Oct. 20, 1959 R. BICKNELL ET AL 2,908,919

ARCTIC SHELTER LIFE RAFT

Filed June 6, 1956 3 Sheets-Sheet 1

Fig. 1.

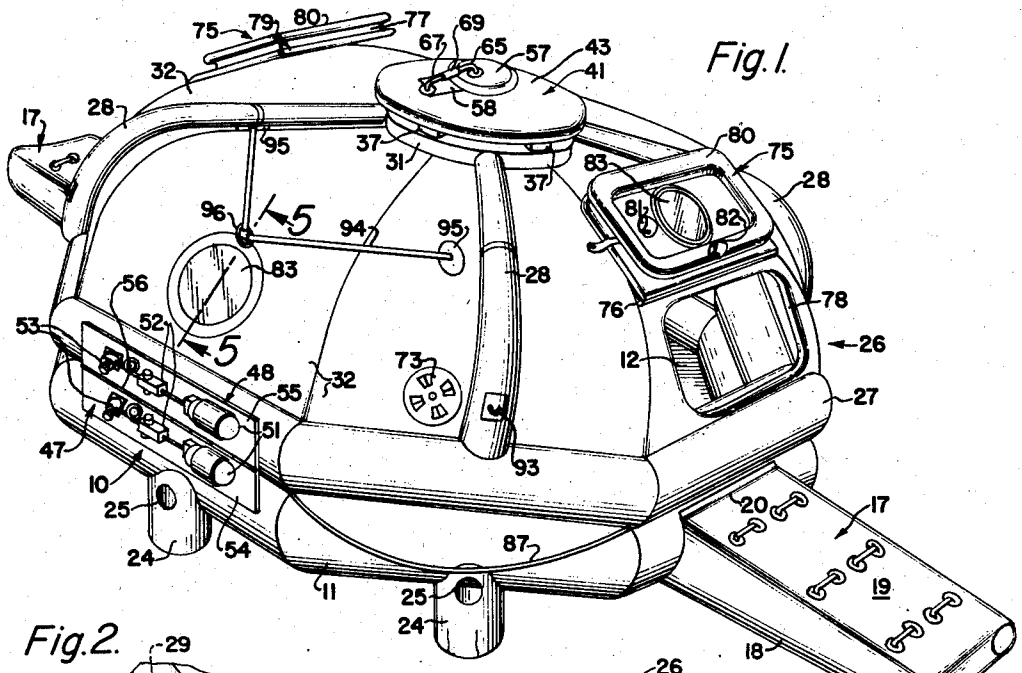
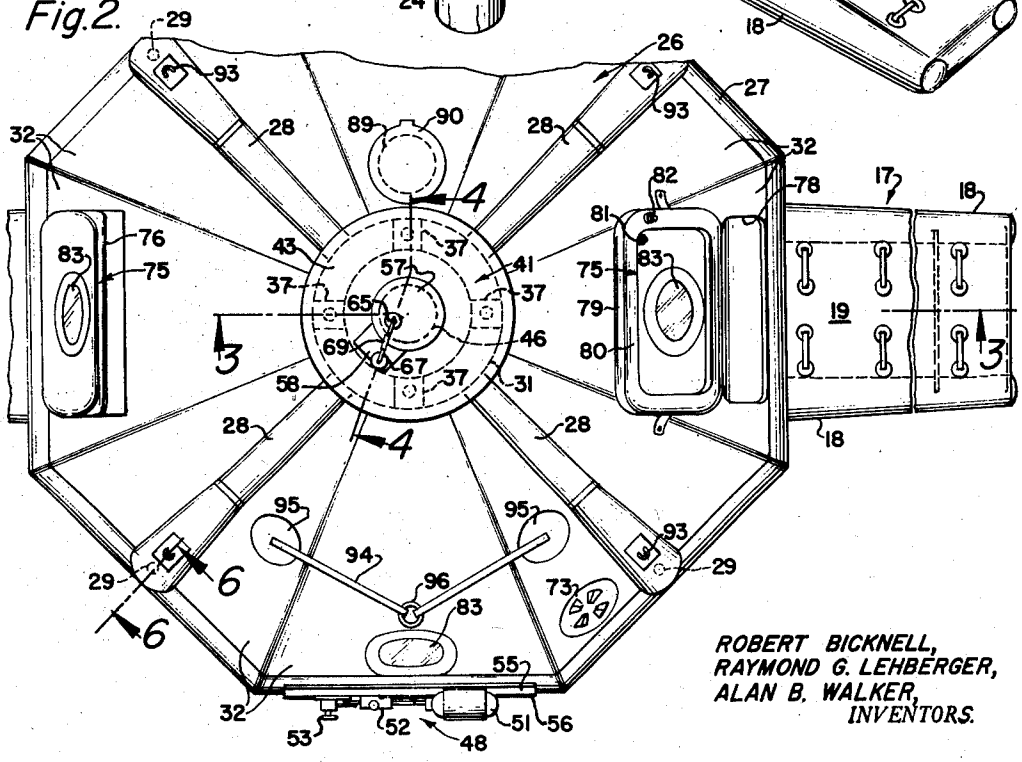


