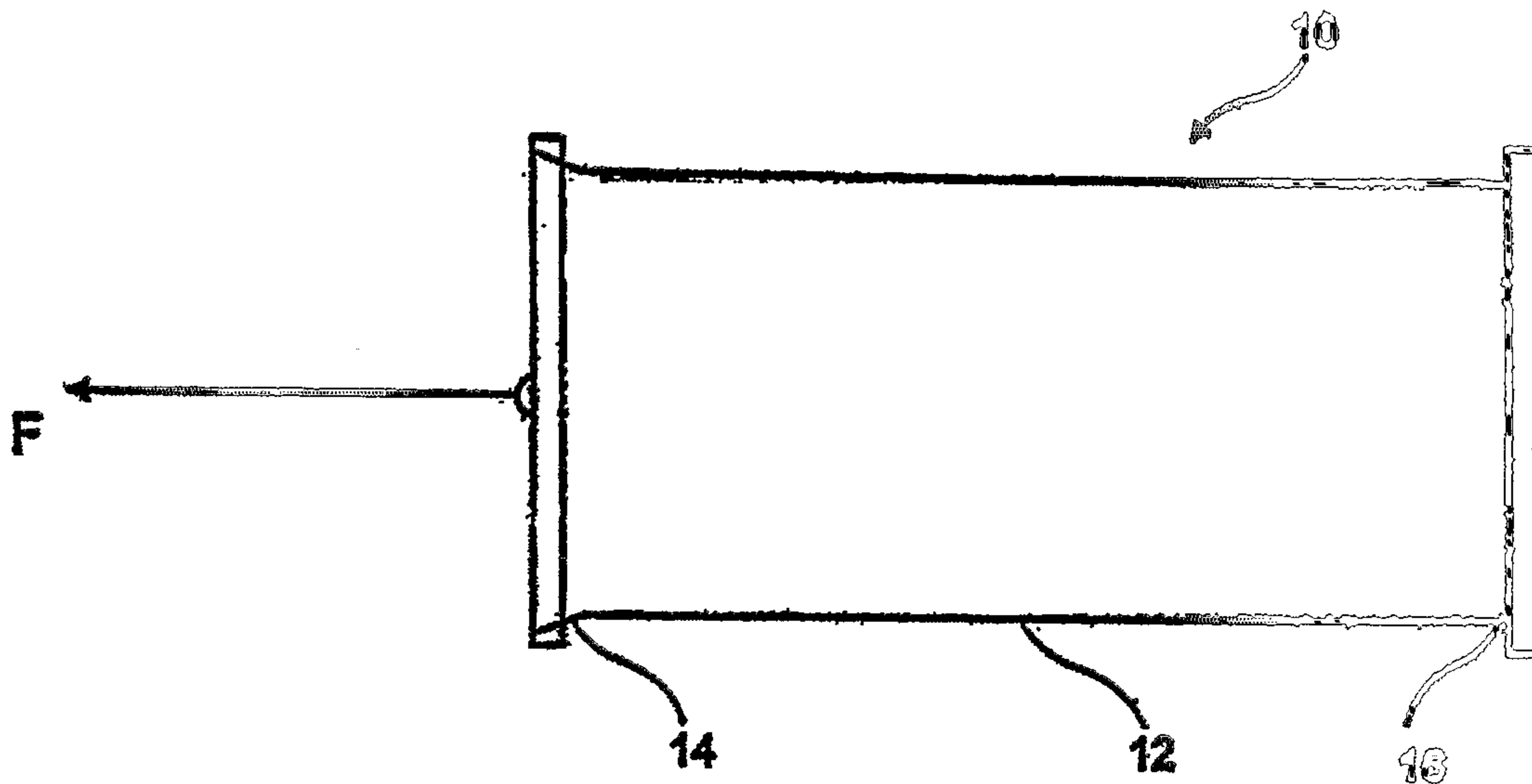




(86) Date de dépôt PCT/PCT Filing Date: 2004/01/12
(87) Date publication PCT/PCT Publication Date: 2004/08/12
(85) Entrée phase nationale/National Entry: 2005/07/15
(86) N° demande PCT/PCT Application No.: US 2004/000547
(87) N° publication PCT/PCT Publication No.: 2004/067442
(30) Priorité/Priority: 2003/01/21 (10/347,996) US

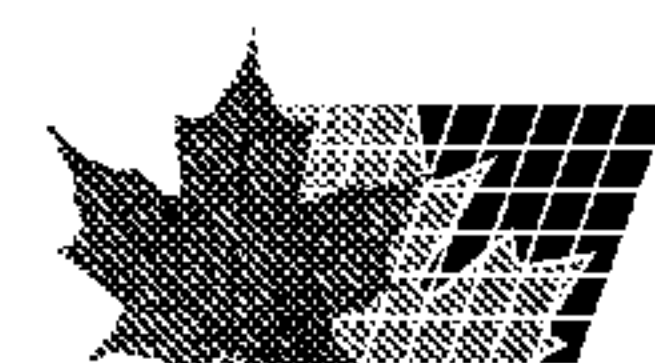
(51) Cl.Int.⁷/Int.Cl.⁷ B63B 25/08
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(54) Titre : RECIPIENT FLEXIBLE DE RETENTION DE FLUIDE CARACTERISE PAR UNE SOUDURE DU TYPE QUILLE
(54) Title: FLEXIBLE FLUID CONTAINMENT VESSEL FEATURING A KEEL-LIKE SEAM



(57) Abrégé/Abstract:

A flexible fluid containment vessel (FFCV) including at least one segment made up of a fabric. Two ends of the fabric are beaded and are joined together so as to form a generally cylindrical section. The interface along which the ends of the fabric are joined form a keel that serves to stabilize the completed FFCV when the FFCV is placed in water.



