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(71) Applicant: The B.F. GOODRICH Company
Dept. 0015 WHB-6 500 South Main Street
Akron, Ohio 44318(US)

(72) Inventor: Brown, Eugene Walter
1288 Mt. Pleasant
North Canton Ohio 44720(US)

(74) Representative: von Kreisler, Alek, Dipl.-Chem. et al,
Deichmannhaus am Hauptbahnhof
D-5000 Köln 1(DE)

(54) Life raft with a low-profile, self-filling ballast having pneumatic assist.

(57) A pneumatic life raft having a self-filling ballast for improving the stability of the raft in turbulent water. The ballast is provided with water inlet holes and air outlet holes for filling the ballast with the stabilizing water, and a supplemental pneumatic means as an assist during self-inflation. The ballast is also designed with, a low-profile shape to minimize the stress to the area of attachment of the ballast to the raft while maximizing the stability of the raft.

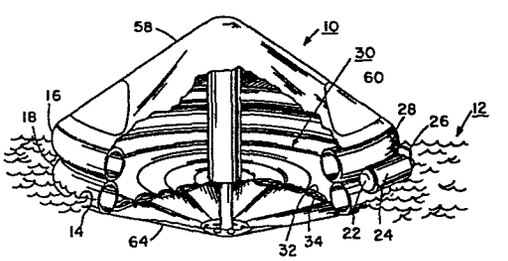

FIG. 1

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LIFE RAFT WITH A LOW-PROFILE, SELF FILLING BALLAST HAVING PNEUMATIC ASSIST

BACKGROUND OF THE INVENTION

The present invention relates to pneumatic life rafts and more particularly to a pneumatic life raft which includes a self-filling ballast of a construction to maximize safety of the raft during deployment and use

DESCRIPTION OF THE PRIOR ART

Life rafts have been well known for many years as useful devices for saving the lives of unfortunate people such as those who crash in an airplane over water or occupants of a ship which may sink or others in situations where drowning might otherwise occur. Known life rafts are normally adequate for their life saving purposes. However, in rough or turbulent water, prior art structures may have a tendency to overturn or fill with water or otherwise fail to fulfil their intended life preserving purpose.

Prior art life rafts offer features designed in an attempt to minimize the risk of overturning during turbulent waters. Examples of such prior art structures include U. S. Patent No. 2,390,199 to Walsh. According to that disclosure, a ballast region is provided beneath a life raft but a supplemental valve and hose, operable from within the life raft, must be utilized and operated from within the raft by occupants. The ballast is not self-filling as in the present invention.

In U. S. Patent No. 3,058,127 to Hassold, self-filling ballasts are employed. However, the magnitude of such ballast is negligible in volume and weight when considering the ballasting needed in turbulent waters. Further, only a single row of holes is utilized minimizing the self-filling

capabilities of the ballasts. Further, supplemental pneumatic assistance means to automatically preform the ballasts prior to and during filling are not employed as they are in the present invention.

In U. S. Patent No. 3,736,607 to Radnofsky, et al a large self-filling ballast is employed but, according to that disclosure, a mere single row of apertures is utilized for the dual function of letting water into the ballast zone and for permitting air to escape. Further, pneumatic assistance means are not provided for the ballast to insure the appropriate and automatic deployment of the ballast. Also, the proportion of the weight of the contained water in the filled ballast to the area of attachment between ballast fabric and raft is such as to be unacceptably high. With such high proportion, the weight of the ballast would rip the ballast material from the raft during use in turbulent water.

Lastly, in two patents to Givens, U. S. Patent Nos. 3,883,913 and 4,001,905, self-filling ballasts are employed but utilize extremely heavy materials for effecting the ballasting function. Such ballast material unduly increases the cost and weight of the life raft. Further, the weight of water in the ballast during normal operation is extremely high, thus, as in the Radnofsky, et al device, exerting a stress on the contact area between the ballast material and the remainder of the raft. The weight is of such magnitude that separation under turbulent seas might be a concern. Further, the excessively large ballast zone requires excess time for filling with water prior to safe utilization of the raft.

SUMMARY OF THE INVENTION

According to the present invention a ballast is formed beneath and part of a conventional life raft. The ballast is located to extend below the life raft, and upon deployment of the life raft, is automatically filled with the water in which it is floating. A plurality of holes adjacent the bottom of the ballast permits the flow of water into the ballast while a series of holes beneath the water line of the raft, but in the ballast above the first series of holes, permits air to be expelled from the ballast as water enters. The filling of the ballast with water is enhanced and assisted by a pneumatic tube operable upon the pneumatic filling of the life raft to cause the ballast zone to quickly assume the proper orientation as an assist in the filling of the ballast with water. Also, the ballast is of a shape to maximize stabilization with minimum stress on the raft to which it is secured

It is, therefore, an object of the present invention to improve the stability of life rafts.

A further object of the present invention is to rapidly ballast pneumatic life rafts in a positive manner with penumatic assistance.

Yet a further object of the instant invention is to increase the ballasting efficiency of pneumatic life rafts with a minimum of weight, structure, and force against the life raft itself.

These and other objects and further features of the present invention will become more fully apparent from the following detailed description, taken in confunction with the accompanying drawings, wherein:

Figure 1 is a perspective view of a life raft constructed in accordance with the present

invention with parts broken away to show internal constructions thereof;

Figure 2 is an elevational view of the life raft shown in Figure 1 in cross-section;

Figure 3 is a view of the bottom of the life raft shown in Figures 1 and 2 with parts broken away to show internal construction thereof;

Figure 4 is an enlarged elevational view of the central pneumatic shafts shown in Figure 2;

Figure 5 is a perspective view of a life raft constructed in accordance with the first alternate embodiment of the present invention;

Figure 6 is a front elevational view of the life raft shown in Figure 5 in cross-section;

Figure 7 is a side elevational view of the raft;

Figure 8 is a perspective view of a life raft constructed in accordance with the second alternate embodiment of the present invention;

Figure 9 is a front elevational view of the life raft shown in Figure 8 in cross-section; and

Figure 10 is a side elevational view of the raft.

