United States Patent

[11] **3,608,510**

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[73] Assignee **The United States of America as represented by the Secretary of the Navy**

[54] **COLLAPSIBLE PONTOON**
10 Claims, 9 Drawing Figs.

[52] **U.S. Cl.** **114/54**
[51] **Int. Cl.** **B63b 7/10**
[50] **Field of Search** ..... 114/54; 244/31; 2/2.1 A

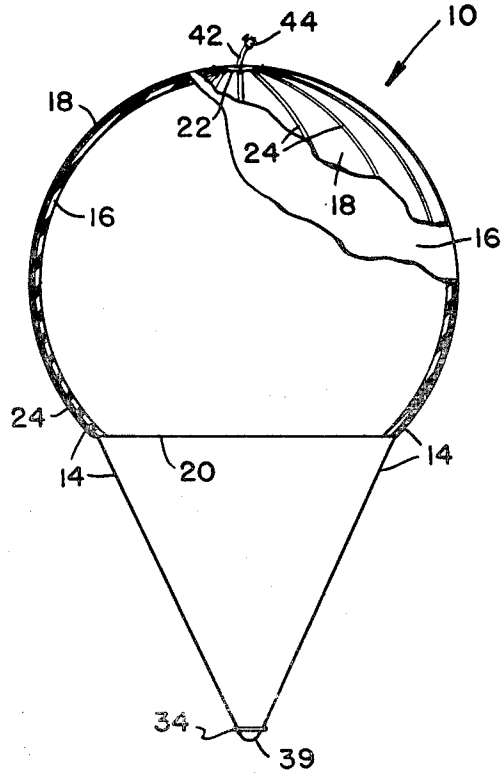
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ABSTRACT: A collapsible pontoon including a flexible metal cage composed of a series of spaced-apart cables an inner inflatable gas-impervious bag disposed within the metal cage and capable upon inflation of tightly engaging the cables of said cage; and an intermediate separate porous fabric bag located between the metal cage and the inflatable bag for providing support for the inflatable bag in the spaces between the cables of said metal cage.



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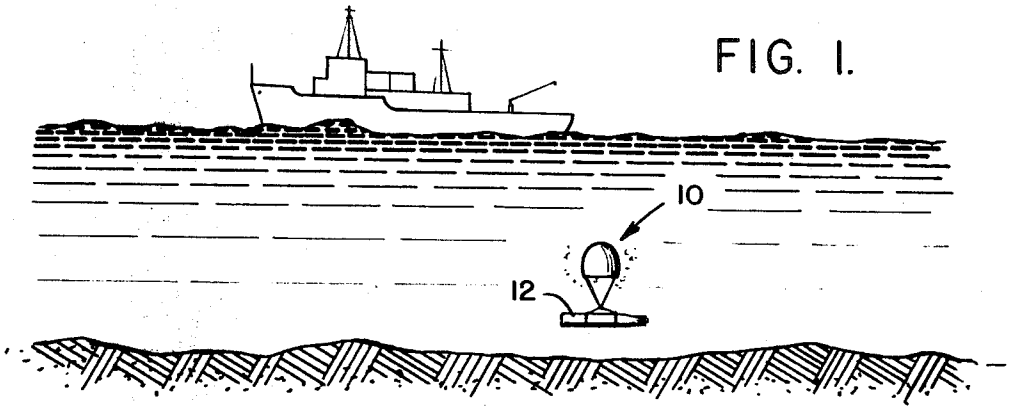


FIG. 1.

