



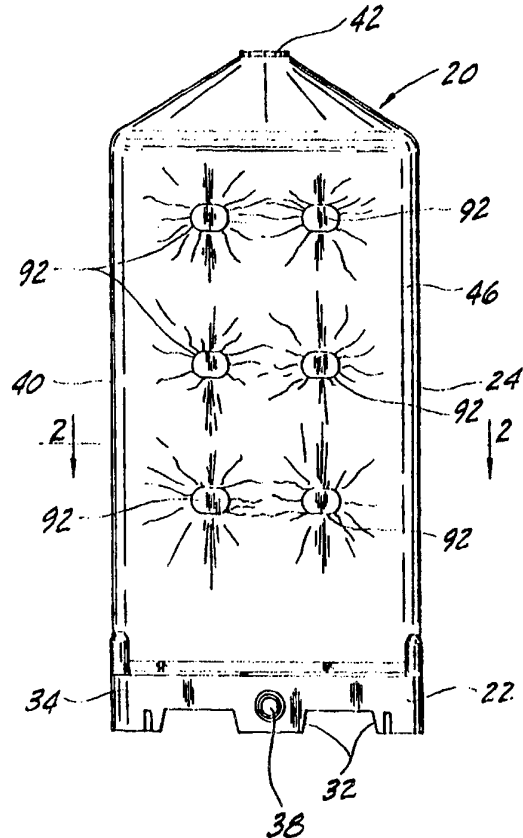
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<p>(21) International Application Number: PCT/US96/12143 (22) International Filing Date: 24 July 1996 (24.07.96) (30) Priority Data: 08/523,260 5 September 1995 (05.09.95) US (71) Applicant: SEMI-BULK SYSTEMS, INC. [US/US]; 159 Cassens Court, Fenton, MO 63026 (US). (72) Inventors: ALACK, Charles, A.; 159 Cassens Court, Fenton, MO 63026 (US). HANDLEMAN, Avrom, R.; 159 Cassens Court, Fenton, MO 63026 (US). WANNER, Benjamin, A.; 159 Cassens Court, Fenton, MO 63026 (US). (74) Agents: SENNIGER, Stuart, N. et al.; Senniger, Powers, Leavitt &amp; Roedel, 16th floor, One Metropolitan Square, St. Louis, MO 63102 (US).</p>		<p>(81) Designated States: CA, JP, KR, European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).  <b>Published</b> <i>With international search report.</i></p>

(54) Title: CONTAINER FOR HOLDING FLUENT MATERIAL

(57) Abstract

A container (20) for holding fluent material comprises a bag (24) defining a volume, a rigid base (22), and tension members within the bag for maintaining the bag in a generally rectangular shape when a load is inside. The bag has four side walls, a top opening (42), and a bottom. The tension members include a first elongate flexible member extending across the interior of the bag between a first side wall and a second side wall, and a second elongate flexible member extending between a third side wall and a fourth side wall. The ends of the members are connected to the side walls of the bag for constraining bulging when a load is inside so that the bag assumes a generally rectangular shape. The elongate tension members are positioned and dimensioned such that they do not significantly inhibit free flow of the fluent material.



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CONTAINER FOR HOLDING FLUENT MATERIALBackground of the Invention

This invention relates generally to material handling apparatus and more particularly to a container  
5 for holding a load of fluent material, such as a fine granular, particulate, or powdered material.

The container of this invention represents an improvement over the container disclosed in co-assigned U.S. Patent No. 4,159,755 and commercially available from  
10 the assignee of this invention, Semi-Bulk Systems, Inc. of St. Louis, Mo. under registered trademark AIR PALLET. The latter container has a generally circular pallet base which supports a generally cylindrical bag of flexible material for containing a load of powder or other fluent  
15 material. While this container has proven to be generally satisfactory, the cylindrical shape of the bag is not the most space efficient for packing or grouping a number of containers closely together in side-by-side relation (a substantial amount of space is wasted between  
20 the bags because of their cylindrical shape). This results in higher storage and transportation costs. Moreover, bags of cylindrical shape are somewhat unstable and have a tendency to tilt on their base, especially if the material in the bag is relatively loosely packed.

