June 11, 1963 C. E. MANHART 3,092,854

LIFE RAFT

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FIG. 1.

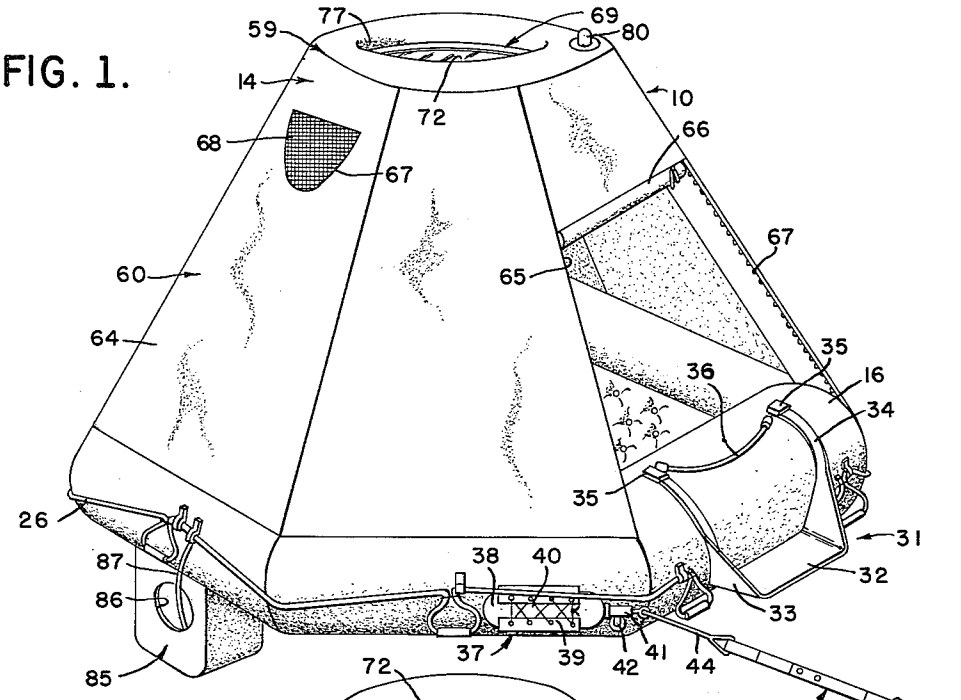
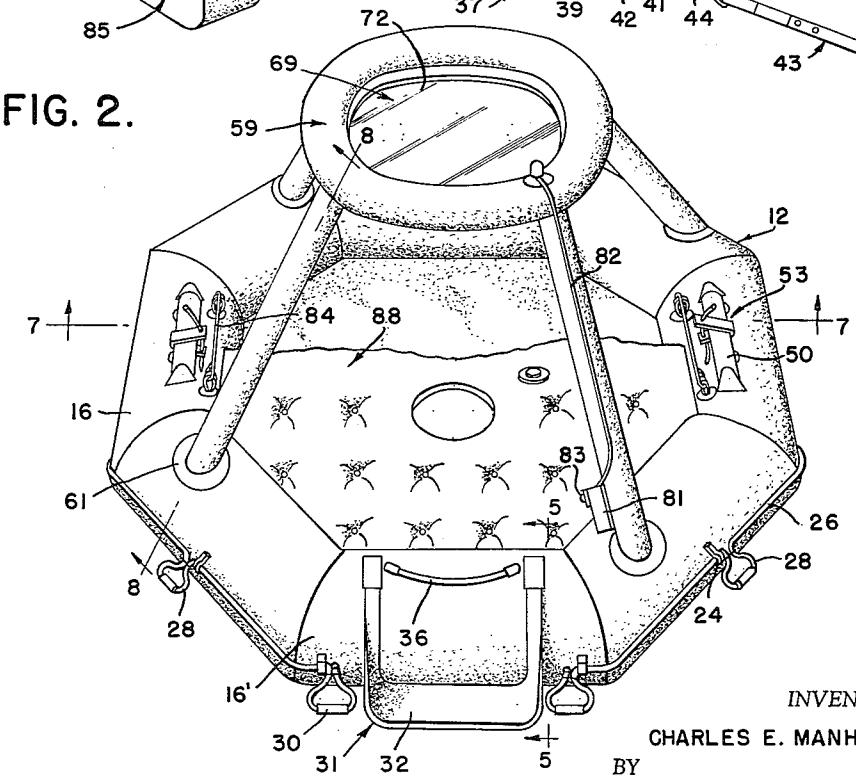


FIG. 2.



