United States Patent [19]

Knaus et al.

[11] **3,779,196**

[45] **Dec. 18, 1973**

[54] **TOWABLE FLOATING STORAGE CONTAINER**

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[73] Assignee: **The Goodyear Tire & Rubber Company**, Akron, Ohio

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[21] Appl. No.: **274,369**

[52] **U.S. Cl.** ..... **114/74 T**, 114/.5 T

[51] **Int. Cl.** **B63b 35/00**

[58] **Field of Search** ..... 114/.5 T, 74 R, 74 T

[56] **References Cited**

UNITED STATES PATENTS

3,067,712	12/1962	Doerpinghaus	114/74 T
2,748,739	6/1956	Monti et al.	114/74 R
2,391,926	1/1946	Scott	114/74 T
2,492,699	12/1949	Houwink	114/.5 T
3,056,373	10/1962	Hawthorne et al.	114/74 T

FOREIGN PATENTS OR APPLICATIONS

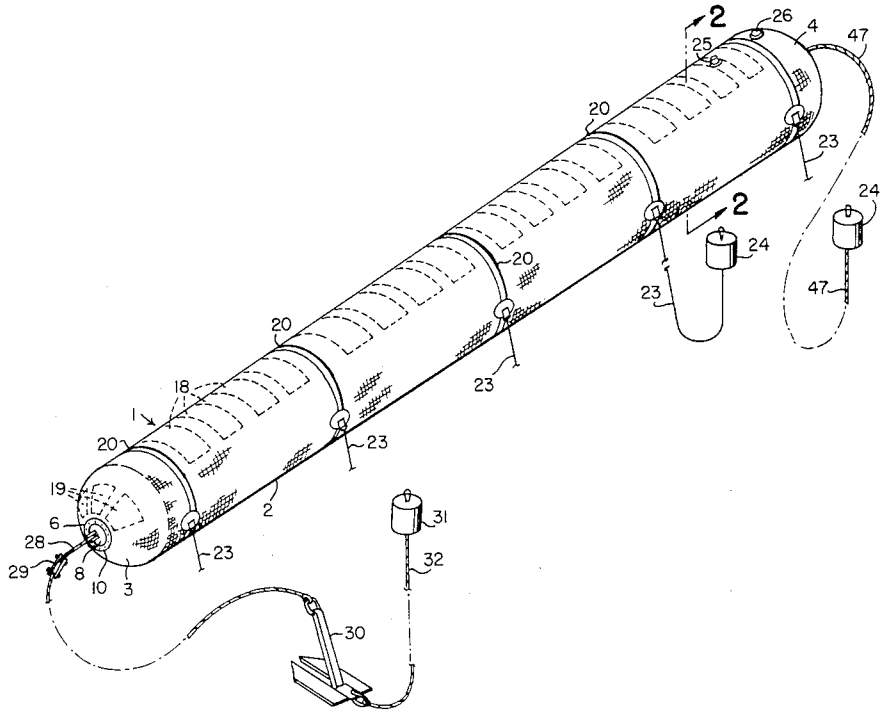
981,167	1/1965	Great Britain	114/74 T

Primary Examiner—Trygve M. Blix
Assistant Examiner—Stuart M. Goldstein
Attorney—F. W. Brunner et al.

[57] **ABSTRACT**

A floating, towable container for liquid comprising an elongated flexible walled body portion shaped like a truncated cone tapering from a smaller diameter at the front end to a larger diameter at the rear end and having hemispherical end portions integral with the body. Rigid end closure fittings having towline attachments are mounted in centrally located holes in each end portion. The rear fitting has a filler and discharge opening. Buoyant material is located inside the body portion along the top of the container. Mooring line attachments are spaced along each side of the container.