DETAILED DESCRIPTION OF THE DRAWINGS

Shown in the figures is the preferred embodiment of the inventive life raft 10. In Figure 1 the life raft is seen floating on the water 12 in which is is located. The water line is designated by number 14. A pair of pneumatic rings, upper ring 16 and lower ring 18, are pneumatically separate but physically joined by stitching and adhesives as at 20 to provide the buoyancy for the raft in which survivors of a disaster may find safety.

The life raft 10 is normally carried in an uninflated condition until need for operation is required. At that time a bottle 22 of a compressed gaseous fluid, such as carbon dioxide, mounted by strap 24 on the upper ring 16 is activated through appropriate valves 26 and 28 to inflate both rings simultaneously. Regulators of known fashion, operated in the lines and valves may be utilized to insure proper inflation but prohibit under inflation.

As can be more readily seen in Figure 2, a floor 30 is provided for the raft occupants. The floor is located within the peripheral confines of the pneumatic rings and is constructed of upper and lower layers 32 and 34 of circular shaped, rubberized fabric joined together with stitching in concentric circles sufficiently loose to permit air to flow therethrough and shaped to form concentric rings 40, 42, 44 and 46. Inflation of the floor may be achieved through a supplemental hand pump or the like, acting through a valve 48 in the upper layer 32 whereby inflation of one of the concentric rings 40 will fill the others through a series of interconnecting passageways between the stitching in the rings.

The floor for the raft occupants is constructed so that the outermost of the concentric rings 40 is coupled through adhesives and stitching to the lowermost face of the bottom pneumatic ring 18. The inside of the innermost ring 46 of the support floor 30 is located between and attached by adhesives and stitching to an upper and lower pneumatic tubes 50 and 52. The upper tube 50 is adapted to be inflated through the automatic inflation bottle 22 along with the pneumatic rings 16 and 18. A small tube 54 pneumatically couples the top of the upper tube 50 with the upper pneumatic

ring 16 for simultaneous inflation. The upper tube has for its function the supporting of an upper shield 58 adapted to protect occupants from exposure to the elements. This upper shield is provided with doors 60 which the survivors can open through zipper or other appropriate closure means, to permit entry of the survivors into or out of the raft.

The lower portion of the upper tube 50 is secured to the floor 30 adjacent the inside of inner ring 46 through adhesives and stitching. Therebeneath is located the upper end of the lower tube 52. The lower tube is of a smaller cross-sectional shape than the upper tube to minimize its buoyancy when in operation inasmuch as it will be positioned beneath the water line. The purpose of the lower tube 52 is to inflate and thereby positively, downwardly expand an inverted cone-shaped ballast 64 located beneath the lowermost segment of the raft. The ballast is coupled to the lowermost portion of the lower pneumatic ring 18 to define the shape of a cone for providing stability to the raft when deployed in the water.

Enlarged water entry holes 66 are provided in a circle near the bottom of the ballast to permit the entry of water into the ballast to add weight and stability to the raft. Smaller holes 68 in a circle around the upper periphery of the ballast are provided to permit the escape of air from the ballast zone during inflation with water so that water may be accommodated into the ballast to provide a stabilizing support to the raft while in operation.

The low-profile, cross-sectional configuration of the ballast is utilized to maximize the weight of the water adjacent the center of the raft

to thereby minimize weight adjacent the edges of the raft for improved stability In operation this particular cross-sectional configuration will hold about 1,200 lbs of sea water and exert a stress of about 15.75 pounds per linear inch along its line of connection with the lowermost pneumatic rings. Greater ballast weight and stress forces may cause separation of the ballast material from the raft during turbulent water with the result of over-turning of the raft.

Because of its conical shape of the ballast, the ballast sheet material, as well as the upper shield material, are preferably formed as a series of overlapping and wedge shaped segments extending from the lowermost pneumatic tube inwardly, each toward an apex. The segments are coupled together with conventional adhesives known for firmly holding together the rubberized cloth of which the segments are preferably constructed.

As can be seen in Figures 2-4, supplemental reinforcing sheets 72 and 74 in ring-like configuration are provided adjacent the lowermost portion of the ballast at the apex of the cone. These sheets 72 and 74 will increase the strength at this area of joining. For added safety, similar reinforcing sheets, also in a ring-like configuration, may be provided at the area where the uppermost segment of the lower tube joins the lowermost segment of the upper tube for holding these parts together at the center of the floor 30.

Figure 4 demonstrates the preferred attachment of the pie-shaped ballast fabric segments 80 and 82 adjacent the lowermost portion of the lower tube. As seen in this view, the securement of the tube to the apex of the ballast material is achieved through pile fasteners such as

velcro. This easily releasable fastener will constitute an area of joining which will separate when it encounters excessive force. This is desirable since this particular segment of the raft receives excessive abuse and force during turbulent weather. Without the releasable coupling, traverse forces could rip these parts apart if they were merely glued and/or stitched to thereby create a hole in the ballast. If such were to occur, the function of the ballast would be lost.

Shown in the Figures 5-7 is a first alternate embodiment of the inventive life raft. In Figure 5 the life raft is seen floating on the water 112 in which is is located. The water line is designated by number 114. A pair of rectangular pneumatic tubes, upper tube 116 and lower tube 118, are pneumatically separate but physically joined by stitching and adhesives as at 120 to provide the buoyancy for the raft in which survivors of a disaster may find safety.