INVENTOR.
CHARLES E. MANHART
BY
Arthur Middleton
ATTORNEY

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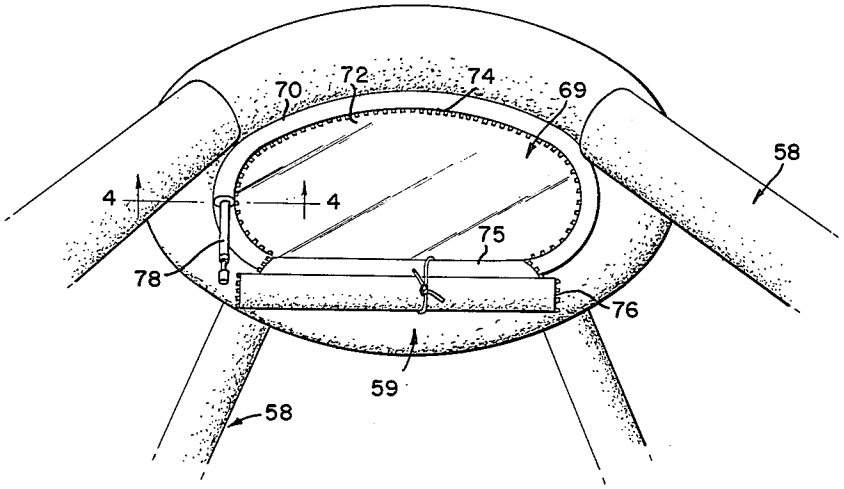
FIG. 3.



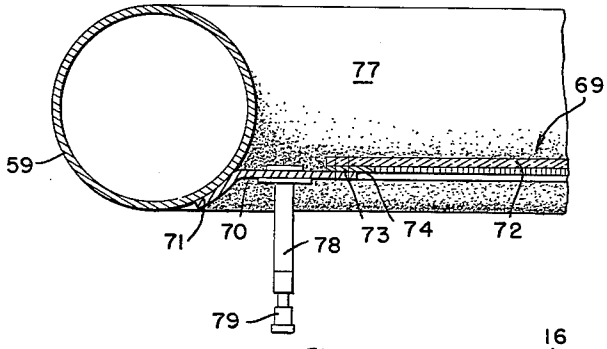


FIG. 4.

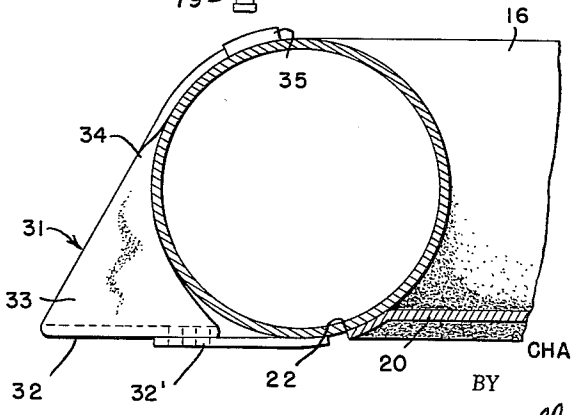


FIG. 5.

INVENTOR.
CHARLES E. MANHART
BY
Arthur Middleton
ATTORNEY

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FIG. 6.

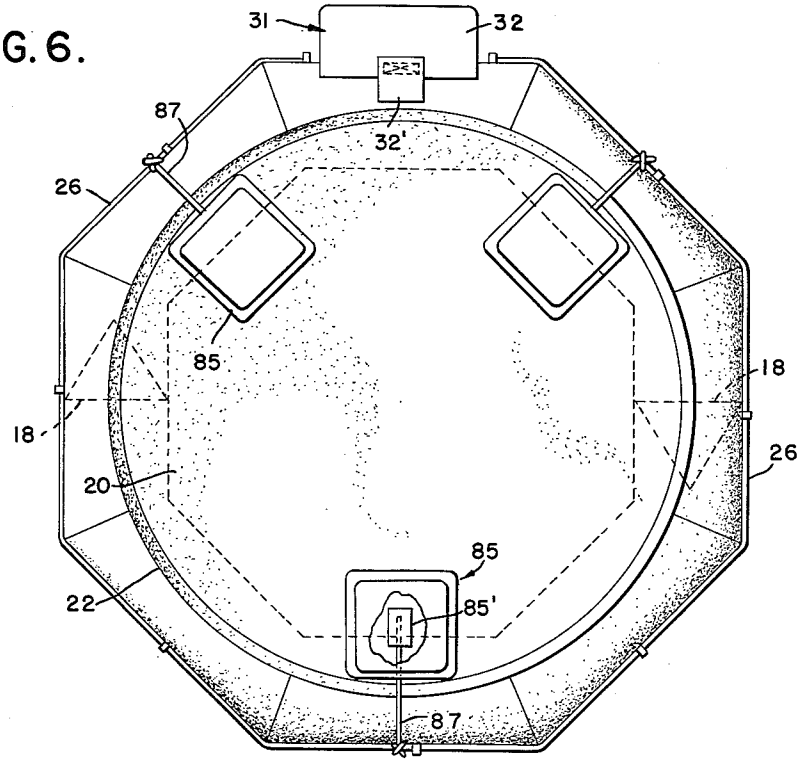


FIG. 12.