10 Claims, 8 Drawing Figures



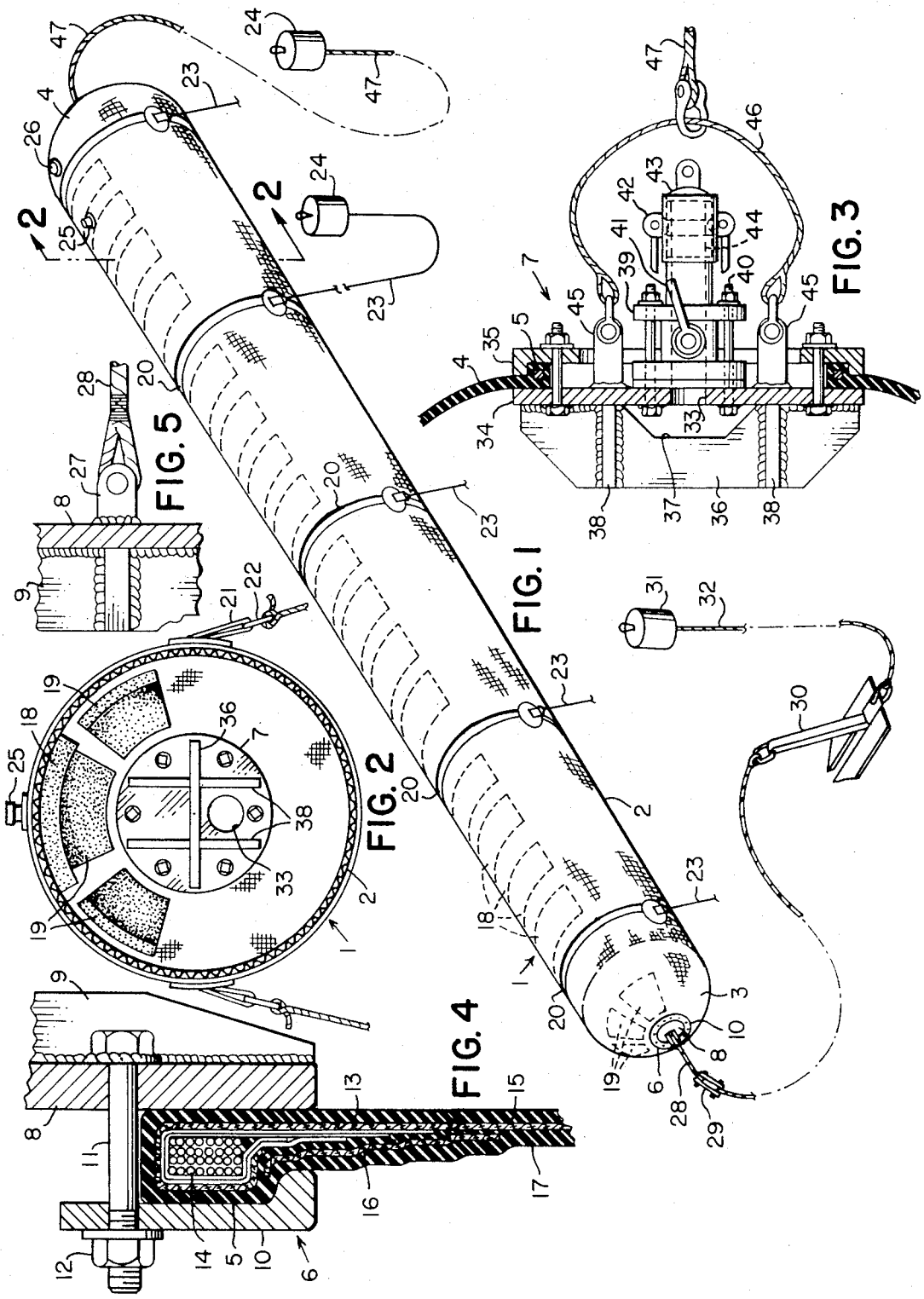


FIG. 1
FIG. 2
FIG. 3
FIG. 4
FIG. 5

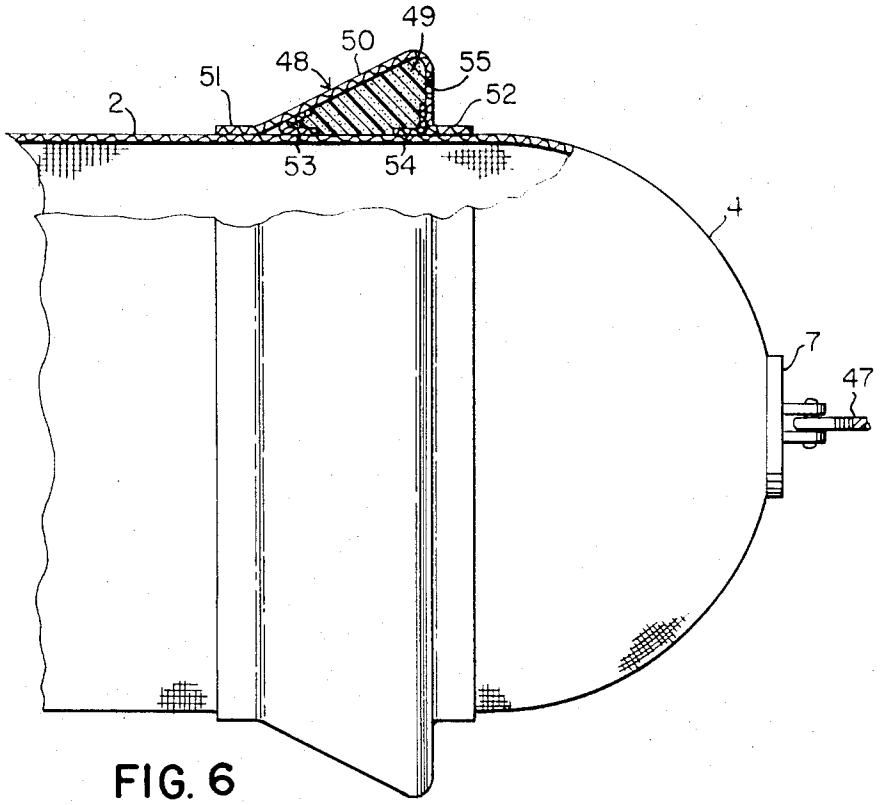


FIG. 6

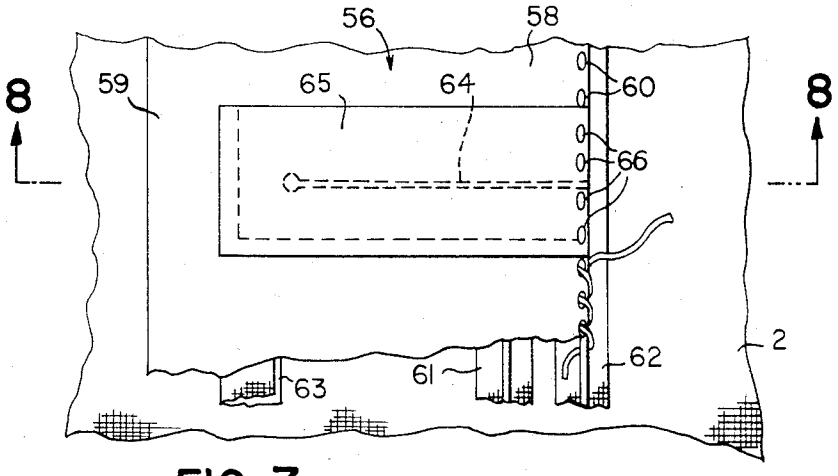


FIG. 7

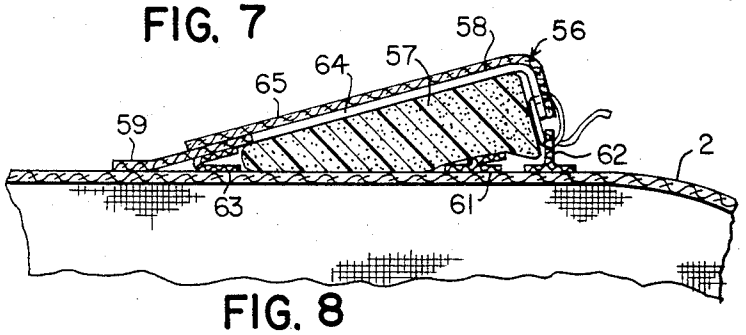


FIG. 8

TOWABLE FLOATING STORAGE CONTAINER

This is a continuation-in-part of my co-pending U.S. Pat. application Ser. No. 184,753 filed Sept. 29, 1971. The invention herein described was made in the course of or under a contract or subcontract thereunder, with the Department of Transportation.

This invention relates to a floating, towable container for transporting oil or other liquid on waterways.

BACKGROUND OF THE INVENTION

The problem of uncontrolled oil spills from damaged tankers has, in recent years, caused a large-scale pollution problem in the ocean and shoreline areas. In order to alleviate such problems, it is necessary to provide some type of container which can be quickly and easily deployed at the scene of a distressed tanker and can serve as a container for oil which has either spilled on the water or must be removed from the damaged tanker. There are various types of flexible walled, towable containers known in the prior art. A typical example of such container is shown in U.S. Pat. No. 3,067,712 issued to E H Doerpinghaus. One of the