25 BAG Corporation has developed a container system which includes a bag having vertical walls or baffles on the inside of the bag extending from substantially the bottom to the top of the bag. These interior walls hold the bag in a non-cylindrical shape  
30 (generally rectangular) which is inherently more space efficient. The walls have holes which permit limited flow of material through the walls. Nevertheless, the walls substantially impede

lateral (side-to-side) flow of material within the container, making side discharge unloading of the bag impractical. Furthermore, the interior walls are secured to the bag by stitching. The holes formed by this stitching permit undesirable leakage into and/or from the bag.

#### Summary of the Invention

Among the several objects and features of the present invention may be noted the provision of an improved container which is more space efficient for packing or grouping a number of containers closely together in side-by-side relation; the provision of such a container which increases the stability of the container when supporting and storing a load of fluent material; the provision of such container which retains the desired shape of the container without significantly inhibiting the free flow of the fluent material within the container; the provision of such a container which is constructed to provide a vapor barrier; and the provision of the bag which reduces transportation and storage costs.

Generally, an improved container of this invention comprises a bag of flexible material defining a volume for containing a load of fluent material. The bag has four side walls, a top opening in communication with the volume for loading of fluent material into the container to fill the volume, and a bottom. The container further comprises a rigid base for supporting the bag and constraining means within the bag for constraining the bag to assume a shape in which the bag is generally rectangular in horizontal cross section when a load is contained within the volume. The constraining means comprises at least one set of tension members within the bag, including a first elongate flexible tension member extending across the interior of the bag

between a first side wall and a second side wall of the four side walls of the bag, and a second elongate flexible tension member extending across the interior of the bag between a third side wall and a fourth side wall of the four side walls of the bag. Respective ends of respective tension members are connected to respective side walls of the bag for constraining outward bulging of the side walls when a load is contained within the volume so that the bag assumes a generally rectangular horizontal cross section when a load is contained within the volume.

The elongate tension members of the set of tension members are so positioned relative to one another and so dimensioned in transverse cross section that they do not significantly inhibit free flow of the fluent material within the volume in any direction with respect to the bag. The flexibility of the tension members permits the bag to collapse when a load is not contained within the volume.

Other objects and features will be in part apparent and in part pointed out hereinafter.

#### BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side elevational view of a container of this invention;

FIG. 2 is a horizontal section taken along line 2--2 of Fig. 1 illustrating constraining means within a bag of the container;

FIG. 3 is an enlarged side elevational view of a cover sheet sealed to the outside of the bag in a position overlying a coupling of this invention;

FIG. 4 is a partial vertical section taken along line 4--4 of Fig. 3 illustrating a tension member connected at one end to a connector secured to a respective side wall of the bag;

FIG. 5 is a partial horizontal section taken along line 5--5 of Fig. 3 illustrating a connector secured to a respective side wall of the bag;

FIG. 6 is a partial side elevational view of a  
5 second embodiment of a container of this invention;

FIG. 7 is a horizontal section taken along line 7--7 of Fig. 6 illustrating constraining means within a bag of the container;

FIG. 8 is an enlarged side elevational view of  
10 a cover sheet sealed to the outside of the bag in a position overlying a ring and a strap of this invention;

FIG. 9 is a partial vertical section taken along line 9--9 of Fig. 8 illustrating a tension member releasably connected at one end to a ring secured to a  
15 respective side wall of the bag;

FIG. 10 is an enlarged side elevational view of a collar secured to a base of the container;

FIG. 11 is an enlarged side elevational view of a screw connector securing the collar to the base of the  
20 container; and

FIG. 12 is a top plan view of the collar shown in Fig. 10.

Corresponding reference characters indicate corresponding parts throughout the several views of the  
25 drawings.

#### Detailed Description of the Preferred Embodiment

Referring now to the drawings, a container for transporting and storing a load of fine granular, particulate, powdered or other conditionable  
30 (fluidizable) material is indicated generally at 20 (Fig. 1). The container 20 is shown to comprise a rigid base 22, a bag 24 of flexible material secured to the base and defining a volume for containing a load 26 of fluent material, and constraining means generally indicated at  
35 28 within the bag for constraining the bag to assume a

shape in which the bag is generally rectangular in horizontal cross section when a load is contained within the volume.