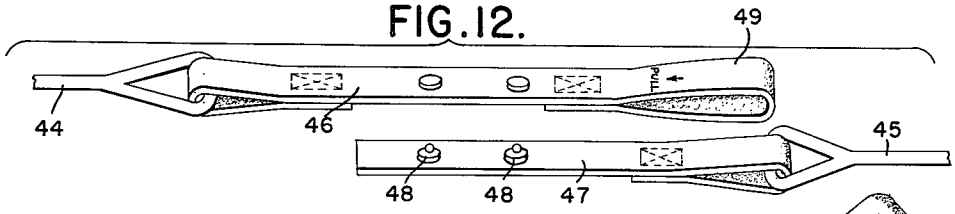
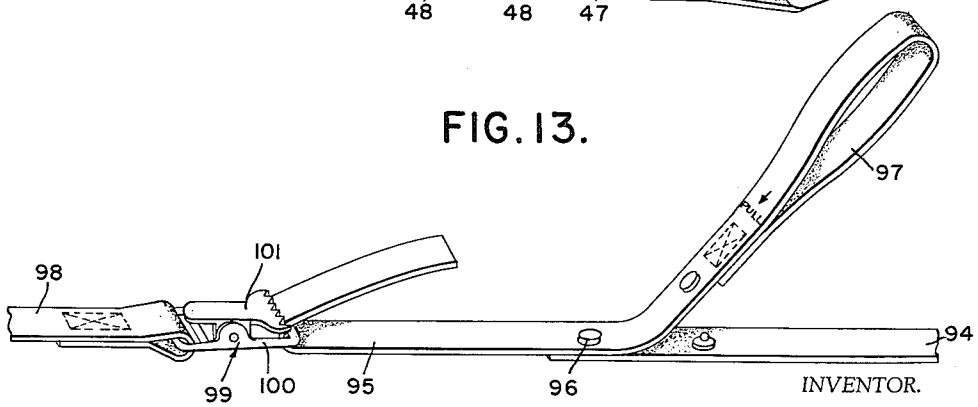


FIG. 13.



INVENTOR.
CHARLES E. MANHART
BY
Arthur Middleton
ATTORNEY

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FIG. 7.

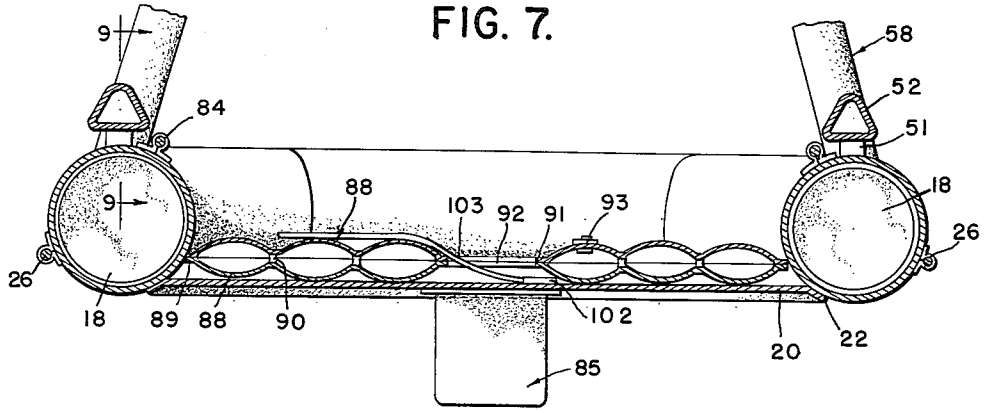


FIG. 8.

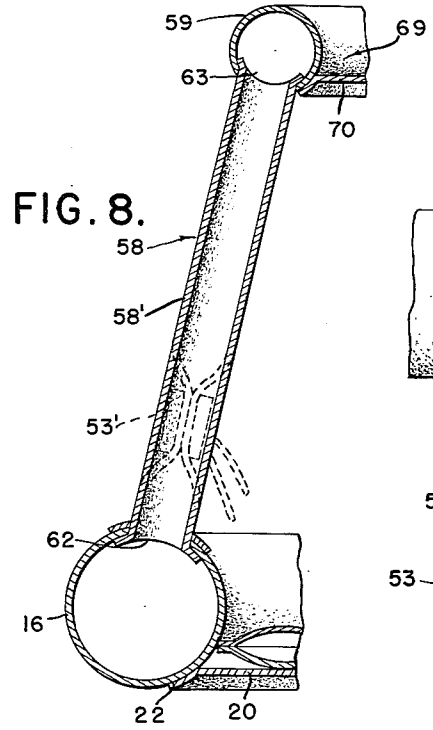


FIG. 10.

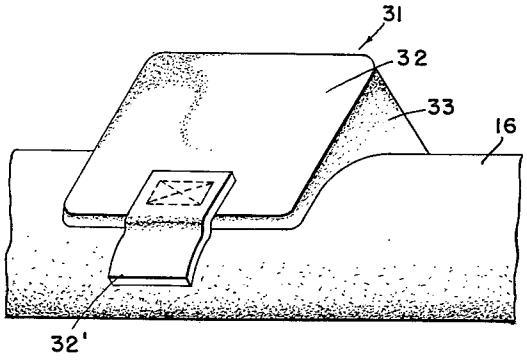


FIG. 11.