Fig. 2.



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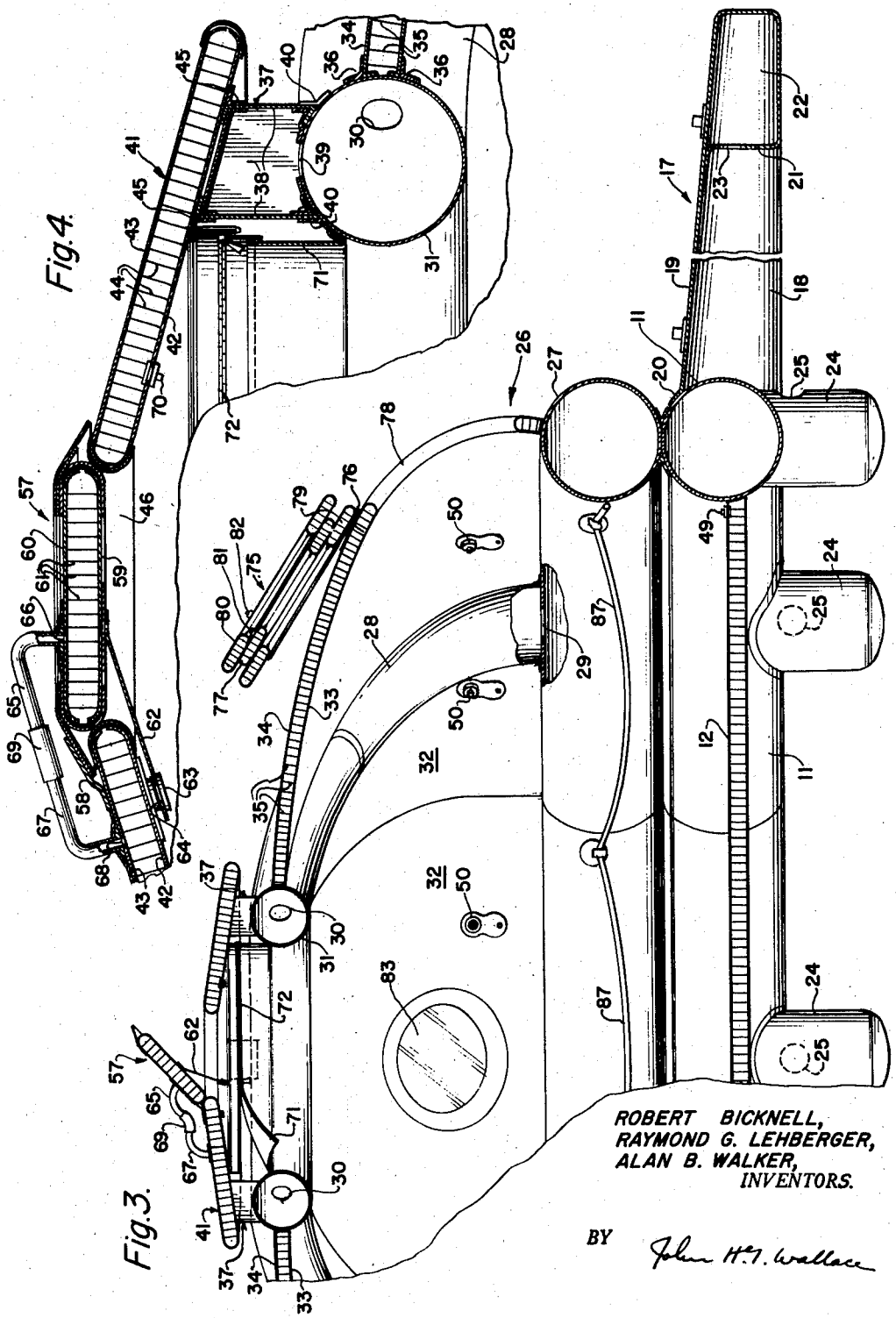