The life raft 110 is normally carried in an uninflated condition until need for operation is required. At that time a bottle 122 of a compressed gasseous fluid, such as carbon dioxide, mounted by strap 124 on the lower tube 118 is activated through appropriate valves 126 and 128 to inflate both tubes simultaneously. Regulators of known fashion, operated in the lines and valves may be utilized to insure proper inflation but prohibit underinflation.

As can be more readily seen in Figures 6 and 7, a floor 130 is provided for the raft occupants. The floor is located within the peripheral confines of the pneumatic tubes and is constructed of upper and lower layers 132 and 134 of rectangular shaped, rubberized fabric joined to-

gether with stitching sufficiently loose to permit air to flow therethrough and shaped to form adjacent sections 140, 142, 144 and 146. Inflation of the floor may be achieved through a supplemental hand pump or the like, acting through a valve 148 in the upper layer 132 whereby inflation of one of the floor sections 140 will fill the others through a series of interconnecting passageways between the stitching in the tubes.

The floor for the raft occupants is constructed so that the outermost of the sections 140 and 146 are coupled through adhesives and stitching to the lowermost face of the bottom pneumatic tube 118 along their sides. The front and back of the floor sections are similarly coupled to the front and back of the bottom pneumatic tube, all in an air tight manner.

Upper support tubes 150 are pneumatically coupled at each end with the upper tube 116 to be inflated upon the automatic inflation of the pneumatic tube. The purpose of the upper support tubes, of which there are two in number, is to provide support for an upper shield 158 adapted to protect occupants from exposure to the elements. This upper sheild is provided with a least one door 160 which the survivors can open through zippers or other appropriate closure means to permit movement of the survivors into or out of the raft.

A plurality of lower support tubes 152, supplemental pneumatic members, are located beneath the lowermost surface of the lower tube 118. Each upper support tube 152 of the plurality extends downwardly and is pneumatically coupled with the lower surface of the bottom tube 118. Preferably one is positioned in each corner of the tube 118 with additional ones in the middle of the sides of

the tube. The purpose of the lower support tubes is to inflate with tube 118 and thereby positively, downwardly expand the inverted box shaped ballast 164 located beneath the lowermost segment of the raft. The ballast is coupled with stitching and adhesives to the lowermost portion of the lower pneumatic tube 118 to define the shape of an inverted box for providing stability to the raft when deployed in the water.

Enlarged water entry holes 166 are provided in the flat bottom face of the ballast adjacent the periphery to permit the entry of water into the ballast to add weight and stability to the raft. Smaller holes 68 in a plane around the vertically extending upper periphery of the ballast are provided to permit the escape of air from the ballast zone during inflation with water so that water may be accommodated into the ballast to provide a stabilizing support to the raft while in operation.

The low-profile, cross-sectional configuration of the ballast is utilized to maximize the weight of the water adjacent the center of the raft to thereby minimize weight adjacent the edges of the raft for improved stability In operation this particular cross-sectional configuration will hold about 2036 lbs of sea water and exert a stress of about 5.96 pounds per linear inch along its line of connection with the lowermost pneumatic tubes. Greater ballast weight and stress forces may cause separ- ation of the ballast material from the raft during turbulent water with the result of overturning of the raft.

Because of the shape of the ballast and upper shield, these raft components are preferably formed as a series of overlapping and tailored

segments. The segments are coupled together with conventional adhesives known for firmly holding together the rubberized cloth of which the segments are preferably constructed.

Shown in the Figures 8-10 is the second alternate embodiment of the inventive life raft. In Figure 8 the life raft is seen floating on the water 212 in which is is located. The water line is designated by number 214. A pair of pneumatic tubes, upper tube 216 and lower tube 218, are pneumatically separate but physically joined by stitching and adhesives as at 220 to provide the buoyancy for the raft in which survivors of a disaster may find safety.

The life raft 210 is normally carried in an uninflated condition until need for operation is required. At that time a bottle 222 of a compressed gasseous fluid, such as carbon dioxide, mounted by strap 224 on the lower tube 218 is activated through appropriate valves 226 and 228 to inflate both tubes simultaneously. Regulators of known fashion, operated in the lines and valves may be utilized to insure proper inflation but prohibit under inflation.

As can be more readily seen in Figure 9 and 10, a floor 230 is provided for the raft occupants. The floor is located within the peripheral confines of the pneumatic rings and is constructed of a single layer 232 of rectangular shaped, rubberized fabric.

The floor for the raft occupants is constructed so that the outermost edges are coupled through adhesives and stitching to the region between the uppermost and lowermost faces of the

pneumatic tubes 216 and 218 in an air tight manner to preclude water from entering the raft from between the tubes.

The floor 230 is constructed of upper and lower layers 232 and 234 of ractangular shaped, rubberized fabric joined together with stitching sufficiently loose to permit air to flow therethrough and shaped to form adjacent sections 240, 242, 244 and 246. Inflation of the floor may be achieved through a supplemental hand pump or the like, acting through a valve 248 in the upper layers 232 whereby inflation of one of the floor sections 240 will fill the others through a series of interconnecting passageways between the stitching in the tubes.

Upper support tubes 250 are pneumatically coupled at each end with the upper tube 216 to be inflated upon the automatic inflation of the upper tube 216. The purpose of the upper support tubes 256, of which there are two in number, is to provide support for an upper shield 258 adapted to protect occupants from exposure to the elements. This upper sheild is provided with a least one door 260 which the survivors can open through zippers or other appropriate closure means to permit movement of the survivors into or out of the raft.