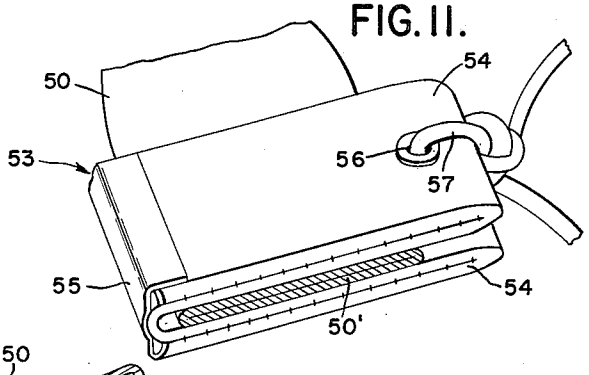
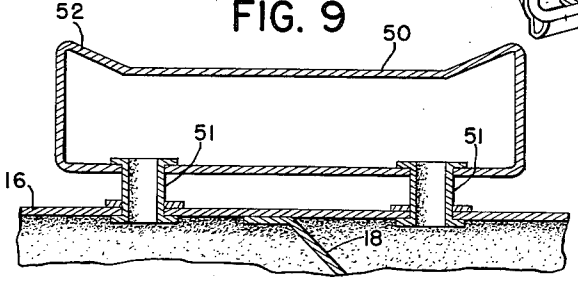


FIG. 9



INVENTOR.
CHARLES E. MANHART
BY
Arthur Middleton
ATTORNEY

United States Patent Office 3,092,854 Patented June 11, 1963

3,092,854

LIFE RAFT

Charles E. Manhart, 3133 SW. 25th Terrace, Miami, Fla.

Filed Sept. 10, 1959, Ser. No. 839,165
2 Claims. (Cl. 9—11)

This invention relates to life rafts and more particularly to life rafts designed to be carried in air and other types of craft and which are designed to be inflated for use for survival at sea in the event of a crash or forced landing or other conditions in which occupants of the craft may be required to abandon the same.

It is an object of the present invention to provide a relatively light weight readily inflatable raft structure which is capable of carrying and of supporting a maximum number of persons and of affording protective shelter to the same.

Rafts of the general type to which the present invention relates are frequently of an open type and are provided with some form of canopy structure which can be set up by occupants thereof, but such protective structure has to be assembled and put in place by the occupants after they board the raft. The disadvantage associated with this type of raft lies in the fact that conditions may be such that an occupant or occupants thereof, after succeeding in getting into the raft, may not be capable of setting up the protective covering and accordingly it is an object of the present invention to provide a life raft of an inflatable type which is constructed so that a protective shelter or canopy will be automatically raised over the bottom part of the raft simultaneously with the inflation of the latter after the raft has been cast adrift.

In crashes of air craft at sea or in other circumstances where occupants of a water borne or air borne craft may have to abandon the craft, it often happens that an appreciable time passes before a rescue is effected and during this time, even though there may be squalls accompanied by precipitation, the raft occupants may not have facilities for catching water and thus be deprived of the same for considerable time. Accordingly it is another object of the invention to provide in a life raft of this type a means for collecting any rain which may fall onto the raft and for conducting the collected rain water into the interior of the canopied raft for use by the occupants.

Another condition which frequently develops in the use of life rafts is that sea water gets into the raft and the occupants thereof are thus compelled, oftentimes for several days, to sit in the water collected therein which causes great discomfort. Accordingly it is another object of the invention to provide an inflatable raft which is equipped with an inflatable deck or mattress designed to fit the interior of the raft structure and rest upon the bottom thereof so that the occupants will be supported above any water which may get into the raft and wherein such deck or mattress is formed with a central opening or well by means of which water may be bailed out or removed from beneath the deck.

Another object of the invention is to provide in an inflatable life raft a body or hull portion having an inflatable superstructure forming a sheltering canopy and wherein the top portion of such shelter or canopy is imperforate but of a transparent material which gives protection against the elements and at the same time permits the occupants of the raft to look skyward and maintain a lookout for rescue air craft and which transparent structure also permits the admission of light into the interior of the protecting shelter.

As hereinbefore stated, the necessity frequently arises for occupants of life rafts to collect rain water for drinking when the supply which may be initially taken onto the raft is exhausted and accordingly it is another object

of this invention to provide such a raft with a depressed top or roof in the sheltering superstructure which is designed to function as a collection basin or reservoir for rain water, together with means whereby the occupants may drain off the collected water into the interior of the structure, as desired.

A still further object of the invention is to provide in a raft structure of the character described a means for ballasting the body or hull so that the raft will maintain a level position upon the water at all times regardless of the shifting of weight within the raft.