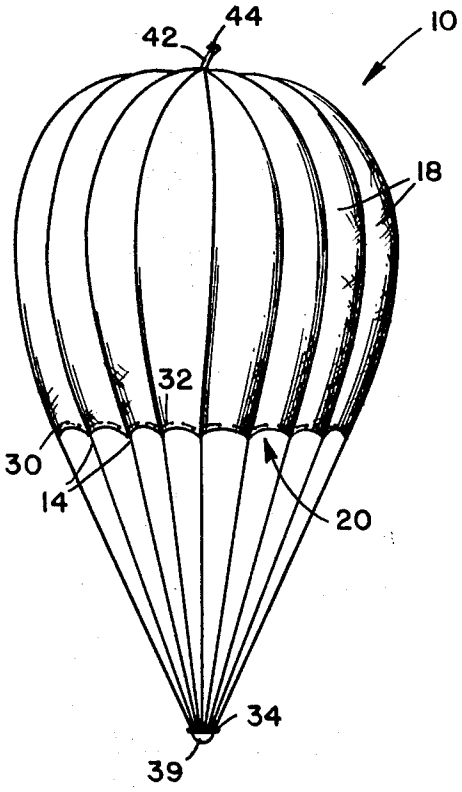


FIG. 2.

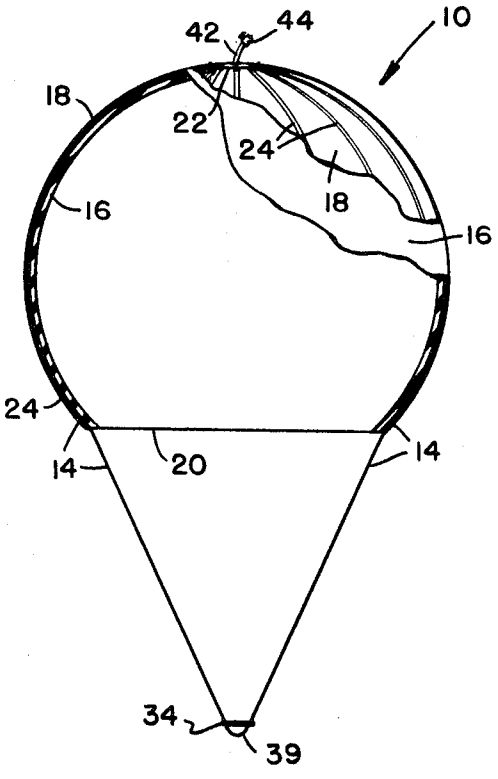


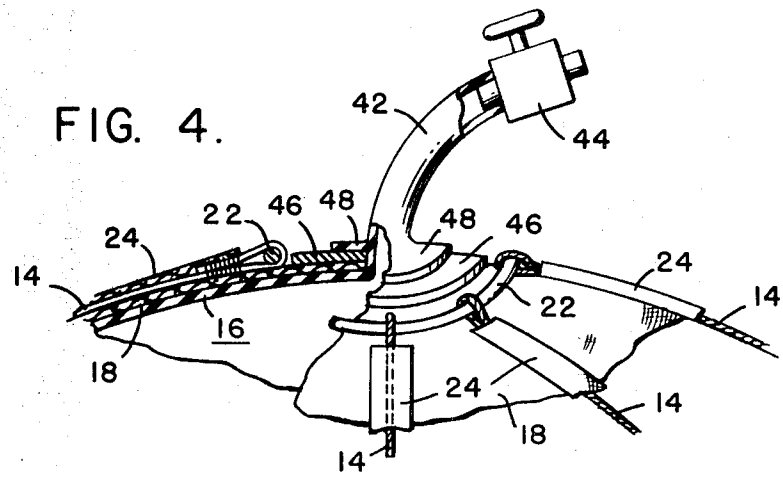
FIG. 3.

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FIG. 4.



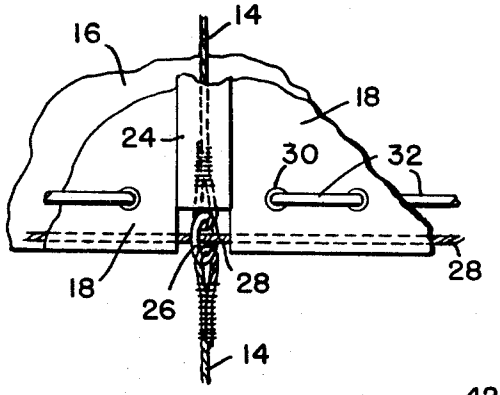


FIG. 5.