Fig. 4.

Fig. 3.

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Fig.6.

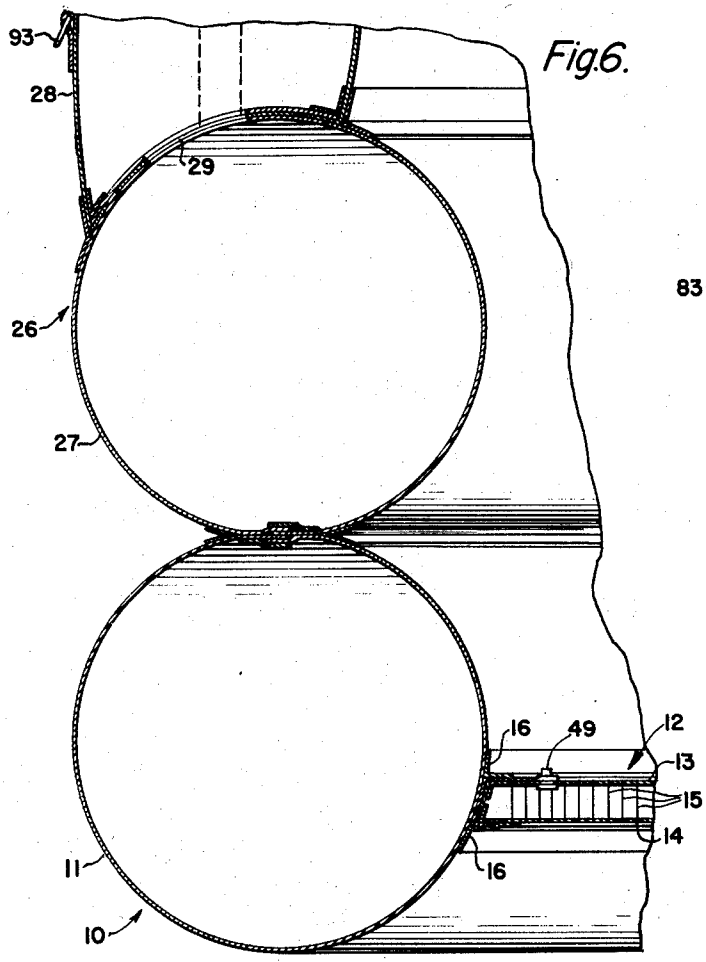


Fig.5.