A single lower support tube 252 is formed in the shape of a V as a supplemental pneumatic member located beneath the lowermost surface of the lower tube 218. Tube 252 extends downwardly at an angle at each end from the sides of lower tube 218 and is pneumatically coupled with the lower surface of the lower tube 218. The ballast zone for receiving water is thus formed between the floor 230, lower tube 218 and sheet material of ballast 264. The purpose of the lower support tube is to

inflate with tube 218 and thereby positively, downwardly expand the inverted ballast 264 located beneath the lowermost segment of the raft. The ballast is coupled with stitching and adhesives to the lowermost portion of the upper pneumatic tube 216 to define the shape of an inverted box with a pyramid shaped cross-section for providing stability to the raft when deployed in the water.

Enlarged water entry holes 266 are provided in a flat bottom face of the ballast adjacent the periphery to permit the entry of water into the ballast to add weight and stability to the raft. Smaller holes 268 in a plane around the vertically extending upper periphery of the ballast are provided to permit the escape of air from the ballast zone during inflation with water so that water may be accommodated into the ballast to provide a stabilizing support to the raft while in operation.

The low-profile, cross-sectional configuration of the ballast is utilized to maximize the weight of the water adjacent the center of the raft to thereby minimize weight adjacent the edges of the raft for improved stability In operation this particular cross-sectional configuration will hold about 768 lbs of sea water and exert a stress of about 2.6 pounds per linear inch along its line of connection with the lowermost pneumatic tubes. Greater ballast weight and stress forces may cause separa- tion of the ballast material from the raft during turbulent water with the result of overturning of the raft.

Because of the shape of the ballast and upper shield, these raft components are preferably formed as a series of overlapping and tailored segments. The segments are coupled together with con-

ventional adhesives known for firmly holding together the rubberized cloth of which the segments are preferably constructed.

While the instant invention has been described with regard to a preferred embodiment thereof, minor changes and variations will be apparent to one skilled in the art, but the invention is intended to be protected broadly within the spirit and scope of the appended claims.

CLAIMS

What is claimed is:

1. A life raft including pneumatic means adapted to provide buoyancy for the raft, a floor provided within the peripheral confines of the pneumatic means and sheet means depending beneath the pneumatic means to define, between the floor and the sheet means a ballast, a first series of holes located in the sheet means to permit the flow of water into the ballast and a second series of holes in the sheet means to permit the escape of air from the ballast.

2. The apparatus as set forth in claim 1 and further including means to positively urge the sheet means away from the floor.

3. The apparatus as set forth in claim 1 wherein the ballast is of a low profile to cause forces between the sheet and pneumatic means of no more than 15.75 lbs. per linear inch.

4. A life raft including pneumatic means adapted to provide buoyancy for the raft, a floor provided within the peripheral confines of the pneumatic means and sheet means depending beneath the pneumatic means to define, between the floor and the sheet means a ballast, holes located in the sheet means to permit the flow of water into the ballast and to permit the escape of air from the ballast and means to positively urge the sheet means away from the floor during inflation.

5. The apparatus as set forth in claim 4 wherein the ballast is of a low-profile to cause forces between the sheet and pneumatic means of no more than 15.75 lbs. per linear inch.

6. A life raft including ring-shaped pneumatic means adapted to provide buoyancy for the raft, a circular floor provided within the peripheral confines of the pneumatic means and sheet means in a cone-shaped configuration depending beneath the pneumatic means to define, between the floor and the sheet means a ballast, a first series of holes located in the sheet means to permit the flow of water into the ballast and a second series of holes in the sheet means to permit the escape of air from the ballast and inflatable means coupled with the pneumatic means to positively urge the sheet means away from the floor to assist in the self-filling of the ballast.

7. A life raft including rectangularly pneumatic tube means adapted to provide buoyancy for the raft, a rectangular floor provided within the peripheral confines of the tube means and box-shaped sheet means depending beneath the tube means to define, between the floor and the sheet means a ballast, a first series of holes located on the flat bottom-most face of the sheet means adjacent the periphery to permit the flow of water into the ballast and a second series of holes in the sheet means on the upstanding sides adjacent the tube means to permit the escape of air from the ballast and a plurality of further inflatable means pneumatically coupled with the tube means to positively urge the sheet means away from the floor to assist in the self-filling of the ballast.

8. The raft as set forth in claim 7 wherein said further inflatable means includes a downwardly extending member located at each corner of the pneumatic tube means.

9. The raft as set forth in claim 8 wherein said further inflatable means includes additional downwardly extending members located on the pneumatic tube means.

10. A life raft including rectangularly pneumatic tube means adapted to provide buoyancy for the raft, a rectangular floor provided within the peripheral confines of the tube means and sh~et means downwardly depending from the tube means to define, between the floor and the sheet means a ballast, a first series of holes located in the sheet means to permit the flow of water into the ballast and a second series of holes in the sheet means between the first series of holes and the tube means to permit the escape of air from the ballast and an inflatable means pneumatically coupled with the tube means to positively urge the sheet means away from the floor to assist in the self-filling of the ballast.

11 The raft as set forth in claim 10 wherein said additional inflatable means includes a member of a V-shaped orientation haaving its opposite ends jointed pneumatically to support side faces of the pneumatic tube means.

12. The raft as set forth in claim 11 wherein said pneumatic tube means includes two tubes joined together adjacent the area of joining to the sheet means.