The foregoing and other objects which will appear hereinafter can be realized by an embodiment of the invention which has a body or hull in the form of an endless inflatable and deflatable tube with a deck or floor secured thereacross in a plane approximately tangential to the bottom side of the tube for supporting survivors thereon. A superstructure carried by the body or hull is characterized by a number of upwardly extending and inwardly inclined tubular stanchions which join at their top ends with a tubular ring and the inflatable and deflatable body tube is in communication through at least one of the tubular stanchions with the tubular ring at the top ends thereof whereby inflating gas introduced into the body or hull tube will enter the stanchions and the ring to simultaneously fill and inflate the same, thereby automatically raising the superstructure in a position of use.

The superstructure further includes wall fabric connecting the body or hull with the inflatable top ring and this wall fabric is drawn out substantially taut as the superstructure takes form under inflation. The top ring is closed by a transparent roof-forming diaphragm which is secured thereacross near the lowermost part of side of the ring, thereby providing a water collecting well or reservoir and means is provided whereby water collected therein can be withdrawn by occupants of the raft.

The bottom part of the body or hull has suspended therefrom a number of collapsible or foldable receptacles which are adapted to be filled with water when the raft is afloat, to function as ballasting means.

Other features of advantage appear hereinafter.

In the drawings:

FIG. 1 is a view in perspective of a raft constructed in accordance with the preferred embodiment of the present invention showing the same fully set up for use and illustrating a door flap rolled up;

FIG. 2 is a view in perspective of the raft structure minus the wall forming material and illustrating the inflatable stanchions and also showing among other details and partially broken away the inflatable deck resting upon the floor of the body;

FIG. 3 is a perspective view looking upwardly at the underside of the top ring of the housing or superstructure showing the transparent window or diaphragm and the means for covering the same;

FIG. 4 is a sectional view on an enlarged scale taken substantially on the line 4—4 of FIG. 3;

FIG. 5 is a sectional view substantially on the line 5—5 of FIG. 2 with the inflatable deck removed;

FIG. 6 is a bottom plan view of the raft structure showing the ballast receptacles one of which has the bottom thereof broken away and showing the underside of the boarding step;

FIG. 7 is a transverse sectional view taken in a vertical plane substantially on the line 7—7 of FIG. 2;

FIG. 8 is a sectional detail taken substantially on the line 8—8 of FIG. 2;

FIG. 9 is a sectional view on an enlarged scale taken substantially on the line 9—9 of FIG. 7;

FIG. 10 is a perspective detail of the underside of the boarding step;

FIG. 11 is a detail perspective illustrating a means of closing the equalizer tube;

FIG. 12 is an exploded view showing one form of releasable connection between the lanyard connecting the raft with a craft from which it has been jettisoned and the means for opening the receptacle secured to the raft and carrying inflating gas for the raft;

FIG. 13 is a perspective view illustrating another form of releasable connection.

Referring now more particularly to the drawings, the present inflatable raft shown fully set up in FIG. 1 is generally designated **10**.

The numeral **12** designates in a general way the body or hull portion of the raft while the numeral **14** generally designates the superstructure or protective housing thereabove and supported thereon.

The body or hull **12** is in the form of an endless tube of rubber which while it may be in the form of a ring or annulus, preferably is divided up into a number of short straight sections **16** which are joined together to give to the hull body a polygonal outline as most clearly shown in FIGS. 2 and 6.

This tubular body or hull structure is divided into a number of compartments by spaced partitions or bulkheads and in the present illustration of the structure two of such bulkheads are shown and indicated by the reference numeral **18** and these bulkheads are placed diametrically opposite one another as shown in FIG. 6. However, the number of bulkheads may be increased in accordance with the increase in size of the structure and accordingly it is to be understood that in showing only two thereof, there is no intention to limit the invention to the use of this number.

These dividing structures or bulkheads **18** are of conical form and are cemented or otherwise secured in place within their respective sections of the tubular body.

The numeral **20** designates the floor or main deck of the raft and this, as shown in FIGS. 5, 7 and 8, is secured around its periphery as at **22** to the lowermost or bottom part of the tubular body, in a plane which is substantially tangential to the tubular body whereby the interior of the raft is given a substantial depth.

The tubular body or hull **12** is provided around its exterior with hand hold or life line moorings **24** to which is attached the life line **26** which encircles the body or hull and is attached to these moorings in the manner illustrated. The line **26** at intervals is also looped to form the hand holds **28** and these hand hold loops may be partially encased by a tubular covering **30** to prevent the line from cutting the hand grasping the loop.

As shown in FIGS. 1 and 2, the life line **26** is discontinuous and the end portions thereof are spaced apart across the length of one of the sections **16** and this particular section which is designated **16'** has secured to the outer side thereof the boarding step which is generally designated **31**.

The boarding step **31** comprises the relatively wide step tread **32** which has secured to the opposite ends thereof the triangular webs **33** and each of these webs merges at its top or apex portion with a band **34** which lies against and over the curved surface of the hull body section **16'** and is cemented or otherwise firmly secured thereon. The top ends of the bands **34** are fixed to anchoring patches **35**. Thus it will be seen that the end portions **33** of the step tread, together with the tread, will hang so that there will be no interference with the folding of the entire raft structure when the latter is deflated and due to the novel arrangement of the tread and suspension means therefor when the raft is inflated, the step will assume its proper hanging position to facilitate entrance of a person from the water into the raft.