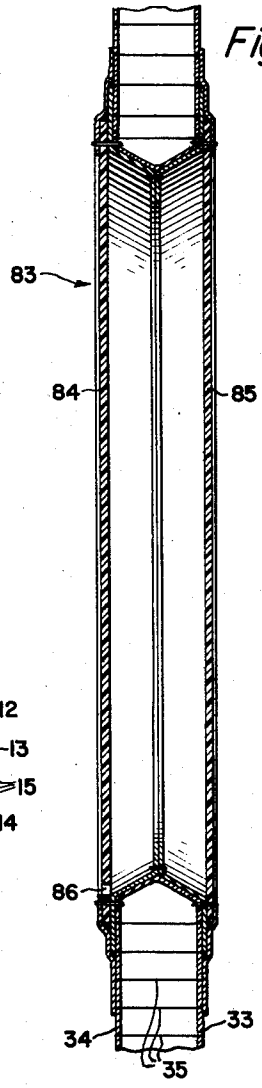
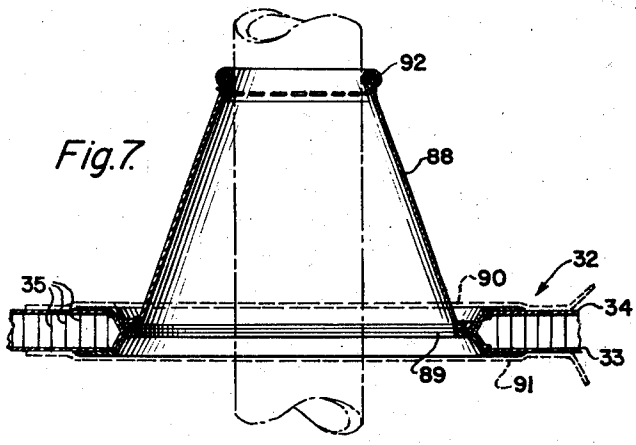


Fig.7.



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ARCTIC SHELTER LIFE RAFT

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Application June 6, 1956, Serial No. 589,784

7 Claims. (Cl. 9—11)

This invention relates to an inflatable device that may be utilized as a life raft, as a shelter for protection against the ice and the cold weather such as may be found in the Arctic region, or as a combined life raft and shelter.

Although the invention is described as being useful in providing protection against the ice and the cold weather such as may be found in the Arctic region, it is to be understood that the invention may be utilized as protection against any kind of weather anywhere in the world.

The invention is particularly useful in Arctic regions, however. For example, commercial aircraft flying between the West Coast of the United States and continental Europe now fly a direct "polar route" over the Artic region between these destinations. Additionally, military bases and weather stations have been established in the Arctic region and journeys on, or flights over, the ice and water in this region are made periodically to collect data and scientific information.

Aircraft of the various military and naval air rescue services and commercial aircraft which operate over large bodies of water carry life rafts of the inflatable type which, when tossed from a plane, are of the inflatable type which, when tossed from a plane, are automatically inflated so that they may be boarded from the water by survivors of abandoned aircraft or ships and occupied pending ultimate rescue. Such inflatable life rafts usually are constructed with two superposed main buoyancy tubes around their periphery and have means to erect a peripheral canopy and a roof that provide shelter from the sun and function as a spray shield. This type of protective covering, however, will not afford the protection necessary for survival against the cold weather in the Arctic region.

It is an object of the present invention to provide a multipurpose inflatable structure that may be utilized as a life raft and/or as a shelter by survivors in the Arctic region be they on water, land, snow or ice.

It is a further object of the invention to provide a multipurpose inflatable life raft and/or shelter having an inflatable framework for supporting the raft and the sheltering canopy over the raft.

It is a still further object of the invention to provide a multipurpose inflatable life raft and/or shelter having an inflatable framework for supporting the raft and the sheltering canopy over the raft, and separably inflatable insulating floor and walls that contribute to the structural support of the structure when inflated.

It is another object of the invention to provide a multipurpose inflatable life raft and/or shelter having a novel inflatable door and jam that provide a weather-tight closure.

It is still another object of the invention to provide a

multipurpose inflatable life raft and/or shelter having adjustable ventilating means.

It is still another object of the invention to provide a multipurpose inflatable life raft and/or shelter having a plurality of boarding ramps that, by virtue of water pockets located at their outer extremity, provide a large stabilizing moment.