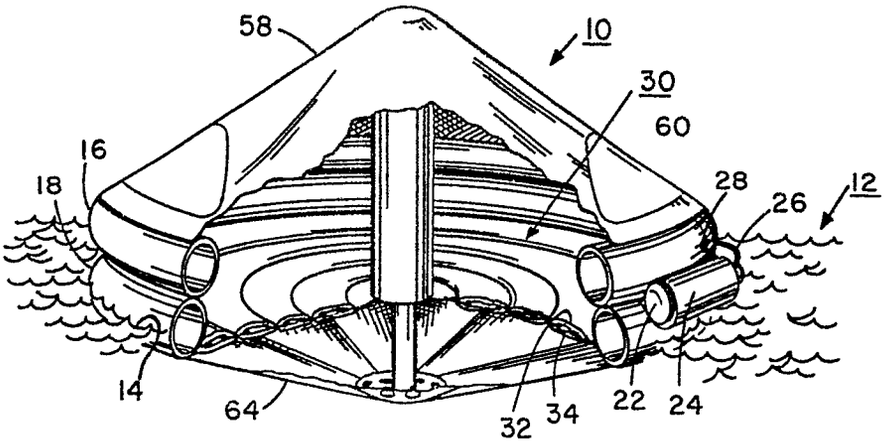
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FIG. 1

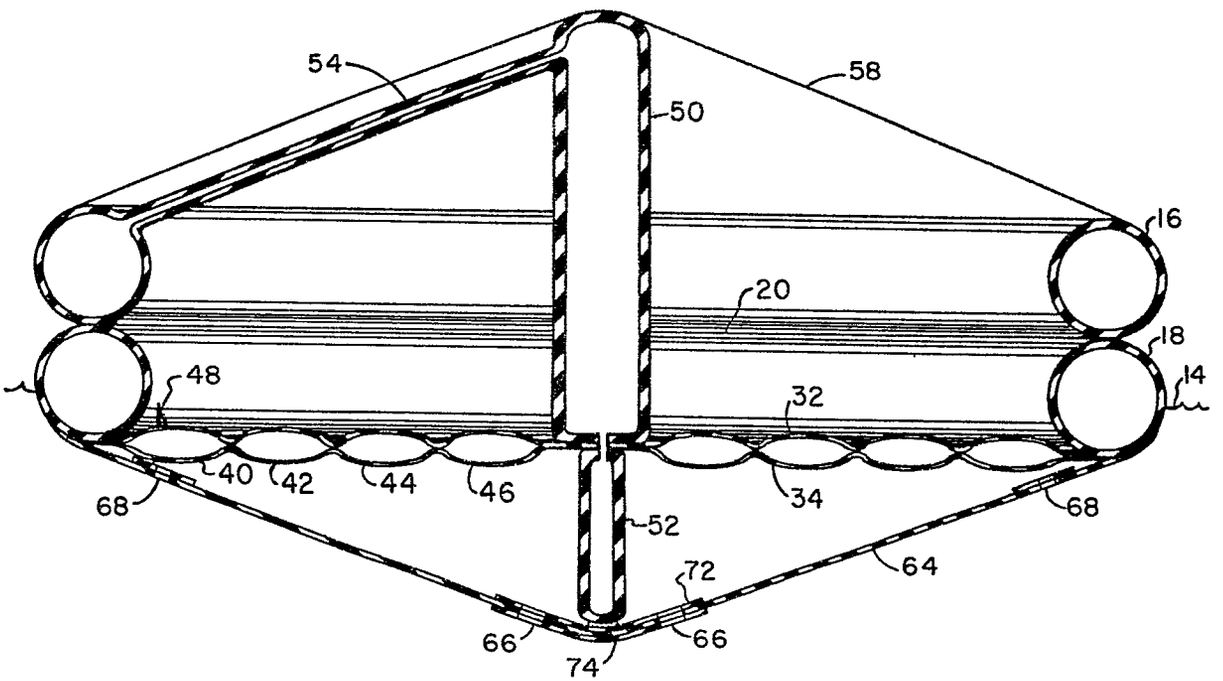
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FIG. 2