In order to maintain the step in position as against tendency to lateral movement when the raft is inflated, a securing patch **32'** is joined to the bottom of the step

tread and to the adjacent surface of the wall of the tubular hull, as illustrated in FIG. 6.

Extending across between the patches **35** at the top of the step structure is a hand hold **36** in the form of a rope having its ends only secured to the body portion.

The hull body has secured to the outer side thereof a stowage means, generally designated **37**, for a cylinder **38** of compressed CO_2 gas for use in inflating the raft. This stowage means for the gas cylinder is of conventional form, comprising a pair of flaps **39** between which the cylinder is placed and which are drawn together over the cylinder by lacing **40**. The discharge end of the cylinder is connected with a conventional cylinder opening mechanism generally designated **41** whereby gas may be introduced through a connection **42** into the tubular hull body when the opening mechanism is actuated.

The mechanism **41** has connected therewith a releasable connection **43** which at one end is joined to a cord **44** while the other end is joined to a lanyard **45**. This releasable connection is shown in one form in FIG. 12 and it comprises two strap members **46** and **47** which are joined in parallel overlapping relation by snap buttons **48**. One end of the strap **46** is connected with the cord **44**, as shown, while the opposite end thereof is turned back upon itself to form the pull loop **49**. The strap **47** has one end connected as illustrated, to the lanyard **45** while the opposite end remains free except for the connection of the same by the snap buttons **48** to the strap **46**.

It will be understood by those familiar with the art that the release of the compressed gas from the cylinder **38** into the tubular hull body can be effected by giving a sharp pull or jerk to the lanyard **45** and after the raft is set up and been boarded by the survivors, disconnection of the raft from the lanyard and the ship or craft to which it was attached can be effected by pulling the loop **49** of the strap **46** to thereby separate the straps **46** and **47**.

The bulkheads **18** are formed of flexible material and are non-planar in cross section, preferably cone-shaped, as shown in dotted outline in FIG. 6. This cone shape or formation is preferred in order to better withstand pressure and to equalize the volumes and pressures in adjacent compartments. It has been found that this non-planar, coned, curved or bowed bulkhead formation satisfactorily withstands breaking in the event that a portion of the tubular body becomes punctured between the bulkheads, even when much greater pressure is applied to one side of the bulkhead than to the other.

When the compressed gas from the cylinder **39** is released into the tubular hull body, the gas is carried from one chamber to another across intervening bulkheads by means of equalizer tubes **50**. Each of these equalizer tubes is located across a bulkhead and is secured upon the outer side of the hull body in the manner shown in FIG. 2. As hereinbefore stated, the present illustration of the raft structure includes only two bulkheads **18** and accordingly only two equalizer tubes are shown, but it will be understood that rafts of a size where a larger number of bulkheads are employed will have an equal number of the equalizer tubes. Each of these equalizer tubes **50** comprises a short flexible tubular body as illustrated in FIG. 9 from the underside of which extend the two coupling nipples **51** one end of each nipple being suitably cemented in an opening in the equalizer tube body while the other end of the nipple is cemented in an opening in the wall of the hull, with the adjacent bulkhead located therebetween. The two ends of the equalizer tube are made partially conical as indicated at **52** whereby to effect faster tube inflation of the entire raft structure.

After the raft structure has been inflated, the equalizer tubes are clamped off, as illustrated in FIG. 11. A suitable type of clamp for this purpose, which is adapted to be easily and quickly applied to the tube and whereby

to compress the tube so as to shut off communication between the nipples **51**, is embodied in a foldable unit as most clearly shown in FIG. 11, where the clamp is generally designed **53** and as will be seen in this figure, it embodies two flat elongate rigid members **54** which are joined together at one end by a fabric hinge **55**. The clamping members or hinged parts **54** have at their opposite ends the eye openings **56** and a cord **57** is passed through the openings after the equalizer tube has been inserted between the parts **54**, and the parts are then drawn tightly together whereby to compress the equalizer tube therebetween as indicated at **50'** whereupon the cord is tied securely.

In FIG. 2 the equalizer tube clamps are shown in open position with the cord **57** extending through the two parts ready to be tied after the clamp parts have been compressed against or onto the tube.

The superstructure **10** which forms the housing or shelter for the raft comprises broadly a number of upwardly and inwardly inclined stanchions **58**, a tubular top **59** and a fabric wall **60**. The stanchions are secured to the top of the tubular hull body as illustrated at **61** and at least one thereof, designated **58'**, opens into or has communication with the tubular hull body as indicated at **62**, in FIG. 8. The top of the housing or canopy is also tubular as shown and each of the stanchions opens thereinto, the stanchion **58'** in FIG. 8 being shown opening into the tubular top body at **63**. Each of the other stanchions, of course, also communicates with the tubular top body as stated. Thus it will be seen that when the gas from the cylinder is introduced into the tubular hull body it will inflate this body and flow through the stanchion **58'** into the tubular top **59** and from there into each of the other stanchions so that the superstructure will be quickly and automatically erected.