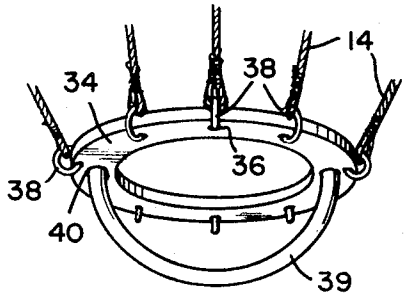


FIG. 6.

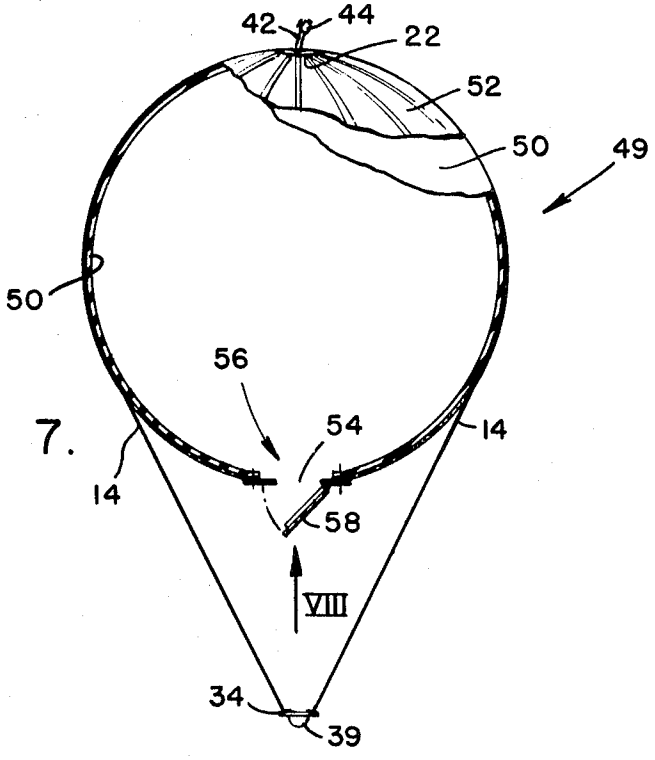


FIG. 7.