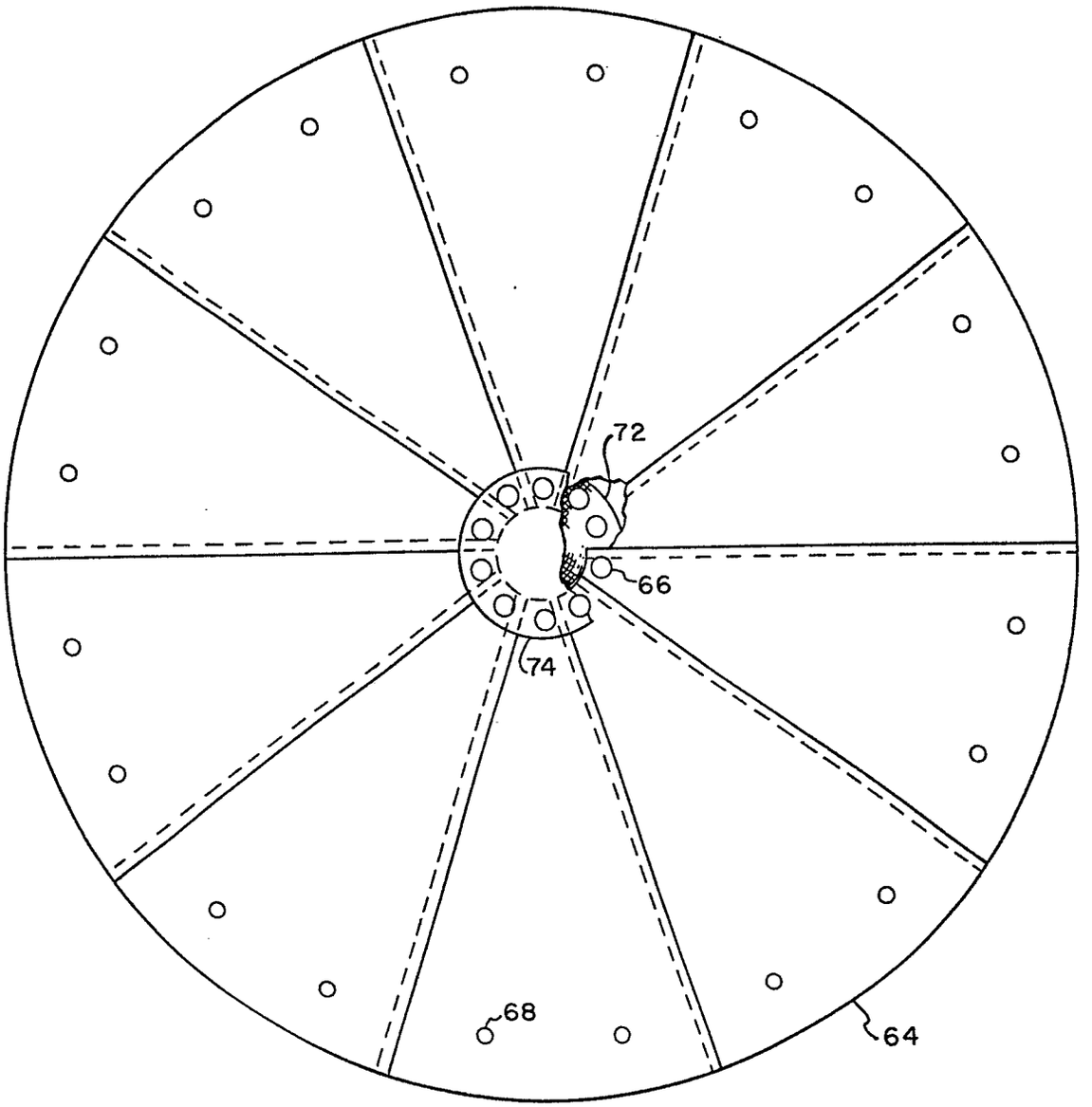

FIG. 3

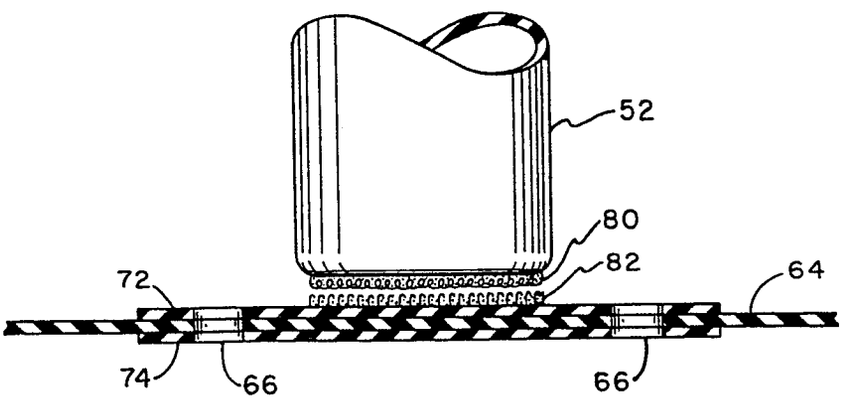

FIG. 4

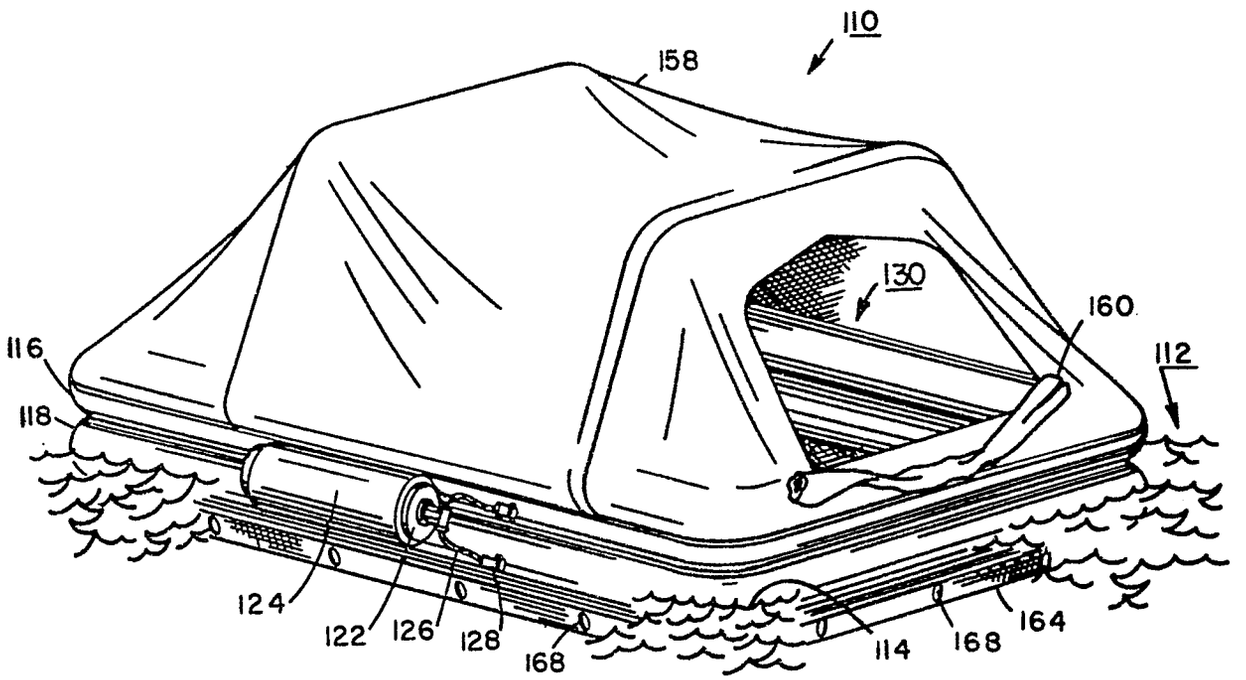

FIG. 5

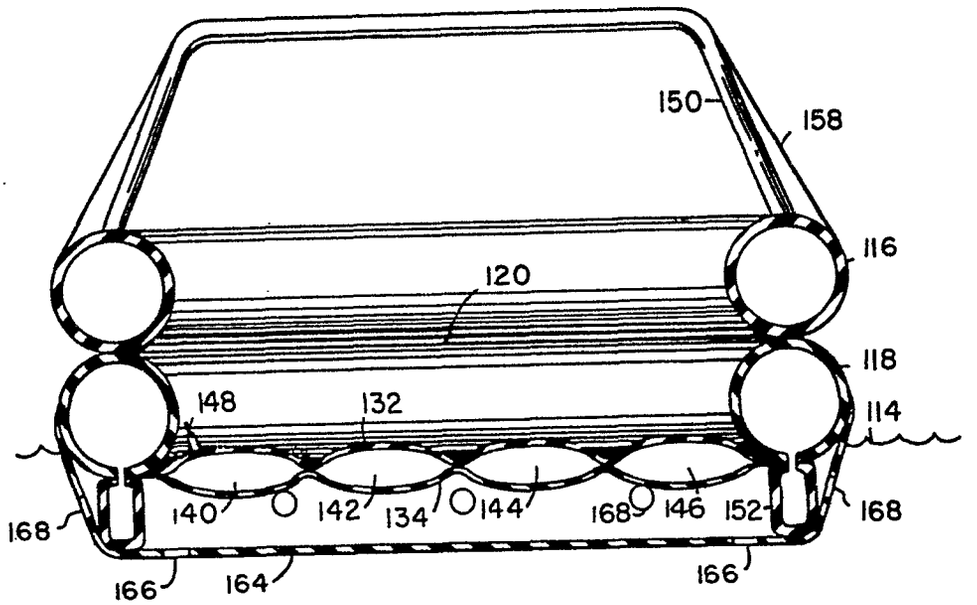
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FIG. 6