The fabric wall **60** covers the outer sides of the stanchions **58** and may be formed in a single piece or in a number of individual panels **64** and the bottom edge of the fabric wall is cemented to the tubular hull while the top edge is cemented to and around the tubular top **59**. One or more door openings **65** is provided in the wall fabric and the portion of the fabric which is removed from the remainder of the wall to provide the door opening is kept integral with the upper part of the panel from which it is taken so that it may be rolled up as indicated at **66** when it is desired to keep the opening clear. Thus this rolled up portion **66** forms a door panel and when it is in down or closed position its longitudinal edges are joined to the adjacent edges of the door opening by a slide fastener **67**, such as the type known in the trade as a "zipper."

In addition to the door opening or openings which may be closed down tightly to prevent the entrance of rain and seas, sections of the canopy wall may have window openings **67** formed therein with provision for closing the same against rain and also provision for screening the opening as illustrated at **68**. While no illustration has been made of the means for closing the window opening **67**, it will be obvious that such opening may be closed by a slide fastener in the same manner as the door opening **65** is closed and for covering the window openings with screening, such screening may be secured around its edges to the edge of the window opening by any suitable device such as snap fasteners or the like.

The top tubular body **59** is in the form of an annulus or it may have a polygonal outline corresponding to the polygonal outline of the tubular hull body and this annulus is closed by a panel structure which is generally designated **69** and the details of which are illustrated in FIGS. 3 and 4.

The panel **69** comprises an annular band **70** the outer edge portion of which is secured as indicated at **71** to the lower inner side of the tubular top body **59**. Joined to the inner edge of the annular band **70** is a disc **72** of a suitable transparent flexible material, preferably a transparent plastic of suitable thickness to withstand rolling and one which will not be affected by rain or sea water. The periphery of this transparent disc is joined in a water-tight seal at **73** to the inner edge portion or inner periphery of the annular band **70**.

The inner edge or peripheral portion of the band **73** also has secured thereto between the band and the transparent disc one of the two parts of a slide fastener, such part being designated **74**, as there is provided a curtain **75** of disc form adapted to cover the inner or underside of the transparent disc **72** which forms a window and the periphery of this disc or circular curtain carries through the major extent of its periphery the other portion of the slide fastener which is designated **76**. The curtain **75** is permanently attached to the inner edge of the annular band **70** along a small part of its periphery so that it always remains in position, whether it is spread out and secured in covering position under the disc **72** or whether it is rolled up as shown in FIG. 3.

By positioning the panel **69** near the bottom part of and within the annular tubular body **59**, there is provided a basin **77** adapted to catch rain water for the benefit of persons in the raft.

In order to facilitate persons in the raft extracting any water which may be collected in the basin **77** the annular band **70** has attached thereto and opening therethrough one end of a short tube **78** which hangs down from the panel and carries on its lower end a conventional type of valve **79** commonly used in life saving apparatus and which is generally known as an oral valve.

The top outer side of the shelter or canopy is provided with a signal light **80** and on the inner side of the stanchion nearest thereto there is secured in a suitable waterproof container **81** a battery or batteries which are connected by wiring run through a water-tight tube **82** to the light **80**. The circuit in which the battery or batteries and light are connected is adapted to be closed by a suitable bottom **83** or other suitable means accessible from the interior of the housing. Obviously it will be understood that all of the parts of this electrical mechanism are enclosed in a water-tight shielding means so that no short circuiting can occur. While the same is not illustrated, it will be understood that a similar light may be installed on the inner side of the annular top **59** with means for energizing it so that occupants of the raft can have desired illumination.

Accessible from the interior of the canopy or housing structure are hand holds in the form of short ropes or cords suitably secured to the tubular hull body such as are indicated at **84**, these being located along the inner sides of the equalizer tubes **50**.

Means is provided for stabilizing the raft structure by the provision of a number of bags or receptacles **85** which are secured to the bottom side of the tubular hull body at equi-distantly spaced locations therearound. These receptacles, when the raft is inflated and is in the water, will be suspended from the underside of the hull and one wall of each receptacle has an opening **86** therein which will permit it to fill with water. Thus as the raft rocks or tilts, the water-filled ballast bags will tend to prevent it from pitching or rolling too violently.

To facilitate the dumping of the ballast bags if such may be required, a cord **87** is provided which is attached to the bottom of the ballast bag in a suitable manner, as by patch **85'**, see FIG. 6, and extended out through the opening **86** and secured to the life line **26** as shown in FIG. 1.