problems encountered with many towable containers of the flexible walled type is the problem of stability during towing of the container, particularly when subjected to high waves. Many shapes of containers tend to yaw and otherwise move about when they are towed through the water and such movement creates undesirable stresses in both the towlines and in the container itself.

OBJECTS OF THE INVENTION

It is a primary object of this invention to provide a towable container which is stable when being towed through the water. This and other objects of the invention will be more fully apparent as the description proceeds in the following specification and the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view showing the overall configuration of the towable container of the invention;

FIG. 2 is a cross-sectional view taken on line 2—2 of FIG. 1;

FIG. 3 is a top plan view showing the rear end closure fitting of the container;

FIG. 4 is an enlarged fragmentary cross-sectional view showing a typical reinforced bead portion onto which the end closure fittings are attached;

FIG. 5 is a fragmentary view showing a portion of the front end closure fitting with a towline attached thereto;

FIG. 6 is a fragmentary side elevational view showing the rear end of the container with a drag skirt;

FIG. 7 is a fragmentary plan view showing a portion of an adjustable drag skirt; and

FIG. 8 is a cross-sectional view taken on line 8—8 of FIG. 7.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to FIG. 1, the towable container is indicated generally by the numeral 1. The container 1 has an elongated body portion 2 shaped like a truncated cone and tapering from a smaller diameter at the front end to a larger diameter at the rear end. The front end has a hemispherical, flexible end portion 3 and the rear

end has a similar hemispherical end portion 4 which is substantially the same as the end portion 3 except that it is larger in diameter to accommodate the larger end of the body portion.

In normal manufacture, the body portion 2 and the end portions 3 and 4 are made as an integral unit with no circumferential seams between the body and end portions. For the sake of simplicity in the drawings, no seams have been shown; however, it should be mentioned that the body portion and the end portions are made up of a series of longitudinal strips of material, preferably square-woven nylon cloth coated with material such as polyurethane or the like, and are assembled in a manner similar to that used in the production of pillow tanks. To provide additional strength, the seams are fastened both by sewing and by adhesive.