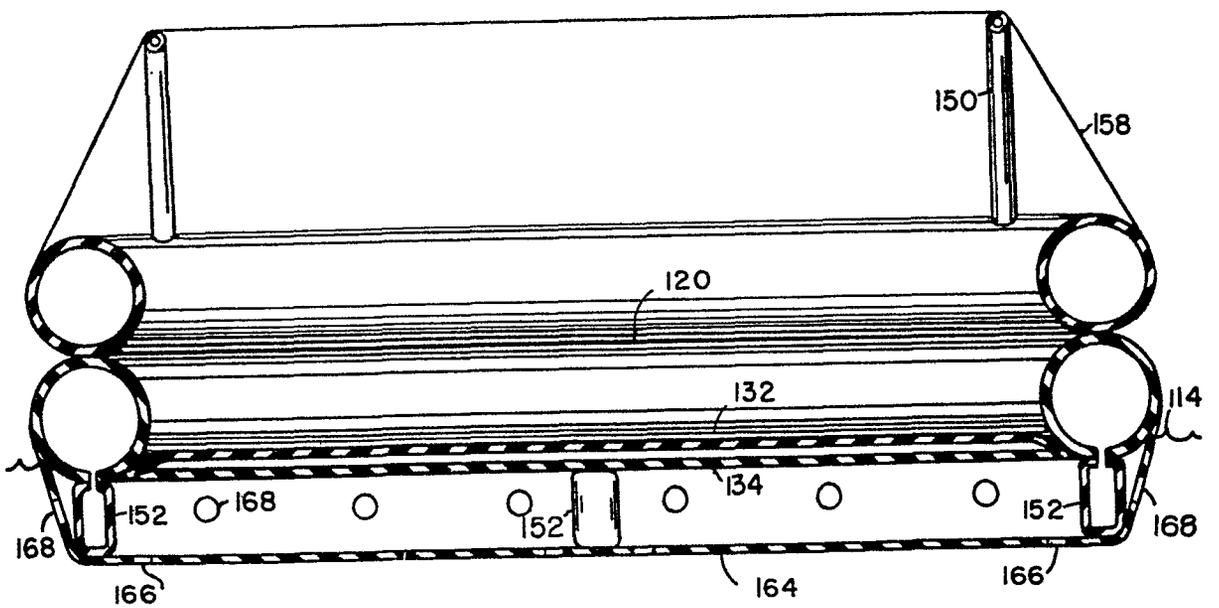
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FIG. 7

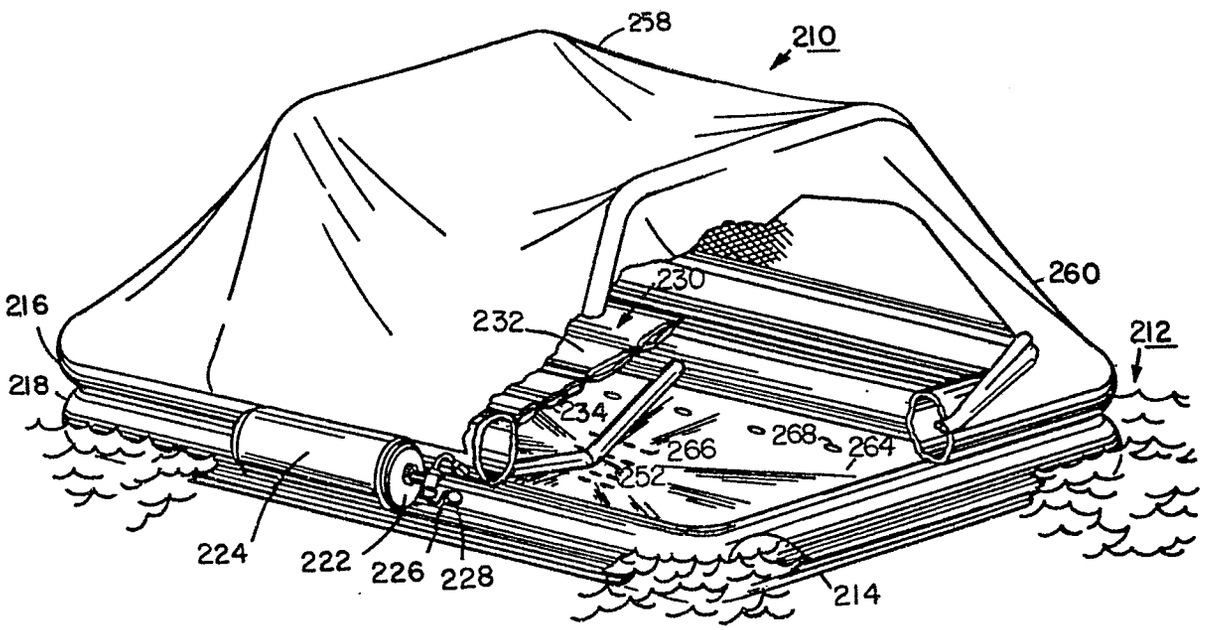
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FIG. 8