Other and further objects of the present invention will become apparent from the disclosures in the following detailed specification, appended claims, and accompanying drawings, wherein:

Fig. 1 is a perspective view of a structure embodying the invention, showing the doors in the fully open position;

Fig. 2 is a plan view of the structure shown in Fig. 1;

Fig. 3 is an enlarged vertical sectional view taken on line 3—3 of Fig. 2;

Fig. 4 is an enlarged vertical sectional view through the ventilating hatch taken on line 4—4 of Fig. 2;

Fig. 5 is an enlarged vertical sectional view through a window of the structure taken on line 5—5 of Fig. 1;

Fig. 6 is an enlarged vertical sectional view taken on line 6—6 of Fig. 2; and

Fig. 7 is an enlarged vertical sectional view through the exhaust pipe opening showing the exhaust pipe sleeve in the extended position.

Referring to the drawings, there is shown in Fig. 1 a multipurpose inflatable structure capable of being used as a life raft and/or as a shelter. The structure has a bottom section shown generally at **10**, comprising a circumferentially disposed inflatable tube **11** and a two-ply, air-tight, inflatable fabric insulating floor **12**. As best seen in Fig. 6, the floor is composed of a first ply fabric **13** and a second ply fabric **14** interconnected by a multiplicity of spaced tie threads **15** of predetermined length, and is connected to the lower tube **11** by crotch tape **16** or by other means well known in the art. The term "crotch tape" as used here and elsewhere in this application denotes a band of rubberized fabric, or other similar material, bonded to the surface of two adjacent members. The crotch tape serves to join the two members or to reinforce the attachment or junction of the two members.

The above-described bottom section of the structure functions as a base when the structure is set on ice or snow, or on the ground, and provides buoyancy when the structure is used as a raft. The floor **12** is set above the base line of tube **11** to permit the tube to immerse into the water when the structure is used as a raft. The attachment point of the floor, however, is appreciably lower than is used for the floor of conventional rafts to provide more headroom within the inflated structure. Placing the floor **12** above the base line of the tube **11** serves to aid the stability of the structure when it is in the water, and also serves to entrap air in the space between the floor of the structure and the water or ice on which the structure rests, and thus contributes to the thermally insulating properties of the structure.

A boarding ramp shown generally at **17** may be provided on one or both sides of the structure to facilitate boarding the structure from the water. The boarding ramp, per se, forms no part of this invention and is disclosed and claimed in the co-pending application of Alan B. Walker, Serial No. 552,014, filed December 9, 1955. The boarding ramp, however, when installed, is an integral part of the bottom section of the structure and is, therefore, briefly described herein.

As shown in Figs. 2 and 3, the boarding ramp has a supporting structure comprising a pair of spaced inflatable structural beams **18** attached to and communicating with the inflatable tube **11**. An air-tight fabric deck member **19** secured to the beams **18** extends from its connection **20** with the tube **11** along the upper side of the beam **18** and is carried around the outboard end thereof and returned a distance on the underside of the beam **18**. Handles may be attached to the upper surface of the deck member **19** as shown in Fig. 2. The end **21** of the fabric deck member **19** is bent up and secured to form a water ballast pocket **22**. Ports **23** are provided for entry of water into the pocket **22**. When the structure is utilized as a raft, the water ballast pocket **22** will fill with water. This ballast pocket located at the extremity of the rigid boarding ramp, will cause the ramp to function in the manner of an outrigger and will provide a large stabilizing moment. Further stability of the raft is obtained by attaching a plurality of water ballast buckets **24** to the underside of the tube **11**. Ports **25** in the buckets **24** are provided for entry of water into the buckets.

Above the bottom section of the structure is an insulating superstructure, shown generally at **26**, having an inflatable supporting framework comprising a circumferentially disposed inflatable tubular member **27** mounted upon, and attached to, the tube **11**, and a plurality of upwardly bowed inflatable structural ribs **28** that communicate through an orifice **29** at their lower ends with the tubular member **27** and through an orifice **30** at their upper ends with an inflatable annular tube **31**.