Each end of the container has a centrally located opening surrounded by a reinforcing bead portion 5 as shown in FIGS. 3 and 4 to which rigid end fittings are attached. A front end fitting 6 is attached at the front of the container and a rear end fitting 7 is attached at the rear of the container. The front end fitting 6 has a circular plate 8, the periphery of which engages the inner side of the bead portion 5 as shown in FIG. 4. A series of reinforcing ribs 9 are welded perpendicular to the plate 8 to provide additional strength. A clamping ring 10 having an L-shaped cross-section is clamped around the bead portion 5 on the outside and is fastened to the plate 8 by bolts 11 which have their heads welded to the plate 8 and receive nuts 12 on the opposite end for retaining the clamping ring 10 in position against the bead 5. The bead 5 is constructed by first passing a series of reinforcing cords 13 around a wire bead ring 14 and then by wrapping a portion of the reinforcing fabric 15 of the container around the bead ring 14 and the reinforcing cords 13. An additional outer fabric reinforcement strip 16 may be placed on the outer surface of the bead portion 5 to provide a transition between the thick portion of the bead and the thinner wall of the container. The entire bead is covered both inside and out with a layer 17 of polyurethane or other suitable elastomeric material. The bead ring with the reinforcing cords 13 wrapped thereabout may be made and molded as an integral unit before attaching the layers 15 of reinforcing fabric. While FIG. 4 shows a bead at the front of the container, the construction of the bead at the rear of the container is identical and will not be described separately.

A series of buoyant pads 18 are positioned along the top of the container 1 on the inner surface of the container wall. The pads 18 are preferably made of a closed cell, vinyl foam but may also be made of any suitable buoyant material. The pads 18 may be adhered to the wall by an adhesive and if desirable, may be covered by a suitable covering. A set of tapered buoyant pads 19, similar to the pads 18, are located at each end of the container. The pads 18 and 19 provide a neutral buoyancy that causes the container 1 to float on the water when empty while it is being deployed. For example, the container is normally packaged in such manner that it can be dropped by parachute over the area that it is to be used. The package is provided for a means of automatically releasing the container from its packaged condition and the container will then float on the surface of the water until it is connected to a tanker or otherwise filled with liquid. After the container is filled,

the pads 18 and 19 serve to hold the container in an upright position.

The container 1 has a series of circumferential bands 20 spaced apart at various locations along the length of the body portion 2. Attached to the bands 20 on each side are loops 21 which carry "D" rings 22 to which mooring and lifting lines 23 may be attached. Each of the lines 23 carries a buoy 24 to aid in retrieving the lines in the water. The mooring and lifting lines 23 are used primarily for handling or mooring the container. A vent 25 is located at the top of the container near the rear end for permitting the escape of air and vapors from the interior of the container. Also located on the top of the container 1 is a beacon light 26 which aids in locating the container when it is towed at night. The beacon light 26 is preferably a battery-operated light which is activated upon impact with the water. The front end fitting 6 as previously described, has a centrally located bracket 27 welded to the plate 8 for receiving a towline 28. The towline has a failsafe link 29 which is designed to break before any damage can be done to the fitting 6 or to the flexible portion of the container 1 which would result in spillage of oil or other liquid from the container. An anchor 30 is connected to the end of the towline 28 prior to the deployment of the container and is used to retain the container in the proximity of the tanker until it is towed to the tanker for filling and/or until it is ready to be towed away. At this time the anchor is removed and the end of the line 28 is attached to a towing vessel. A buoy 31 is attached by a line 32 to the anchor 30 to aid in locating it.