The base 22 is a generally rectangular, one-piece pallet preferably molded of a suitable synthetic resin material (e.g., polyethylene or nylon). The pallet has a plurality of legs 32 engageable with the ground for supporting the container 20 and the load 26 therewithin. The legs 32 are spaced apart to receive lifting tines of a forklift (not shown) so that the loaded container may be readily transported. As disclosed in co-assigned pending U.S. Patent Application Serial No. 08/222,083, which is incorporated herein by reference, the pallet base 22 includes an outer, generally vertical peripheral wall 34 defining the outside of the pallet, a generally planar load supporting deck (not shown) inclined downwardly toward one side of the pallet base, and a gas-permeable membrane (not shown) overlying the deck. The base 22 has a gas inlet (not shown) at one side of the base for the introduction of pressurized gas into the base and an outlet opening 38 for the discharge of conditioned (fluidized) material within the container. Reference may be made to pending U.S. Patent Application Serial No. 08/222,083 for further details regarding the construction of the base.

The bag 24 of the container 20 has four side walls, generally indicated at 40, a top opening 42 in communication with the volume for loading of fluent material 26 into the bag to fill the volume, and an open bottom 44. The bag 24 is preferably formed of a flexible, gas-imperious, heat sealable sheet material, such as a plastic coated fabric of the type commercially available from Van Leer Plastics, Inc. of Houston, Texas under the trademark VALERON. The bag 24 may be of multi-part construction. For example, the relatively large main body portion 46 of the bag 24 (which is

constrained to have a generally rectangular shape when filled) may be a sleeve formed from four panels of the aforementioned sheet material having vertical edges heat sealed together in overlapping relation. The height of the bag 24 is preferably (but not necessarily) no greater than twice the diameter so as to maintain the stability of the bag. The bottom 44 of the bag 24 is open and overlies the gas-permeable membrane of the base 22. Gas introduced through the gas inlet flows up through the membrane of the base 22 and into the volume defined by the bag 24 via the open bottom 44 of the bag 24 to condition the material 26 within the container 20 for unloading.

As noted, when filled with a load of fluent material 26 the bag 24 is configured by constraining means 28 to a shape in which the bag is generally rectangular in horizontal cross section. The constraining means 28 comprises at least one set of tension members within the bag 24. As depicted in the drawings, the bag 24 has three such sets of tension members, each set being disposed generally at the same level and being vertically spaced from each other set inside the main body portion 46 of the bag. As shown in Fig. 2, each set of tension members includes four tension members depicted 51, 53, 55, and 57. The first tension member 51 extends between two adjacent side walls 54, 56 of the bag, and the second tension member 53 extends generally parallel to the first tension member between two adjacent side walls 60, 62 of the bag. The first and second tension members 51, 53 are located generally adjacent a first pair of diagonally opposite corners of the bag indicated at 61 and 63, respectively. The third tension member 55 extends between two adjacent side walls 56, 60 of the bag, and the fourth tension member 57 extends generally parallel to the third tension member between two adjacent side walls 54, 62 of the bag. The



third and fourth tension members are located generally adjacent a second pair of diagonally opposite corners of the bag indicated at 71 and 73, respectively.

As shown in Fig. 2, each tension member is in the form of a flexible wire cable 89 which may be covered with a flexible sheath 79 to protect the cable. The cable may be formed, for example, from 3/32 in. galvanized or stainless steel braided wire strands, and the sheath may be fabricated from 1/8 in. plastic tubing. Other materials are also suitable. It is important, however, that the sheathed cable have an overall diameter which is sufficiently small so that it does not significantly inhibit free flow of the fluent material within the volume in any direction with respect to the bag 24. The flexibility of the cables and sheaths allows the bag to collapse when the bag is not full of material.