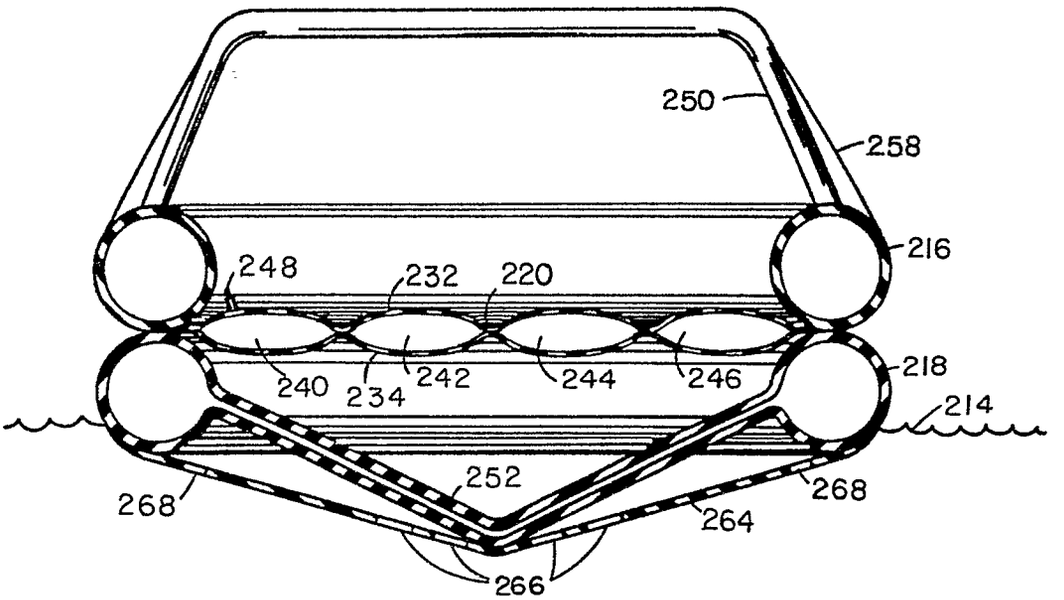
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FIG. 9

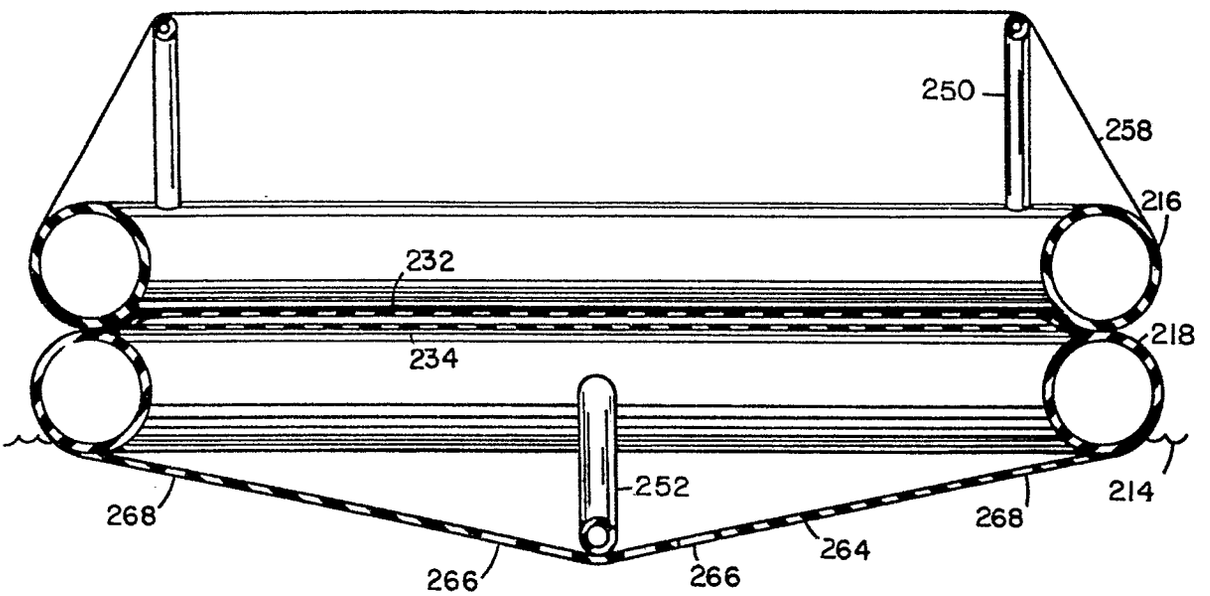
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FIG. 10