Referring now to FIGS. 2 and 3 which show the details of the rear end fitting, it may be seen that the rear fitting 7 differs primarily from the front fitting 6 in that it has a filling and discharge opening 33 located in a plate 34 which is similar to the plate 8 on the front fitting 6. The fitting 7 is attached to the bead 5 by a clamping ring 35 which is bolted to the plate 34 in the same manner as the clamping ring 10 on the fitting 6. The fitting 7 has a centrally located reinforcing rib 36 with an opening 37 adjacent the filler opening 33 to permit the flow of liquid coming through the opening 33 to be easily distributed into the interior of the container. A pair of reinforcing ribs 38 are positioned perpendicular to the rib 36. The ribs 36 and 38 are all welded to the plate 34 and to each other to provide a rigid assembly. Other reinforcing rib patterns may be used and a different number of ribs may be used depending upon the size of the plate 34 and the structural requirements of the fitting. Additional openings serving the same function as the opening 37 may be located in the other ribs of the assembly. A valve assembly 39 is fastened to the plate 34 by a plurality of bolts 40. The valve assembly 39 has a conventional butterfly-type valve 41 and a conventional cam-lock device 42 which secures an end plug 43 in the central opening 44 of the fitting which communicates with the opening 33 in the plate 34. When it is desired to fill or empty the container, the plug 43 is removed and is replaced by a hose fitting which is locked in position by the cam lock in the same manner as the plug 43. A pair of brackets 45 provides a means for attaching a line 46 which forms a loop for receiving a rear mooring and maneuvering line 47. A locating buoy 24 similar to those used on the lines 23 is attached to the line 47. In the event that the container cannot be towed from the front towline 28, it can also be towed by attaching a line to the line 46 on the rear fitting 7. However, because of the taper of the container, there is much greater stability obtained when the container is towed from the front fitting 6 since the taper affects the manner in which the container performs in the water. The larger diameter at the rear of the container causes a certain amount of drag which tends to stabilize the container when it is being towed. In some instances, to further improve stability of the container when towed, it may be desired to attach a drag skirt or flow separator around the stern or rear end of the container. Such a skirt would be in the form of an annular ring surrounding the container.

A typical fixed drag skirt 48 is shown in FIG. 6 encircling the body member 2 just forward of the hemispherical rear end portion 4. The details of the valve assembly 39 used in the rear fitting have been shown in FIGS. 3 and for the purpose of simplicity, will not be shown in FIG. 6.

The drag skirt 48 has a spacer ring 49 having a tapered cross-sectional shape which increases in thickness from the front to the rear edge thereof. When assembled on the body portion 2, the radially inner surface of the ring 49 lies against the outer surface of the body portion 2. The ring 49 is encircled by a cover sheet 50 which conforms to the outer surface of the ring 49 and has flaps 51 and 52 which extend beyond the front and rear edges of the ring 49 and are secured to the body portion 2 by a suitable adhesive or other means. Additional internal strips 53 and 54 may be secured to the cover sheet 50 and to the body portion 2 to further aid in securing the drag skirt 48 in position. The filler ring 49 is made preferably of compressible foam which permits the skirt 48 to be compressed when the container 1 is folded and packaged. A plurality of air vents 55 are provided on the cover sheet 50 to permit escape of air from the interior of the skirt 48 when it is compressed.

The drag skirt 48 in the non-compressed position operates as a fixed member in which the width-to-height ratio is set at some predetermined proportion which is determined by the characteristics required to properly stabilize the container during towing while providing a minimum amount of drag necessary for stabilization. A width-to-height ratio of 2 to 1 has been found to perform quite well. An increase in height relative to width increases the drag.

In some instances, it may be preferable to use a variable height skirt 56 such as the one illustrated in FIGS. 7 and 8 instead of the fixed skirt 48 in FIG. 6. The variable skirt 56 is designed to open at the rear of the skirt to permit insertion of different sizes of foam rubber spacers in order to vary the height of the skirt. The skirt 56 has a tapered spacer 57 held in position by a cover sheet 58 which is fastened to the body member 2 by a forwardly extending flap 59 and which has a row of grommet holes 60 along the rear edge of the sheet 58 to permit the sheet to be laced to either one of a pair of T-shaped grommet strips 61 and 62 which are fastened to the surface of the body member 2 by an adhesive or other suitable means. An internal reinforcement strip 63 may be positioned adjacent the forward flap 59 to further strengthen the attachment of the sheet 58 to the body member 2. When a spacer of greater height is placed beneath the sheet 58, the sheet is laced to the forward grommet strip 61. When a spacer of lesser height is used, then the sheet 58 is laced to the rear