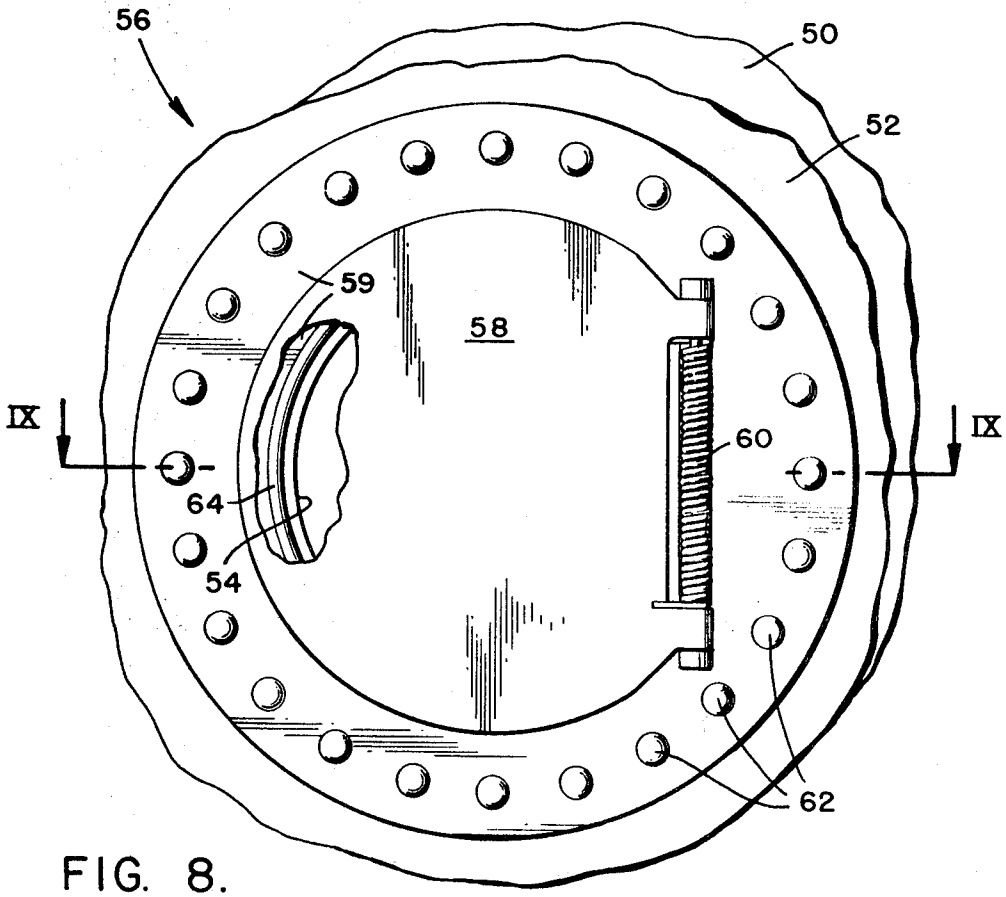


FIG. 8.

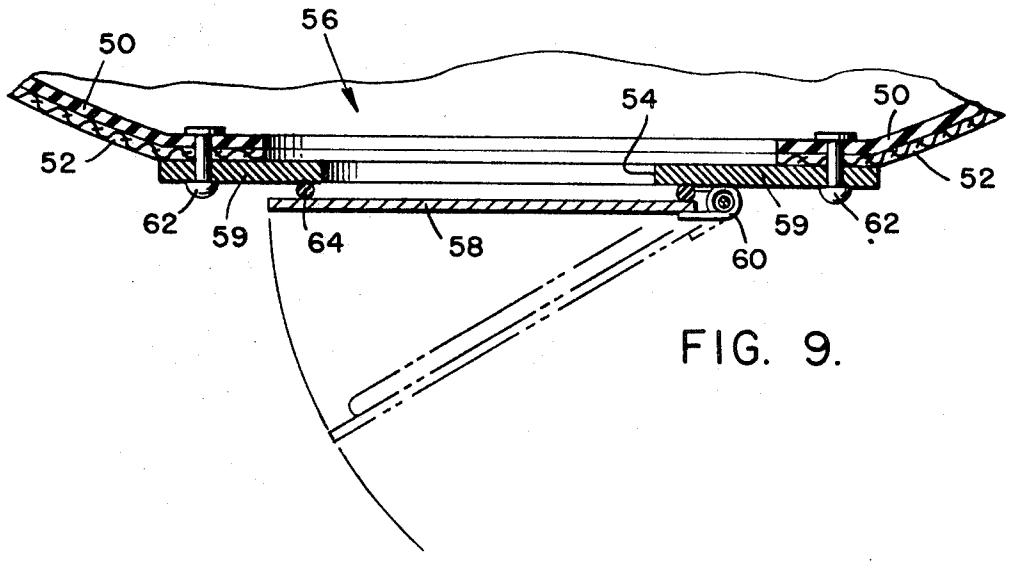


FIG. 9.

COLLAPSIBLE PONTOON

The invention described herein may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalties thereon or therefor.

Many prior art salvage pontoons have been constructed of an outer metal cage and an inner vulcanized bag which is composed of a combination of cloth and rubber. With time the vulcanized bag deteriorates and has to be replaced, thus requiring a major expense to maintain the salvage pontoon. Further, the vulcanized bag is heavy in weight, difficult to assemble in the metal cage, and cannot be easily folded for storage purposes.