(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property
Organization
International Bureau



(43) International Publication Date
12 August 2004 (12.08.2004)

PCT

(10) International Publication Number
WO 2004/067442 A3

(51) International Patent Classification⁷: **B63B 25/08**

(21) International Application Number:

PCT/US2004/000547

(22) International Filing Date: 12 January 2004 (12.01.2004)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:

10/347,996 21 January 2003 (21.01.2003) US

(63) Related by continuation (CON) or continuation-in-part (CIP) to earlier application:

US 10/347,996 (CIP)

Filed on 21 January 2003 (21.01.2003)

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(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US (patent), UZ, VC, VN, YU, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

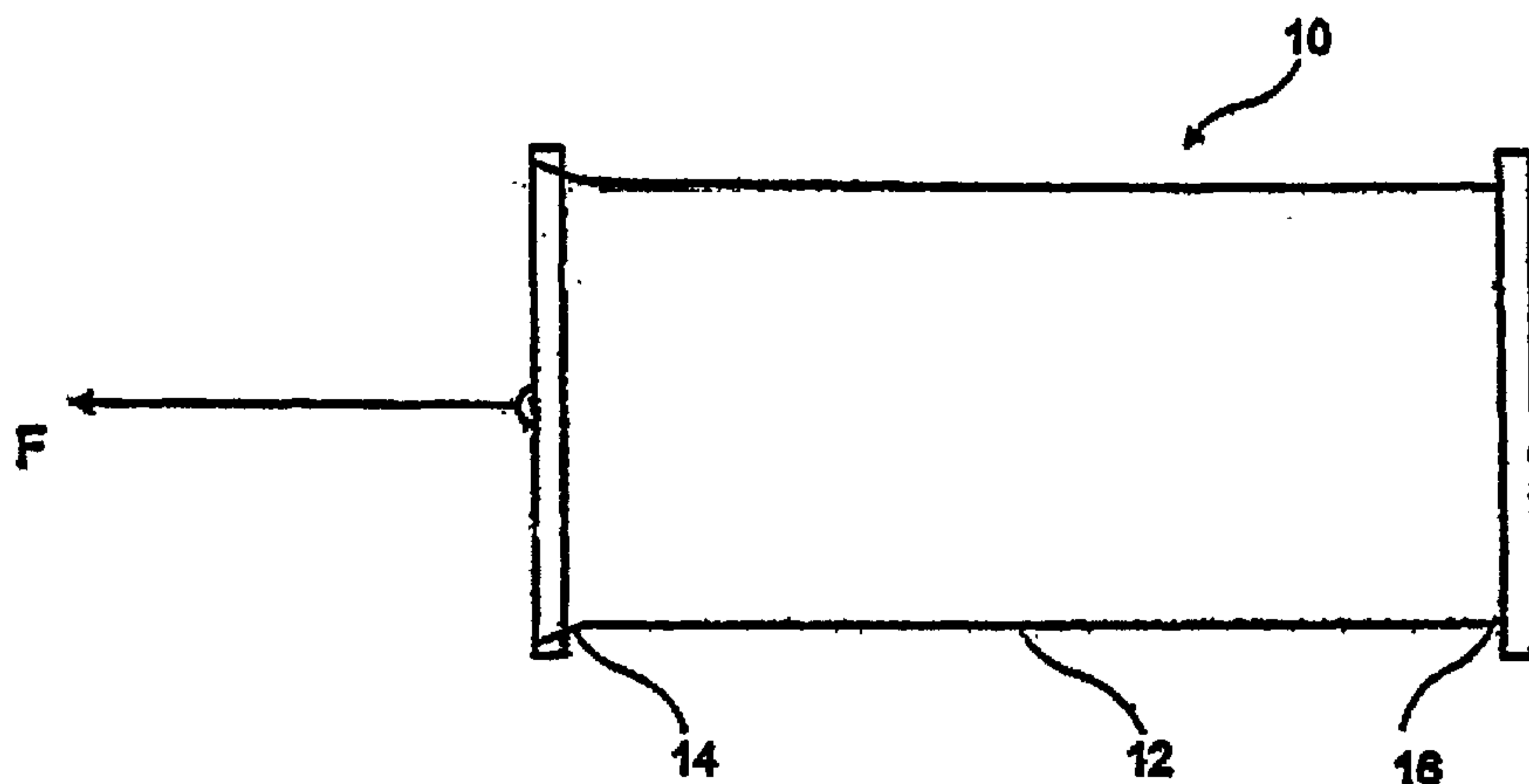
— with international search report

(88) Date of publication of the international search report:

18 November 2004

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: FLEXIBLE FLUID CONTAINMENT VESSEL FEATURING A KEEL-LIKE SEAM



(57) Abstract: A flexible fluid containment vessel (FFCV) including at least one segment made up of a fabric. Two ends of the fabric are beaded and are joined together so as to form a generally cylindrical section. The interface along which the ends of the fabric are joined form a keel that serves to stabilize the completed FFCV when the FFCV is placed in water.

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FLEXIBLE FLUID CONTAINMENT VESSEL FEATURING A
KEEL-LIKE SEAM

Field of the Invention

5 The present invention relates to a flexible fluid containment vessel (sometimes hereinafter referred to as "FFCV") for transporting and containing a large volume of fluid, particularly fluid having a density less than that of salt water, more particularly, fresh water, and the method of making the same.

10

Background of the Invention

 The use of flexible containers for the containment and transportation of cargo, particularly fluids or fluidizable solids, is well known. It is well known to use containers to transport such liquid cargo in water, particularly, salt water. Furthermore, it is common to transport materials which have a density less than that of salt water. If the density of the liquid cargo is less than the density of the liquid cargo, the cargo provides buoyancy for the flexible transport bag when a partially or completely filled bag is placed and towed in salt water. This buoyancy of the cargo provides flotation for the container and facilitates the shipment of the cargo from one seaport to another.

 If the cargo is fluid or a fluidized solid that has a density less than salt water; there is no need to use rigid bulk barges, tankers or containment vessels. Rather, flexible containment vessels may be used and towed or pushed from one location to another. Such flexible vessels have obvious advantages over rigid vessels. Moreover, flexible vessels, if constructed appropriately, allow themselves to be rolled up or folded after the cargo has been removed and stored for a return trip.

 Throughout the world there are many areas which are in critical need of fresh water. Fresh water is such a commodity that harvesting of the ice

cap and icebergs is rapidly emerging as a large business. However, wherever the fresh water is obtained, economical transportation thereof to the intended destination is a concern.

5 For example, currently an icecap harvester intends to use tankers having 150,000 ton capacity to transport fresh water. Obviously, this involves, not only the cost in using such a transport vehicle, but the added expense of its return trip, unloaded, to pick up fresh cargo. Flexible container vessels, when emptied can be collapsed and stored on, for example, the tugboat that pulled it to the unloading point, reducing the expense in this
10 regard.

Even with such an advantage, economy dictates that the volume being transported in the flexible container vessel be sufficient to overcome the expense of transportation. Accordingly, larger and larger flexible containers are being developed. However, technical problems with regard to
15 such containers persist even though developments over the years have occurred.

Summary of the Invention

It has been recognized that one of the problems with current FFCVs
20 is the lack of stability they exhibit when being towed in water. That is, FFCVs under tow tend to exhibit sinusoidal movements and/or yaw which interfere with their smooth transport and give rise to undue wear and tear.

Accordingly, it is an object of the present invention to provide an efficient system and method for stabilizing an FFCV under tow in water.

25 It is a further object of the invention to provide a fabric construction for an FFCV which may be readily varied to meet possible changing requirements for the FFCV.

Still another object of the invention to provide a fabric construction for an FFCV in which seams in the construction may be readily inspected.

30 In view of the above, an FFCV according to the invention includes at least one segment made up of a fabric. Two ends of the fabric are beaded and

are joined together so as to form a generally cylindrical section. The interface, along which the ends of the fabric are joined, forms a keel that serves to stabilize the completed FFCV when the FFCV is placed in water.

5 Brief Description of the Drawings

Thus by the present invention, its objects and advantages will be realized the description of which should be taken in conjunction with the drawings wherein:

10 Figure 1 is a somewhat general perspective view of a prior art FFCV which is cylindrical having a pointed bow or nose;

Figure 2 is a somewhat general perspective view of an FFCV which is formed in segments, incorporating the teachings of the present invention;

Figure 3 is a perspective view useful in describing the formation of an FFCV section incorporating the teachings of the present invention; and

15 Figure 4 shows a seam construction in accordance with the present invention; and

Figure 5 is a schematic diagram showing an illustrative FFCV construction in accordance with the present invention.

20 Detailed Description of the Preferred Embodiment

The proposed FFCV 10 is intended to be constructed of an impermeable textile tube. The tube's configuration may vary. For example, as shown in Figure 2, it would comprise a tube 12 having a substantially uniform diameter (perimeter) and sealed on each end 14 and 16. The
25 respective ends 14 and 16 may be closed, pinched, and sealed in any number of ways. A means for loading and unloading cargo (e.g. fresh water) would be provided. The resulting impermeable structure which is fabricated out of segments or strips of material 18 will be flexible enough to be folded or wound up for transportation and storage.

30 In designing the FFCV to withstand the loads placed thereon, certain factors should be considered. In this regard, in co-pending U.S. Patent

Application Serial No. 09/832,739 filed April 11, 2001 entitled "Flexible Fluid Containment Vessel" and incorporated herein by reference, such factors are set forth in detail, along with possible materials for the fabric, their construction and possible coatings and methodology to apply to it to
5 render the fabric impermeable, in addition to other features which may be desirable with regard to the FFCV. Accordingly, further discussion thereof will not be repeated herein rather reference is made to said application.

Also, the present device may have application with regard to the spiral formed FFCV as disclosed in co-pending U.S. Patent Application
10 Serial No. 09/908,877 filed July 18, 2001 entitled "Spiral Formed Flexible Fluid Containment Vessel" and incorporated herein by reference. While there is discussed therein means and methods for joining the wound strips together to form an FFCV, an alternative thereto is disclosed in the aforesaid first mentioned patent application for all or part of the joining process. For
15 example, in high load portions of the FFCV, typically the front and rear, one methodology may be used. For less stressful locations another methodology may be used.

In addition, reference is made to U.S. Patent Application Serial No. 09/921,617 filed August 3, 2001 entitled "End Portions for a Flexible Fluid
20 Containment Vessel and a Method of Making the Same" which relates to possible construction of the end portions of the FFCV and U.S. Patent Application Serial No. 09/923,936 filed August 7, 2001 entitled "Coating for a Flexible Fluid Containment Vessel and a Method of Making the Same" which discloses additional construction for the fabric, in addition to possible
25 coatings therefor. Both 09/921,617 and 09/923,936 are incorporated herein by reference.

The fabric 18 can be that of a patchwork to create the FFCV, wound strip or of other configuration suitable for the purpose. For example, it may be made in segments of flat fabric that has one of its dimensions equal to that
30 of the circumference of the FFCV which is formed into a tube and joined with other so formed segments. The variations are endless.

Turning now to Figure 3, there is shown a perspective view of an FFCV section formed according to the invention. As can be seen from the figure, a rectangular piece of flat woven fabric 20 is provided. Two opposing ends of the fabric, 22a and 22b, are beaded such that they can be joined through stitching, sintering, cauterizing, gluing, bonding, overlapping, stapling and/or any other suitable joining method. Upon joining of ends 22a and 22b, the FFCV section takes on a generally cylindrical shape.

The preferred method of joining the two ends involves using a "circus-tent" type of stitching, that is a hemming stitch, half-cross stitch, or the like. The ends are brought together by the stitching and then the stitching is covered using a two-part reactive resin system. The covering can be, but is not limited to a sheath laminated by adhesive, or a curable liquid coating applied via spraying. The preferable covering material for the seam is two-part polyurethane. Furthermore, the covering is preferably performed on the inner surface 24a of the generally cylindrical section rather than on the outer surface 24b, creating a water tight seal while leaving the stitching visible and accessible from outside the FFCV. By constructing the section with the stitching visible and accessible from the outside, inspection and maintenance of the seam are facilitated.

Figure 4 shows a seam 26 formed through circus-tent stitching 28. A two-part covering 30 is included in the figure but is peeled back to reveal the stitching underneath. As can be seen, the two ends 22a and 22b of the flat woven fabric 20 are beaded and include holes for the stitching. As mentioned above, it is preferable that the stitching is visible from outside the FFCV section.

Referring to Figure 5, there is shown an FFCV 32 constructed in part from segments like that shown in Figure 3. More specifically, the FFCV shown in Figure 5 includes four such segments 34, 36, 38 and 40. These segments are joined so as to form an overall generally cylindrical body for the FFCV. One way of joining the segments is to use the same stitching and covering technique used to form the individual segments, as described in

connection with Figure 3. Although, it should be noted that many alternative techniques for joining the segments will be apparent to the skilled designer when viewed in light of this disclosure.

5 In addition, the FFCV includes a bow segment 42, a stern segment 44, a bow cap 46 and a stern cap 48. The stern segment and bow segment are each formed in a manner similar to the segment of Figure 3, one possible exception being that the stern and bow segments are not formed from rectangular pieces of flat woven fabric, but rather, are formed from curved pieces of the fabric. When formed from curved pieces of fabric, the stern and bow segments take on a generally non-cylindrical shape. The bow and stern segments, as well as the caps, may be joined to the overall body in the same manner that the body segments are joined to each other.

10 In any event, each of the segments 34-44 include keel-like seams, respectively denoted as 34s-44s. The seams are aligned so that they form a single keel 50 that runs along the greater portion of the FFCV. The keel generally faces downward when the FFCV is placed in a body of water such that the keel is below the surface of the water. In this manner the keel provides stability when the FFCV is under tow, suppressing unwanted snaking and/or yaw.

20 It should be noted that, if the FFCV is not buoyant, it may be desirable to provide a foamed coating on the inside, outside, or both surfaces of the fabric or otherwise coat it in a manner set forth in the aforesaid applications to render the fabric buoyant.

25 In view of the closed nature of the FFCV, if it is intended to transport fresh water, as part of the covering/coating process of the inside thereof, it may provide for a coating which includes a germicide or a fungicide so as to prevent the occurrence of bacteria or mold or other contaminants.

30 In addition, since sunlight also has a degradation effect on fabric, the FFCV may include as part of its coating, or the fiber used to make up the fabric, a UV protecting ingredient in this regard.

While the present invention has been particularly shown and described in conjunction with preferred embodiments thereof, it will be readily appreciated by those of ordinary skill in the art that various changes may be made without departing from the spirit and scope of the invention.

5 Therefore, it is intended that the appended claims be interpreted as including the embodiments described herein as well as all equivalents thereto.

What Is Claimed Is:

1. A flexible fluid containment vessel for the transportation of cargo comprising a fluid or fluidizable material, said vessel comprising:

5 At least one segment formed by joining two ends of a piece of fabric so that the segment takes on a generally cylindrical shape with a keel-like seam at the interface where the two ends are joined; and means for sealing open ends of said generally cylindrical segment.

10 2. A vessel in accordance with claim 1 wherein joining said two ends includes stitching said ends together.

3. A vessel in accordance with claim 2 wherein said stitching includes circus-tent type stitching.

15 4. A vessel in accordance with claim 1 further comprising a covering for said keel-like seam to make said keel-like seam impervious to fluids.

20 5. A vessel in accordance with claim 4 wherein said covering is a two-part polyurethane covering.

6. A vessel in accordance with claim 4 wherein said segment has an inside and an outside and said covering is applied on the inside of said segment such that said keel-like seam remains visible from outside said vessel.

25 7. A vessel in accordance with claim 1 wherein said vessel comprises a plurality of segments, each segment being formed by joining two ends of a piece of fabric so that the segment takes on a generally cylindrical shape with a keel-like seam at the interface where the two ends are joined, said segments
30 being joined so as to form an overall generally cylindrical body, and said

means for sealing being used to seal open ends of said overall generally cylindrical body.

5 8. A vessel in accordance with claim 7 wherein said keel-like seams of said segments are aligned to form a keel along said overall generally cylindrical body.

9. A vessel in accordance with claim 7 wherein said means for sealing the open ends of said overall generally cylindrical body includes a generally non-cylindrical segment and a cap.

10. A vessel in accordance with claim 1 wherein said means for sealing the open ends of said generally cylindrical body includes a generally non-cylindrical segment and a cap.

15

11. A vessel in accordance with claim 1 wherein said piece of fabric is a piece of flat woven fabric that is impervious to fluids.

12. A method of forming a flexible fluid containment vessel for the transportation of cargo comprising a fluid or fluidizable material, comprising the steps of:

forming at least one segment by joining two ends of a piece of fabric so that the segment takes on a generally cylindrical shape with a keel-like seam at the interface where the two ends are joined; and
25 sealing open ends of said generally cylindrical segment.

13. A method of forming a vessel in accordance with claim 12 wherein the step of joining two ends includes stitching said two ends together.

30 14. A method of forming a vessel in accordance with claim 13 wherein said step of stitching includes stitching in a circus-tent type fashion.

15. A method of forming a vessel in accordance with claim 12 further comprising the step of covering said keel-like seam to make said keel-like seam impervious to fluids.
- 5
16. A method of forming a vessel in accordance with claim 15 wherein said step of covering includes providing a two-part polyurethane covering.
17. A method of forming a vessel in accordance with claim 15 wherein
10 said segment has an inside and an outside and said step of covering is involves covering said keel-like seam on the inside of said segment such that said keel-like seam remains visible from outside said vessel.
18. A method of forming a vessel in accordance with claim 12 further
15 comprising the steps of:
- providing a plurality of segments, each segment being formed by joining two ends of a piece of fabric so that the segment takes on a generally cylindrical shape with a keel-like seam at the interface where the two ends are joined; and
- 20 joining said segments to form an overall generally cylindrical body;
wherein said step of sealing includes sealing open ends of said overall generally cylindrical body.
19. A method of forming a vessel in accordance with claim 18 further
25 comprising the step of aligning said keel-like seams of said segments to form a keel along said overall generally cylindrical body.
20. A method of forming a vessel in accordance with claim 18 wherein
30 said step of sealing the open ends of said overall generally cylindrical body includes using a generally non-cylindrical segment and a cap.

21. A method for forming a vessel in accordance with claim 12 wherein said step of sealing the open ends of said generally cylindrical body includes using a generally non-cylindrical segment and a cap.
- 5 22. A method for forming a vessel in accordance with claim 12 wherein said piece of fabric is a piece of flat woven fabric that is impervious to fluids.

FIG. 1
(PRIOR ART)

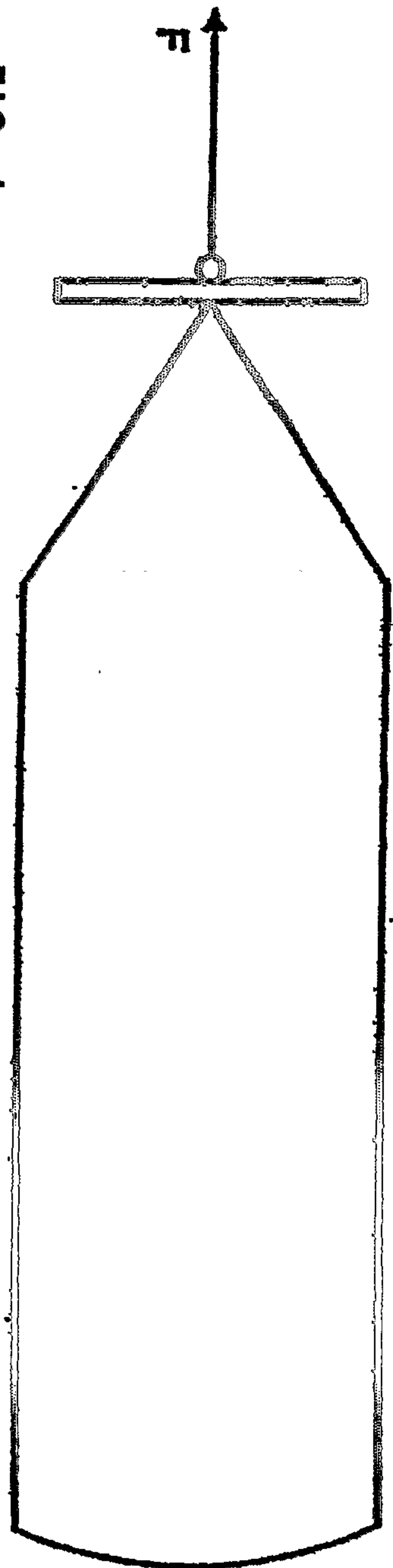
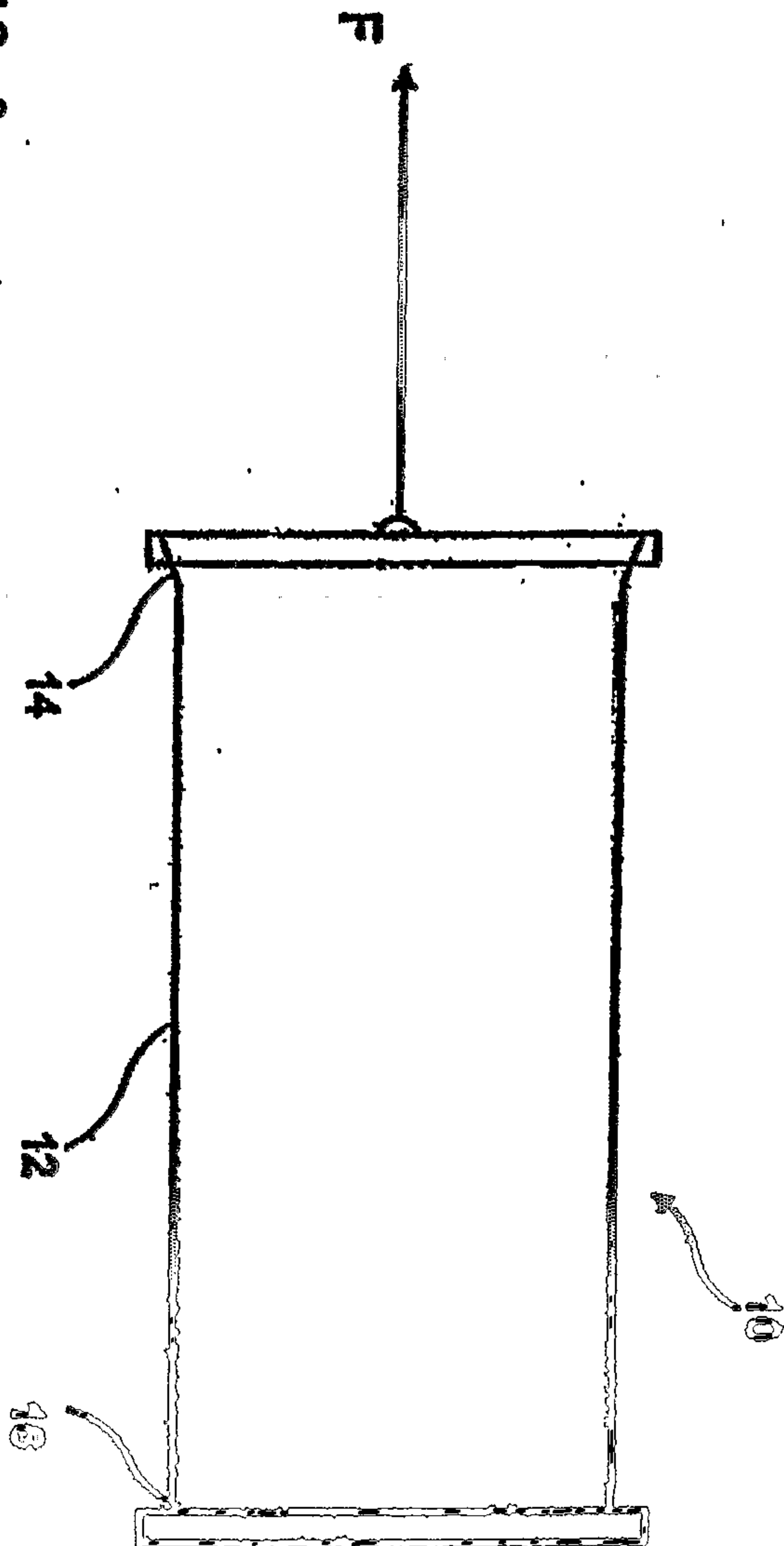