grommet strip **62.** In order to permit the sheet **58** to expand radially outwardly to receive a higher spacer, a series of transverse slits **64** are cut in the sheet **58** and extend from the rear of the sheet to a point adjacent the forward flap **59.** The slits **64** are spaced substantially uniformly from each other around the circumference of the skirt **56.** Each slit **64** is covered by a cover flap **65** which is adhered to the cover sheet **58** along the front edge and one side edge of the flap. The cover flap **65** also has a series of grommet holes **66** along the rear edge thereof to permit the rear edge to be laced to the grommet holes **60** in the cover sheet **58** and to grommet holes in one of the grommet strips **61** or **62.** Thus, it may be seen that the cover flaps **65** will permit spreading of the fabric at the slits **64** to permit radial expansion of the cover sheet **58.** However, once a particular size of spacer is inserted, the rear edge of the cover flap **65** can be securely laced down as previously described to provide a smooth surface over the slit **64** and prevent tearing of the cover sheet at the slits due to the flow of water across the skirt **56** when the container is being towed through the water.

While a tapered or wedge-shaped drag skirt has been illustrated herein, it will be understood that it is possible to use drag skirts having other cross-sectional configurations which will also provide stabilization for the container. It appears, however, that a drag skirt of tapered configuration seems to provide a better water flow and give more efficient stabilization with a minimum of drag than do other configurations which may be used.

It will be understood that various materials could be used in the manufacture of the flexible container described herein and square-woven, nylon cloth coated with polyurethane has been given as one of the preferred embodiments. The end fittings for the sake of lightness in weight, are made preferably of aluminum; however, other suitable materials could also be used. Various other modifications can also be made in the various components of this container without departing from the scope of the invention.

We claim:

1. A floating container for transporting liquid on waterways comprising:

A. an elongated flexible walled body portion having substantially the shape of a truncated cone which has the smallest diameter at the front end thereof and which gradually increases in diameter toward the rear end;

B. a substantially hemispherical flexible walled end portion on each end of the body portion and integral therewith, each end portion having a centrally located opening therein, the hemispherical portion at the rear end being larger than the hemispherical portion at the front end;

C. a rigid closure fitting mounted in each of said openings, each fitting having a means for attaching a towline thereto;

D. at least one of the fittings having a filling and discharge opening therein; and

E. buoyant material located along the top of the body portion on the interior wall surface thereof to cause the tank container to float when empty.

2. A floating container as claimed in claim **1** including mooring line attachment means fastened in spaced apart relationship along each side of the body portion.

3. A floating container as claimed in claim **2** wherein the mooring line attachment means is secured to the body portion by flexible circumferential bands encircling the flexible body portion and adhered to the outer surface thereof.

4. A floating container as claimed in claim **1** wherein the end closure fittings have light reinforcing ribs on the inner side thereof and wherein at least part of the ribs have openings therethrough to facilitate liquid flow from the inlet opening into the container.

5. A floating container as claimed in claim **4** wherein the ribs are of sufficient height to hold the wall of the container a spaced distance from the inlet opening to prevent blockage of the opening by the container wall.

6. A floating container as claimed in claim **1** wherein the buoyant material is a closed cell foam.

7. A floating container as claimed in claim **1** including a drag skirt extending around the circumference of the body portion at the rear end thereof at substantially the location of the maximum diameter of the body portion.

8. A floating container as claimed in claim **7** wherein the drag skirt is tapered in cross section so that it becomes progressively higher from the front to the rear edge thereof.

9. A floating container as claimed in claim **8** wherein the height of the drag skirt is variable.

10. A floating container as claimed in claim **9** wherein the height of the drag skirt is varied by changing from one height of internal spacer to another.

* * * * *

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,779,196 Dated December 18, 1973

Inventor(s) Ernest Knaus, Francis M Milhoan

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 6, line 24, "light" should read --rigid--.

Signed and sealed this 4th day of June 1974.

(SEAL)
Attest:

EDWARD M.FLETCHER, JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents