 7 which also forms the stern fins. The rear transom wall 24 now formed by the loosely suspended skin of the boat, is connected with the transom 20 by latching eyelets at the point 26.

The same numerals in FIGS. 5 and 6 denote the same parts. Only the axis of rotation or hinge axis of the intermediate boards 8, 9 differ. While in FIGS. 1 to 4 the axis of rotation 27 is disposed transversely or at right angles to the direction of travel 21, this axis of rotation herein is arranged parallel to the direction of travel or the arrow 21. The ledges 28, 29 are of rib like construction, as is evident from FIG. 6. This embodiment causes a keel 30 to be formed.

It is also evident from FIG. 5 that bevelled edges 31, 32 prevent the intermediate boards 8, 9 from shifting their position. The floor boards 6, 7 of FIGS. 5 and 6 may form an integral whole or they may have an axis of rotation which is like the axis of rotation 27 of the intermediate boards. The stern portion with transom 20 is constructed as in FIGS. 1 to 4.

In FIGS. 7 to 9 the same numerals denote the same parts. The ledges 14 herein are provided with hooks 33, which engage in bores 34 of the angle members 35 and, when straightening, as shown in FIGS. 7, 8, brace the floor boards 6 with one another. The drawing herein is not to scale.

FIG. 9 shows that the floor boards 6 are so spaced 36 from the buoyancy tubes 1 that the latter sink by this distance thereby forming lateral runners or keels which increase the safety when the inflatable boat turns.

In FIGS. 10 to 16 the buoyancy tubes are formed by part sections 38 which are cemented to fastening boards 39. The fastening boards which may be pressed wood and be profiled, or be straight plywood panels, impart the different travelling properties to the boat. In FIG. 15 the capsizing of an inflatable boat about a capsizing edge 40 with such fastening boards is rendered difficult, as the distance 41, which represents the tilting surface, is greater than the distance 52 of the normal round profile of the buoyancy tubes. In addition there may be provided a lee board box 42 or a center board casing having a lee board or center board therein (not shown). Box 42 is mounted on the floor board 6 rigidly cemented to the skin 3 of the boat. The passage aperture 43 for the lee board in the lee board box is hence also sealed off. In the buoyancy tube there may be arranged bracing boards 44 or bracing struts 45, which hold part sections 38 of the buoyancy tube 1, in order to ensure a better guidance to the boat. In FIG. 14 (not to scale) there is shown the development of a keel by using bracing boards 44, which additionally support the floor boards 6 by means of bracing struts 45. The floor boards in turn are also cemented to the skin 3 of the boat. Of course the distance between the buoyancy tubes 1 is much greater than stated in FIG. 14. The bracing struts may also be used for fixing eyelets 46 for sails or hooks 47 for hooking seats into position.

FIG. 16 shows that a transom 48 with supports 49 is fixed e.g. by hooking in position on the fastening boards 39. The mounting for the motor is indicated schematically by means of the traverses 50. The motor power is now transmitted by the fastening, bracing and floor boards forming a static unit, to the whole boat. Additional holders 51 e.g. for fitting row locks may also be provided. A step for a mast may be provided on one of the floor boards which is cemented to the skin and chain plates for the standing rigging can be provided along the edges of the floor.

The invention is adapted to be applied to all possibilities wherein boards or rigid and loadable parts are rigidly connected by cementing to parts of the skin of the boat which impart a greater loading capacity and stability to the boat without impairing its collapsibility.

What I claim is:

1. An inflatable collapsible boat comprising flexible sheet material defining a pair of spaced buoyant tubes connected at one end to form the bow of the boat and spaced at the other end to form the stern of the boat, there being flexible material between said spaced tubes defining the bottom of the boat, a pair of rigid floor boards positioned side by side and undetachably secured to said flexible bottom, said boards having adjacent edges in spaced relation, a pair of pivotally connected removable floor boards between said spaced floor boards the edges of said pivotally connected boards opposite said pivotally connected edges contacting the spaced edges of the undetachably secured floor boards to brace the boat with said first-named floor boards longitudinally thereof, a transom extending upwardly from the rearmost of said first-named floor boards between said tubes and spaced inwardly of the stern end of said rearmost first-named floor boards for mounting a motor on the boat, the portion of said rearmost undetachable floor board extending aft of said

transom being covered with said flexible sheet material and defining stern fins.