FIG. 2



2/3

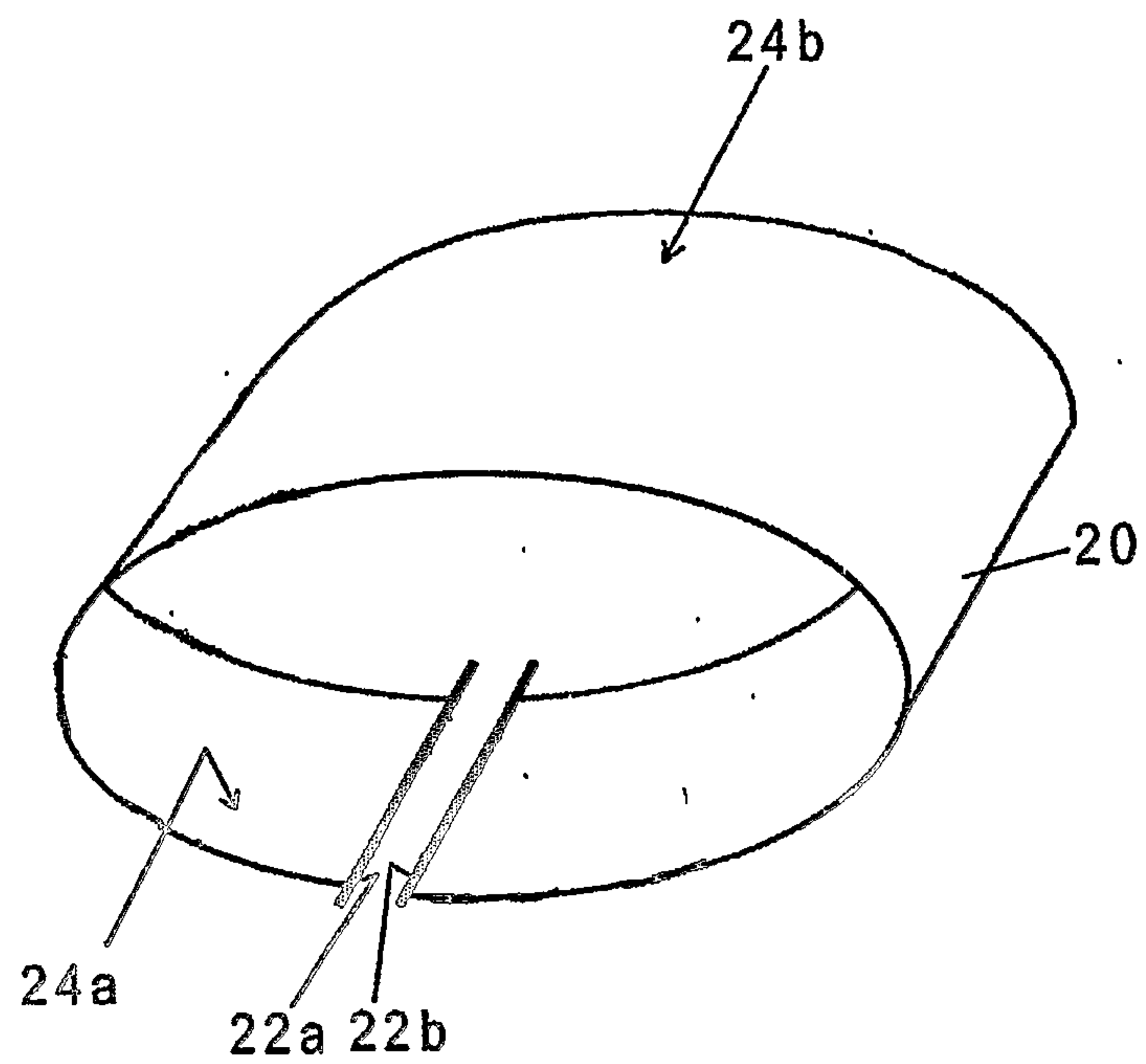


FIG. 3