An inflatable fabric insulating canopy wall composed of a plurality of individual segmental walls **32** is mounted on the supporting framework. Each wall **32** is composed of a first ply inner fabric **33** and a second ply outer fabric **34** interconnected by a multiplicity of spaced tie threads **35** of predetermined length and is connected at its lower end to the upper surface of the tubular member **27**, at its upper end to the annular tube **31**, and at each of its sides to the structural ribs **28** by crotch tape **36** or by other means well known in the art.

A plurality of inflatable supports **37** defined by walls **38** communicate at their lower ends with the annular tube **31** through an orifice **39**. The bottom of the walls **38** are secured to the upper surface of the tube **31** by means such as crotch tape **40**. An annularly shaped ventilating hatch **41** consisting of a first ply bottom fabric **42** and a second ply top fabric **43** interconnected by a multiplicity of spaced tie threads **44** of predetermined length is mounted on the upper periphery of the walls **38** of the supports **37** and is secured thereto by means such as crotch tape **45**. The port **46** formed in the central portion of the ventilating hatch **41** may be utilized as an observation port, or as an access for external radio antennae, and is covered in the manner hereinafter described.

The bottom section **10** and the insulating superstructure **26** are each provided with separate inflation means. As shown in Fig. 1, a pneumatic inflation assembly, shown generally at **47**, is provided for inflating the tube **11** and the boarding ramp structural beams **18** of the bottom section **10**. A second pneumatic inflation assembly, shown generally at **48**, is provided for inflating the tubular member **27**, the canopy structural ribs **28**, the annular tube **31** and the supports **37**. An inflation valve **49** is provided for separately inflating the floor **12**. Flaps (not shown) having fastening means of any type well known in the art may be provided as a protective covering for the inflation valve **49** and other inflation valves hereinafter described. Each segmental canopy wall **32** is also provided with an inflation valve **50** so that these walls may be inflated separately. When the structure is inflated, the tubes, beams, ribs and members that form the supporting framework are inflated first, thus allowing the structure to stand and provide protection against wind, snow or rain while the insulating floor and canopy walls are being inflated. The floor and canopy walls, when inflated, contribute to the structural support of the structure.

While the floor and canopy walls are described as being separately inflatable, it is to be understood that, if desired, either or both may be connected to the supporting framework so that they can be inflated by the respective inflation assembly. As shown in Fig. 6, there is no connection between the tube **11** of the bottom section **10** and the tubular member **27** of the superstructure **26**. Therefore, in the event of a puncture, at least one portion will remain turgid.

The inflation assemblies **47** and **48** may be identical or may differ only in size. Each assembly comprises a gas or air pneumatic storage cylinder **51**, a pressure regulator **52** and an aspirator **53**. A type of pressure regulator that may be used in the inflation assembly is disclosed in the co-pending application of James V. Crawford et al., Serial No. 507,356, filed May 2, 1955, and a type of aspirator that may be used in the inflation assembly is disclosed in the co-pending application of James V. Crawford et al., Serial No. 507,355, now Patent Number 2,772,829. It is to be understood, of course, that various other regulators and aspirators may be used in the inflation assembly, the mechanism in the above applications being used only by way of example. The inflation assembly **47** is mounted on a base **54** secured to tube **11** of the bottom section, and the inflation assembly **48** is mounted on a base **55** secured to tubular member **27** of the superstructure **26**. The base **54** and the base **55** are hingedly connected at **56** to aid in packing the structure in a compact bundle.

A cover **57** for the port **46** is connected by a hinge **58** to the top fabric surface **43** of the hatch **41**. The cover **57** is circular in shape and is comprised of a first ply bottom fabric **59** and a second ply top fabric **60** interconnected by a multiplicity of spaced tie threads **61** of predetermined length. To maintain the cover **57** in the closed position, a strap **62** is fixedly secured at one end to the bottom fabric **59** of the cover **57** and is provided at its other end with a fastening means **63** that may be releasably connected to a co-operating fastening means **64** secured to the bottom fabric **42** of the ventilating hatch **41**. Flexible tube **65** communicating with the interior of the cover **57** through an orifice **66** in the top fabric **60**, and a flexible tube **67** communicating with the interior of the hatch **41** through an orifice **68** in the top fabric **43** are joined intermediate their ends by a sleeve **69** to provide for free passage of air between the cover **57** and the hatch **41**. An inflation valve **70** is provided for separately inflating the hatch **41** and the cover **57**. Curtains **71** extending between the supports **37** and secured at the top to the hatch **41** and at the bottom to the annular tube **31** are provided with slide fasteners **72** so that they may be opened or closed as ventilation requirement dictates. To obtain a natural draft ventilation, a plurality of adjustable ventilators **73** of any type well known in the art are installed in the canopy walls **32** near the tube **27**.

A door **75** located above the boarding ramp **17** is attached to the outer fabric **34** of the canopy wall **32** by a hinge **76**. The door **75** is comprised of a center panel **77** constructed in the same manner as the canopy wall and formed to fill an opening **78** in the canopy wall when inflated, an outer peripheral ring **79** attached to and extending peripherally beyond the outer face of the panel **77**, and an inner peripheral ring **80** attached to and extending peripherally beyond the inner face of the panel **77**. The center panel **77** and the outer peripheral ring **79** freely communicate with each other and are jointly inflated by an inflation valve **81** before the door is closed. The inner peripheral ring **80** is separately inflated by means of an inflation valve **82** after the door is closed. When the inner ring is thus inflated after the door is

closed, the inflated peripheral rings 79 and 80 overlap each side of the canopy wall to form a tight seal and a very effective means for holding the door in place.

Windows 83 for admitting light into the structure may be installed in the canopy walls 32 and the center panel 77 of the door 75. As shown in Fig. 5, the windows in the canopy walls 32 comprise spaced window panes such as an outer translucent or transparent plastic pane 84 secured to the outer fabric 34 of the wall and an inner translucent or transparent plastic pane 85 secured to the inner fabric 33 of the wall. The window in the panel 77 of the door 75 may be similarly constructed. This type of construction serves to entrap air between the plastic panes 84 and 85 and thus contribute to the thermally insulating properties of the structure. A hole 86 is provided in the outer pane 84 to serve as a drain for condensation and as a vent.

Life lines 87 are looped around the outside and the inside of the structure to serve as hand holds for the survivors in the water and those inside the structure.

The subject structure may also be utilized as a utility shelter for military operations or by scientific expeditions. When so utilized, it may be desirable to install a stove to supply heat within the structure. An asbestos or other fireproof fabric sheet (not shown) may therefore be secured to the floor 12 and an asbestos fabric chimney sleeve 88 is provided in an opening 89 in the canopy wall 32 for the chimney. The sleeve 88 may normally be stored between an outer patch 90 removably secured to the outer fabric 34 of the wall 32 and an inner patch 91 removably secured to the inner fabric 33 of the wall 32. When it is desired to install the chimney, the patches 90 and 91 are removed, and the sleeve 88 is extended outwardly and secured at 92 to the chimney by drawstrings or other means well known in the art. To secure the structure to the ground, when utilized as a utility structure, a plurality of rings 93 are secured to the structural ribs 28 for the attaching of guys (not shown) affixed to ground stakes.

The subject structure is ideally suited to be packaged in a container which is attached by a static line to an aircraft. The static line may open the package in the drop and initiate the inflation. A sling 94 attached at each end to the canopy wall at 95 and at the center to a ring 96 is provided for the attachment of a parachute or an air drogue (not shown) that functions to retard the fall of the structure and insure that the raft will land right side up. The well rounded canopy walls, however, provide the raft with a semi-self-righting characteristic should it become overturned. The curved upper surface additionally provides the structure with a good aerodynamic form for resisting wind loads.

We claim:

1. A multipurpose inflatable structure, comprising: an inflatable bottom section having a circumferentially disposed inflatable tube and an inflatable insulating floor; an inflatable insulating superstructure fixedly mounted on the bottom section, the superstructure having an inflatable supporting framework and an inflatable insulating canopy wall connected to the supporting framework, the canopy wall having an opening forming an entryway; and an inflatable door for the entryway, the door having means forming a tight seal around the periphery of the entryway when inflated.