2. An inflatable collapsible boat as claimed in claim 1, and further comprising a pair of longitudinally extending ledges adjacent said tubes secured to said removable and undetachable floor boards to form a rigid load supporting unit with the same.

3. An inflatable collapsible boat as claimed in claim 1, and further comprising supporting members fixed on the upper surfaces of said undetachable floor boards along the spaced edges thereof to retain said removable floor boards in position.

4. An inflatable collapsible boat as claimed in claim 1, with said flexible sheet material extending from said stern fins being detachably connected to said transom.

5. An inflatable collapsible boat as claimed in claim 1, wherein the pivotal axis of said removable floor boards is at right angles to the longitudinal axis of the boat.

6. An inflatable collapsible boat as claimed in claim 1, wherein the pivotal axis of said removable floor boards is parallel to the longitudinal axis of the boat.

7. An inflatable collapsible boat comprising flexible sheet material defining a pair of spaced buoyant tubes connected at one end to form the bow of the boat and spaced at the other end to form the stern of the boat, there being flexible material between said spaced tubes defining the bottom of the boat, a pair of rigid floor boards undetachably secured to said flexible bottom and extending parallel to said buoyant tubes, said rigid floor boards being transversely spaced with respect to their adjacent edges, a plurality of transversely extending ledges secured to said undetachable floor boards, said ledges being bent downwardly so as to form a keel for said boat, a pair of removable floor boards between said spaced floor boards, said last-named pair of boards being pivotally connected along edges thereof which are substantially parallel to the said spaced edges, a transom extending upwardly from the rearmost of said undetachable floor boards between said tubes and spaced inwardly of the stern end of said rearmost undetachable floor board for mounting a motor on the boat, the portion of said rearmost undetachable floor board extending aft of said transom being covered with said flexible sheet material and defining stern fins.

8. An inflatable collapsible boat as claimed in claim 7, with the ends of said removable floor boards being tapered.

9. An inflatable boat having a flexible outer skin bottom and sides of laterally spaced inflatable buoyant longitudinally extending tubes, said skin bottom between said tubes having rigid bottom pieces positioned thereon, certain of said rigid bottom pieces having their adjacent edges spaced apart and inseparably attached to the skin bottom, others of said rigid bottom pieces being flexibly hinged together along an edge substantially parallel to said spaced apart edges and inserted under compression into the space between said spaced apart edges whereby said skin bottom between said edges is held under tension in a stretched condition.

10. An inflatable boat as claimed in claim 9, in which said certain of said rigid bottom pieces comprise a front rigid bottom piece and a rear rigid bottom piece, and in which said flexible hinged pieces engage beneath holding members fixed on said front and rear pieces.

11. An inflatable boat as claimed in claim 9, in which said certain of said rigid bottom pieces comprise a front rigid bottom piece and a rear rigid bottom piece, and in which the rear end of said rear bottom piece terminates in a stern fin.

12. An inflatable boat as claimed in claim 11, in which said rear bottom piece has a transom secured to the upper face thereof adjacent the stern fin for mounting a motor thereon.

13. An inflatable boat as claimed in claim 12, in which said certain of said rigid bottom pieces comprise spaced longitudinally extending side pieces.

14. An inflatable boat as claimed in claim 13, in which each of said spaced longitudinally extending side pieces terminate rearwardly in a stern fin.

15. An inflatable boat as claimed in claim 14, in which said spaced longitudinally extending side pieces have an upwardly extending transom detachably secured thereto at their rear ends adjacent said stern fins.

16. An inflatable boat as claimed in claim 13, in which said rigid bottom pieces converge downwardly toward each other and meeting at an apex running longitudinally of the boat and forming a keel.

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