To provide maximum comfort for persons occupying the raft, there is provided an inflatable deck generally designated **88** which is of a contour to fit within the hull body and rest upon the permanent deck portion **20** of the body. This inflatable deck or inflatable mattress comprises top and bottom layers of waterproof material joined together around the peripheries thereof as at **89**

with a plurality of intermerdiate connecting elements **90** which, when the deck is inflated, give the same a tufted form. The sheets **88** are centrally apertured and have the inner edges joined as at **91** whereby there is provided a central opening **92**. A flush or mattress type valve **93** is secured in one wall of the inflatable deck or mattress whereby the latter may be inflated by mouth and the use of this flat or flush type valve is made so as to avoid injury or discomfort to persons resting on the mattress structure.

Since it is possible that water may get in the raft and lie on the permanent deck or floor **20**, the centrally positioned opening **92** of the inflatable deck or mattress provides a means whereby water may be readily bailed out so that the occupants will not have to lie or sit therein.

In FIG. 13 there is illustrated another form of releasable connection which may be used between the raft and the craft from which it is thrown. In this form of releasable connection straps which are connected one to the lanyard and the other to the gas release valve of the CO_2 cartridge or cylinder are designated respectively **94** and **95**. The two straps **94** and **95** are detachably connected by snap buttons **96** and the strap **95** is shown with the hand hold loop **97** corresponding to the loop **49**. The strap or connection between the strap **95** and the valve of the gas cylinder is designated **98** and this is joined to the strap **95** by a buckle which is generally designated **99** and which comprises the frame **100** to one end of which the connection **98** is permanently joined. The opposite end of the frame is adapted to have the free end of the strap **95** passed therethrough and the frame carries a spring urged jaw **101** which closes down against the free end of the strap **95** and binds it in position against the end of the frame **100** through which the strap passes so that the strap **95** can only be disconnected from the strap or connection **98** by oscillating the buckle jaw **100** to permit the free end of the strap **95** to slip out of the buckle. This type of release employing the buckle **99** has additional uses such as serving as a release for baggage or cargo, for fire extinguisher units or oxygen units and other items requiring fast or immediate operation.

In operation the folded and deflated raft is thrown overboard, the lanyard **45** being attached to the craft from which it is thrown so that it can be maintained at a convenient location adjacent thereto to permit survivors to reach the raft. In preparation for the launching of the raft, the lanyard or retaining line is either secured to a person or to the air craft from which it is thrown and in use a line of some 40 foot length is employed. After the raft has been thus tossed overboard, a sharp jerk is given to the retaining line or lanyard which effects the opening of the gas containing receptacle to permit the gas to pass therefrom into the raft hull body to and through the open stanchion **58'** and from there into the tubular top part **59** and into the other stanchions, thus completely inflating the raft hull and the superstructure.

It will be readily seen that due to the fact of the superstructure, as well as the hull, becoming inflated, if the raft structure should lie on the water in an inverted position before the inflatable portions are filled with gas, after inflation the raft automatically will right itself so that survivors do not have to set it up in the proper position on the water. The survivors will then be able to climb into the raft by means of the step **31**, and the hand grip **36**, after which the inflatable deck or mattress can be filled with air and placed in position. As previously stated, after the raft has been inflated, the clamps **53** are applied to the equalizer tubes so as to prevent complete loss of air from the inflatable hull body in the event that the same becomes punctured.

In addition to using the clamps **53** on the equalizer tubes a clamp may be applied to the tube **58'** as indicated at **53'**, which carries the inflating gas from the hull body into the stanchions and to the top of the superstructure.

An anchor patch **102** is cemented to the top of the main deck or raft floor **20** to hold an end of a fabric tape **103**. This tape is employed for lashing survival equipment to the floor through the hole of the inflatable mattress.

As this invention may be embodied in several forms without departing from the spirit or essential characteristics thereof, the present embodiment is therefore illustrative and not restrictive, since the scope of the invention is defined by the appended claims rather than by the description preceding them, and all changes that fall within the metes and bounds of the claims or that form their functional as well as conjointly cooperative equivalents, are therefore intended to be embraced by those claims.

I claim:

1. A life raft having an inflatable endless tube forming a hull body, a diaphragmatic deck extending inwardly of the tube, a shelter structure carried by the hull body and including a number of upwardly extending inflatable converging stanchions, at least one of the stanchions being in communication at its lower end with the interior of the endless tube, and an endless tube top unit supported on the upper ends of the stanchions, said stanchions all being in communication with the interior of the endless tube top unit, means for inflating the hull body, the stanchions and the endless top unit, a panel unit extending horizontally inwardly of said endless top unit when the latter is inflated, said panel lying in a plane with respect to the endless tube top unit closely adjacent to the underside of the latter, said panel unit comprising an annular band secured to the endless tube top unit and a transparent sheet encircled by and secured around its periphery to said annular band, said panel unit lying entirely below the topmost part of said endless tube top unit and forming therewith a rain water catch basin, a valved tube attached at one end to and opening through the said annular band for use in withdrawing rain water from the catch basin by occupants of the raft.

2. The invention according to claim 1 with a curtain formed to cover the said transparent sheet and means for attaching the periphery of the curtain to the inner periphery of said annular band beneath the transparent sheet.

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