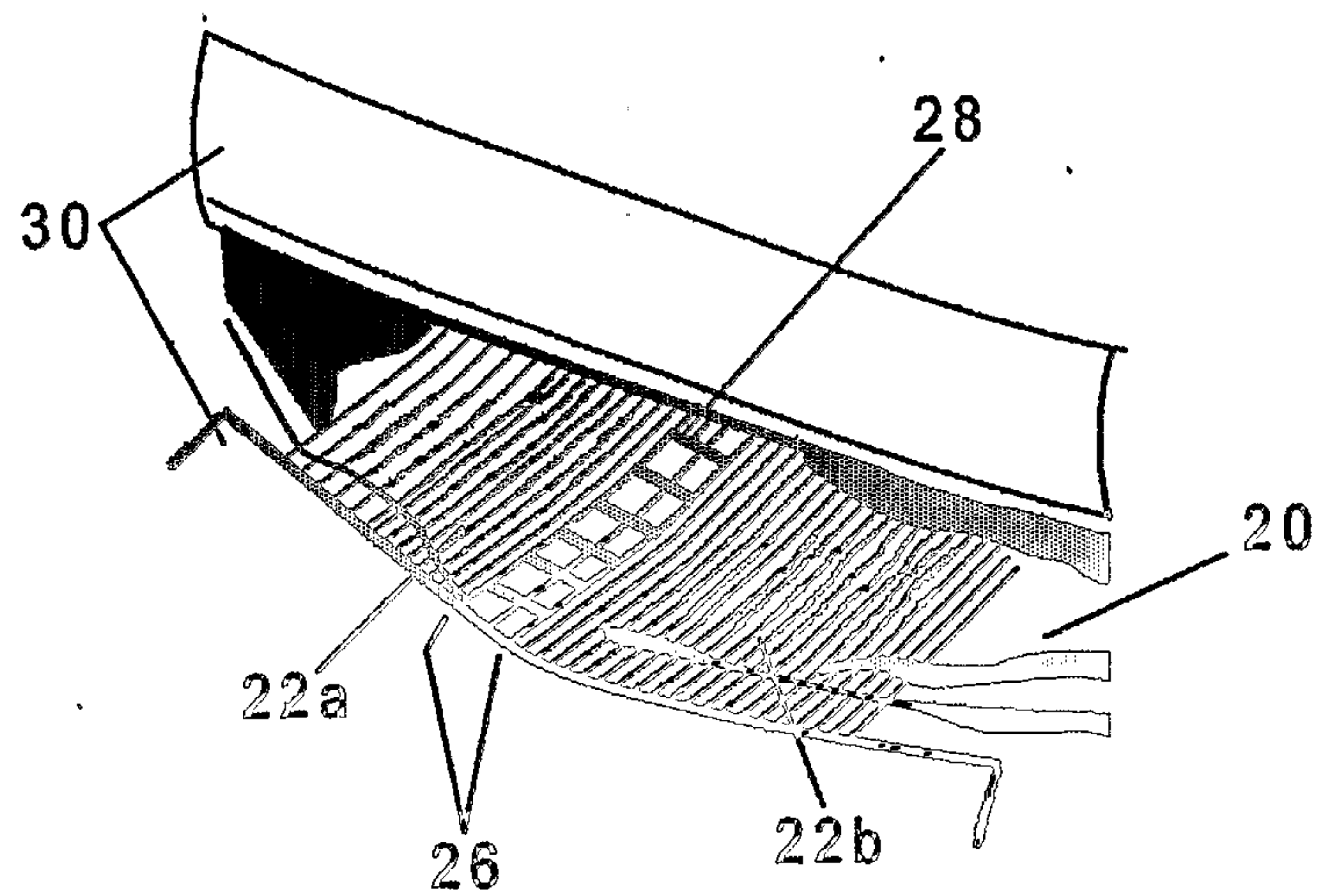


FIG. 4

3/3

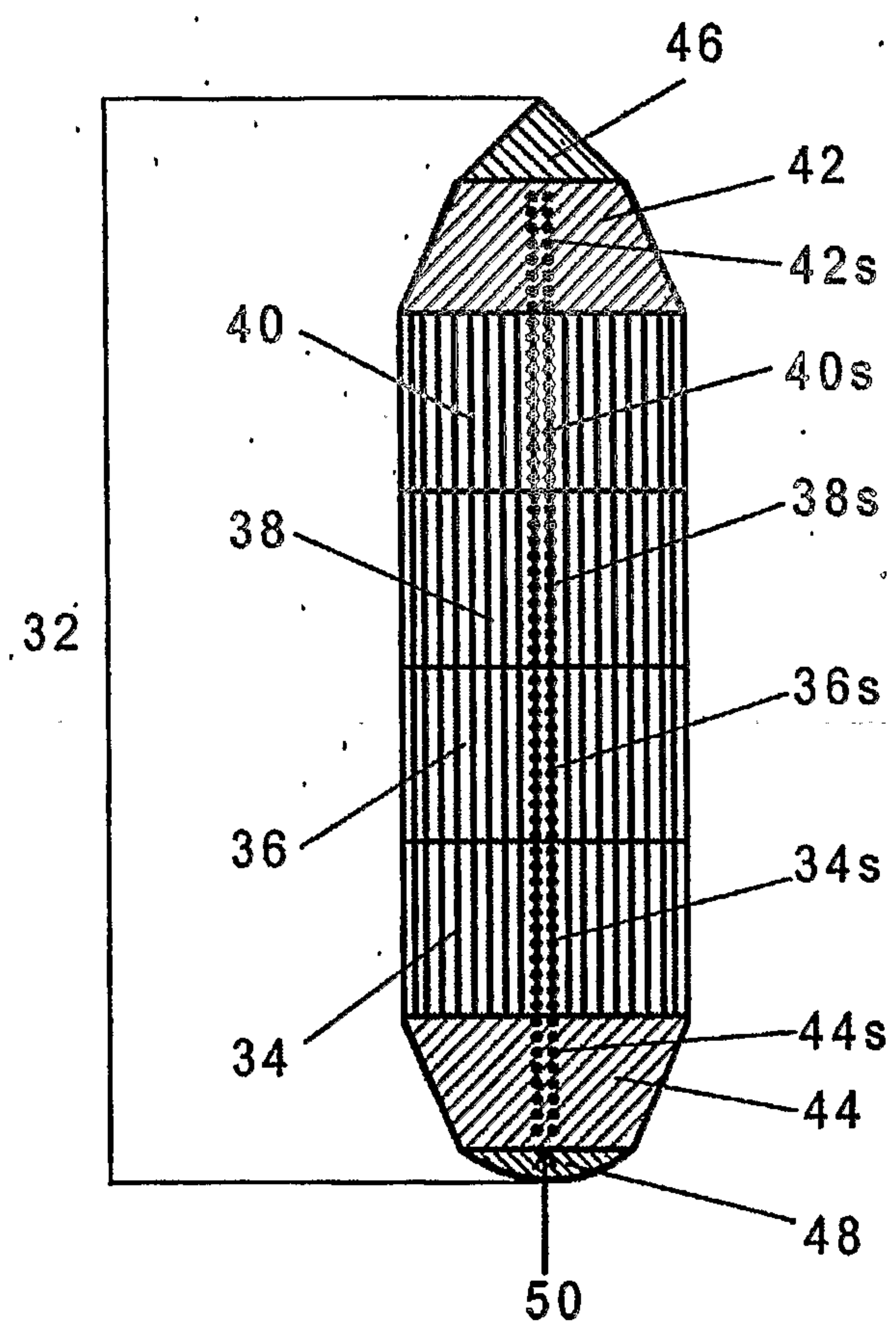


FIG. 5