The present invention has made many significant improvements over the prior art salvage pontoons. One such improvement overcomes the aforementioned problems of prior art salvage pontoons. This has been accomplished by providing two separate bags within the metal cage, one bag being an inflatable gas impervious bag and the other bag an intermediate porous fabric bag which is located between the metal cage and the inflatable bag. Accordingly, the fabric bag provides support for the inflatable bag between the spaces of the metal cage. By providing separate bags the replacement cost for a deteriorated inflatable bag has been lessened, and both bags are easier to handle and store.

The construction of the present salvage pontoon is also significantly improved over prior art salvage pontoons. Simple and unique provisions are provided for fastening the tops and bottoms of the bags to the metal cage. In one embodiment of the invention provision has been made for retaining air within the salvage pontoon when the pontoon surfaces and surges upwardly with its payload attached.

An object of the present invention is to overcome the aforementioned problems of prior art salvage pontoons.

Another object is to provide a salvage pontoon of greater versatility and improved construction.

Other objects and many of the attendant advantages of this invention will be readily appreciated as it becomes better understood by reference to the description and accompanying drawings which follow:

FIG. 1 illustrates a salvage pontoon in operation lifting a payload from the floor of the ocean;

FIG. 2 is a side view of an exemplary salvage pontoon;

FIG. 3 is a vertical cross section through the salvage pontoon of FIG. 2;

FIG. 4 is an enlarged detail of the top of the salvage pontoon of FIG. 2;

FIG. 5 is an enlarged detail of the salvage pontoon of FIG. 2 showing the bottom of the fabric bag fastened to one of the cables of the cage;

FIG. 6 is a detail of the salvage pontoon of FIG. 2 showing the connection of the bottoms of the cables of the cage;

FIG. 7 is a vertical cross section of another embodiment of the present invention;

FIG. 8 is a bottom plan view of the flapper valve assembly for the bottom of the salvage pontoon in FIG. 7; and

FIG. 9 is a cross-sectional side view of the flapper valve assembly of FIG. 8.

Referring now to the drawings wherein like reference numerals designate like or similar parts throughout the several views there is shown in FIG. 1 an exemplary salvage pontoon 10 which is in the process of lifting a torpedo 12 to a surface ship. As shown in FIGS. 2, 3, and 4 the salvage pontoon 10 includes a flexible cage 14, an inner inflatable gas impervious bag 16, which is disposed within the cage 14, and an intermediate separate porous fabric bag 18 which is located between the cage 14 and the inflatable bag 16. The cage 14 may be metal and may be constructed of woven wire or a series of gores or cables as shown in FIGS. 2 and 3.

It is desirable that the fabric bag 18 is slightly larger than the volume of the expanded cage 14 so that the fabric bag will bulge out in the spaces between the cables when the inflatable bag 16 is inflated. Such construction will reduce the tensile stress on the fabric bag as it supports the inflatable bag in the spaces between the cables of the cage. It is further desirable

that the inflatable bag 16 is slightly larger than the fabric bag 18 so that upon inflation the inflatable bag 16 is subjected to substantially no tension. For instance, if the inflatable bag 16 is constructed of rubber its size should be such that when it is inflated the rubber of the bag is not stretched. In the same manner, if the inflatable bag 16 is constructed of plastic there should be no tension on the plastic in the inflated condition. Such a construction enables the inflatable bag 16 to be made of very thin material so as to reduce weight, and overcome assembly and storage problems. I have found that a satisfactory construction for the salvage pontoon is to make the fabric bag 18 of canvas and the inflatable bag 16 entirely from rubber. The thickness of each of the bags may then be approximately one-sixteenth inch and the cables of the cage 14 may be approximately 1 foot apart at their widest spacing.

As shown in FIG. 3, the inflatable bag 16 and the fabric bag 18 each have a bottom opening 20. The cables of the cage 14 may be joined at common top and bottom locations. As shown in FIG. 4, the cables may be joined to a common top location by a top ring 22. Each of the cables 14 may pass about the ring 22 and may be fastened back upon itself.