2. A multipurpose inflatable structure, comprising: an inflatable bottom section having a circumferentially disposed inflatable tube and an inflatable insulating floor; an inflatable insulating superstructure fixedly mounted on the bottom section, the superstructure having an inflatable supporting framework, an inflatable insulating canopy wall connected to the supporting framework and a separately inflatable door hingedly connected to the canopy wall and comprising a center panel formed to fill an opening in the canopy wall, an outer peripheral ring attached to the outer face of the panel, and an inner peripheral ring attached to the inner face of the panel, the inner and outer peripheral rings overlapping each side of the canopy wall when inflated, to form a tight seal around the opening.

3. In an inflatable structure having an opening in an inflatable wall, an inflatable door comprising a center panel formed to fill the opening, a peripheral ring attached to the outer face of the center panel, and a peripheral ring attached to the inner face of the center panel, the peripheral rings overlapping the edges of the panel and contacting the wall on each side of the panel when inflated to hold the door in place and form a tight seal around the opening.

4. A multipurpose inflatable structure, comprising: a framework of inflatable structural beams having sufficient strength when inflated to support the structure; an inflatable floor and inflatable canopy walls attached to the inflatable structural beams and having entry doors and windows, the floor, canopy walls, doors and windows throughout the structure having an inner and outer surface formed to define a substantially fluid-tight chamber for retaining an insulating layer of air therebetween.

5. A multipurpose inflatable structure, comprising: an inflatable bottom section having a circumferentially disposed inflatable tube and an inflatable floor composed of two fabric plies formed to define a substantially fluid-tight chamber therebetween; a first inflating means, including a first pneumatic storage cylinder, for inflating the bottom section; an inflatable insulating superstructure including an inflatable supporting framework comprising a circumferentially disposed inflatable tubular member fixedly mounted on the circumferentially disposed inflatable tube of the bottom section, a plurality of bowed structural ribs communicating at their lower ends with the circumferentially disposed inflatable tubular member, and a plurality of inflatable canopy wall sections composed of two fabric plies formed to define a substantially fluid-tight chamber between the bowed structural ribs; and a second inflating means, including a second pneumatic storage cylinder for inflating the superstructure.

6. A multipurpose inflatable structure, comprising: an inflatable bottom section having a circumferentially disposed inflatable tube and an inflatable insulating floor; an inflatable insulating superstructure including an inflatable supporting framework comprising a circumferentially disposed inflatable tubular member fixedly mounted on the circumferentially disposed tube of the bottom section, a plurality of bowed structural ribs communicating at their lower ends with the circumferentially disposed inflatable tubular member, an inflatable annular tube communicating with the bowed structural ribs at their upper ends, and an inflatable insulating canopy wall attached to the supporting framework; means for inflating the bottom section and superstructure; and ventilating means including an adjustable vent in the canopy walls for admitting a supply of fresh air to the structure and an inflatable insulating ventilator hatch disposed on the annular tube and having adjustable means for controlling the flow of air from the structure.

7. A multipurpose inflatable structure, comprising: an inflatable bottom section having a circumferentially disposed inflatable tube and an inflatable insulating floor; an inflatable insulating superstructure including an inflatable supporting framework comprising a circumferentially disposed inflatable tubular member fixedly mounted on the circumferentially disposed tube of the bottom section, a plurality of bowed structural ribs communicating at their lower ends with the circumferentially disposed inflatable tubular member, an inflatable annular tube communicating with the bowed structural ribs at their upper ends, and an inflatable insulating canopy wall attached to the supporting framework; an insulating ventilating hatch disposed to be supported on the annular

tube, said ventilating hatch including a central port for ventilating said structure and an inflatable insulating cover hingedly connected to the ventilator hatch and adapted to close the central port; and means for inflating the inflatable structure.

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