The top of the fabric bag 18 may be fastened to the cables at their top location by a fastening means which includes the top ring 22, and with a plurality of sleeves 24 on the fabric bag 18 which receive the cables and extend downwardly from an abutting position with respect to the top ring 22. Each of the sleeves 24 may be a fabric strap which is stitched along its opposite edges to the exterior side of the fabric bag 18.

As shown in FIG. 5, the fabric bag 18 has a bottom edge which may be attached to the cables 14 intermediate the top and bottom locations of the cables by a bottom-fastening means. The bottom fastening means may include a plurality of rings 26; each cable 14 being broken at the location of a respective ring 26 and mutually joined to the ring by any suitable means such as extending through the ring and fastened back on itself; a bottom cable 28 connected to and extending about the bottom edge of the fabric bag 18 and through the rings 26; and the sleeves 24 of the fabric bag extending to abutting positions with respect to respective rings 26. The bottom cable 28 may be connected to the bottom edge of the fabric bag 18 by folding the bottom edge of the fabric bag back on itself about the cable 28 and then stitching the bag in this folded position. In order to connect the bottom edges of the inflatable and fabric bags 16 and 18 the bags may be provided with spaced eyelets 30 along their edges with lacing 32 extending through and between the eyelets 30.

As shown in FIG. 6, the bottoms of the cables 14 may be connected at their bottom location to a support ring 34. The support ring 34 may be provided with a series of transverse apertures 36 through which there extends a plurality of small rings 38. Each of the cables 14 may extend through a respective small ring 38 and may be fastened back upon itself. In order for the ring 34 to carry a payload a U-bolt 39 may extend through vertical apertures 40 in the ring and may be bolted from an opposite side (not shown).

As shown in FIG. 4, the inflatable bag 16 may be provided at its top with an outlet tube 42 which extends through the ring 22 and the fabric bag 18. Means, such as a valve 44, may be connected to the outlet tube 42 for opening and closing the tube. In this manner, air may be released from the salvage pontoon after the pontoon has delivered its payload to the surface of the water. In order to retain the tube 42 and the inflatable bag 16 in position a plate 46 may be disposed over the bags, and the outlet tube 42 may extend therethrough and may be provided with a small flange 48 which overrides the plate 46 and holds the outlet tube in position.

FIG. 7 illustrates another embodiment 49 of the invention and is similar to the first described embodiment. A primary exception is that the inflatable bag 50 and the fabric bag 52 are generally spherical. The bottoms of the bags 50 and 52 are provided with bottom openings 54 which are closed by spring-biased flapper valve 56. As shown in FIGS. 8 and 9 the flapper valve 56 may include a door 58 which is hinged to a plate 59

and biased to a closed position by a torsion spring **60**. The plate **59** may be bolted to the bags **50** and **52** by bolt and nut combinations **62**. One end of the torsion spring is fastened to the plate **59** and the other end is attached to the door **58**. The plate **59** has the bottom opening **54** and may be provided with a ringlike gasket **64** adjacent this opening for providing a seal for the door **58**.

The flapper valve provides a unique advantage by retaining air within the inflatable bag **50** when the salvage pontoon surfaces and surges a distance out of the water. The torsion spring **60** should be designed so as to just keep the door **58** closed when the salvage pontoon surges out of the water. For instance, assuming 40-foot high bags and a surge of 15 feet out of the water, the torsion spring **60** should be of sufficient strength to maintain a pressure within the inflatable bag **50** of about 7 lbs. per square inch greater than he water pressure at the flapper valve **56**. In this manner, the expanding air within the inflatable bag **50** can easily escape as the he salvage pontoon ascends and yet the flapper valve **56** will remain closed to maintain the buoyancy of the salvage pontoon when it surges out of the water upon surfacing with a payload.

It should be noted that one of the main advantages of the present invention is that an inner vulcanized bag has been eliminated. An inner inflatable bag can now be provided from a homogeneous material such as rubber or plastic. In this manner the inflatable and fabric bags can be constructed of thin material and the inflatable bag can be replaced at a relatively low cost upon deterioration. Further, a diver can easily assemble and handle the bags during operation.

Obviously many modifications and variations of the present invention are possible in the light of the above teachings. It is therefore to be understood that within the scope of the appended claims the invention may be practiced otherwise than as specifically described.

I claim:

1. A collapsible pontoon comprising:
a flexible cage;
an inner inflatable gas impervious bag disposed within the cage and capable upon inflation of tightly expanding against said cage;
an intermediate separate porous fabric bag located between the cage and the inflatable bag for providing support for the inflatable bag in the spaces between the cage; and
the inflatable bag being slightly larger than the fabric bag so that upon inflation the inflatable bag is subjected to substantially no tension.

2. A collapsible pontoon as claimed in claim **1** wherein:
the fabric bag is slightly larger than the volume of the expanded cage so that the fabric bag will bulge out in the spaces between the cage when the inflatable bag is inflated therein.

3. A collapsible pontoon as claimed in claim **1** wherein:
the inflatable bag and the fabric bag each have a bottom opening.

4. A collapsible pontoon as claimed in claim **3** including:
a spring-biased, flapper valve mounted at the bottom openings of the bags for closing said bags.

5. A collapsible pontoon as claimed in claim **3** wherein:
the cage comprises a series of cables which are joined at common top and bottom locations; and including:
a top means for fastening the top of the fabric bag to the cables at their top location, the top-fastening means including:
a top ring connecting the cables at their top locations; and
the fabric bag having a plurality of sleeves which receive the cables and extend from an abutting position with respect to said top ring.

6. A collapsible pontoon as claimed in claim **5** wherein:
the fabric bag is slightly larger than the volume of the expanded cage so that the fabric bag will bulge out in the spaces between the cables when the inflatable bag is inflated therein.

7. A collapsible pontoon comprising:
a flexible cage;
an inner inflatable gas impervious bag disposed within the cage and capable upon inflation of tightly expanding against said cage;
an intermediate separate porous bag located between the cage and the inflatable bag for providing support for the inflatable bag in the spaces between the cage;
the inflatable bag being slightly larger than the fabric bag so that upon inflation the inflatable bag is subjected to substantially no tension;
the inflatable bag and the fabric bag each having a bottom opening;
the cage comprising a series of cables which are joined at common top and bottom locations, and a top means for fastening the top of the fabric bag to the cables at their top location;
the top-fastening means including a top ring connecting the cables at their top locations and further including the fabric bag having a plurality of sleeves which receive the cables and extend from an abutting position with respect to the top ring;
the fabric bag being slightly larger than the volume of the expanded cages so that the fabric bag will bulge out in the spaces between the cables when the inflatable bag is inflated therein; and
said fabric bag having a bottom edge which is attached to the cables intermediate the cables top and bottom locations by a bottom-fastening means, said bottom-fastening means including: a plurality of bottom rings; each cable being severed at the location of a respective ring and mutually joined to the ring; a bottom cable connected to and extending about the bottom edge of the fabric bag and through the bottom rings; and said sleeves of the fabric bag extending to abutting positions with respect to respective rings.

8. A collapsible pontoon as claimed in claim **7** including:
lacing connecting the bottom edges of the inflatable and fabric bags.

9. A collapsible pontoon as claimed in claim **7** wherein:
the inflatable bag consists essentially of rubber.

10. A collapsible pontoon as claimed in claim **7** wherein:
a plate is disposed over the top of the bags and is located within said top ring;
the inflatable bag has an outlet tube at its top which extends through the fabric bag, the plate, and said ring;
said outlet tube having a flange which is spaced from the inflatable bag; and
said plate and the top of the fabric bag being disposed in the space between said flange and the inflatable bag so that the inflatable bag will be retained in position.