The tension members are connected at their ends to side walls of the bag by connectors, each generally designated at 68. Each connector comprises a coupling 73 and a clevis 71 attached to the coupling. The coupling has a base 75 and a body 77 extending from the base. The body 77 has a vertical hole (not shown) through it. The clevis 71 is generally U-shaped, having two legs 81 and a head 83 connecting the two legs. A pin or rivet 91 extends through the two legs 81 and through the hole in the body of the coupling 73 so that the clevis 71 can pivot relative to the connector about a generally vertical axis A (Fig. 4). The pivoting of the clevis 71 relative to the coupling 73 allows the tension members to align themselves relative to one another such that the bag 24 retains its rectangular shape. One end of a respective tension member extends through a hole 85 in the head 83 of the clevis 71 and is retained in position by a retaining member 95 secured (e.g., swaged) on the end of the cable 89. It will be understood that the

tension members 51, 53, 55, 57 may be secured to the connectors 68 by any means of attachment and still be within the scope of this invention.

As shown in Figs. 3, 4 and 5, the base 75 of each coupling 73 is positioned on the inside of a respective side wall of the bag, and the body 77 of the coupling extends through a generally horizontal slit 70 in the side wall. The slit is preferably horizontal to reduce the risk of "running"--uncontrolled tearing--of the slit, which is more common with a vertical slit. A cover sheet 74 overlies the base 75 of the coupling. The cover sheet 74 is heat sealed to the bag along seal lines indicated at 76, to secure the cover sheet on the outside of the bag with the cover sheet overlying the base 75 of the coupling 73 to seal the opening 70 in the side wall through which the coupling extends. Heat sealing is the preferred method of sealing the slit 70 because, unlike the stitching holes inherent with sewing, it maintains the integrity of the vapor barrier of the bag 24. The cover sheet 74 further serves to reinforce the bag. It will be understood that the connectors 68 can be secured to the bag by alternative means without departing from the scope of this invention.

Figures 6 through 12 illustrate a second embodiment of this invention. Parts of the second embodiment which correspond to the same or similar parts in the first embodiment are indicated by the same reference numeral with the addition of a prefix "1". In this embodiment, the elongate tension members of each set comprise two relatively narrow flexible strap-like web members 152, 158 (Fig. 7), each of which is so dimensioned in transverse cross section that it does not significantly inhibit the free-flow of material within the bag. In the configuration shown in Fig. 7, the first elongate flexible tension member 152 extends across the interior of the bag 124 between a first side wall 154 and

a second side wall 156 of the four side walls of the bag, and the second elongate flexible tension member 158 extending across the interior of the bag between a third side wall 160 and a fourth side wall 162 of the four side walls of the bag. Respective ends 164 of respective tension members 152, 158 are connected to respective side walls 154, 156, 160, 162 of the bag 124 for constraining outward bulging of the side walls so that the bag (at least the main body portion 146 thereof) assumes a generally rectangular (e.g., square) horizontal cross section when a load 26 is contained within the volume. The tension members 150 are flexible which allows the bag 124 to collapse when a load 26 is not contained within the volume. It will be understood that the tension members 152, 158 do not necessarily have to cross or can cross at different locations and still be within the scope of the present invention.

The ends 164 of the first and second tension members 152, 158 of each set 150 are releasably connected by means of clips 166 to rings 168 (e.g., D-rings) secured to respective side walls 154, 156, 160, 162 of the bag 124 (see Figs. 7 and 9). The rings 168 extend from outside of the bag 124 to inside of the bag through generally horizontal slits 170 in respective side walls 154, 156, 160, 162 of the bag. Each ring 168 is secured to the side wall 140 by a strap 172 which extends through the ring on the outside of the bag 124. A cover sheet 174 overlies the ring and the strap. The strap 172 and cover sheet 174 are heat sealed to the bag 124 along seal lines indicated at 176, to secure the strap and cover sheet on the outside of the bag with the cover sheet overlying the ring 168 to seal the opening 170 in the side wall 140 through which the ring extends.

The container 120 of the second embodiment, further comprises a rigid collar 180 extending up from the base 122 and surrounding the bag 124 at its tapered

lower end 148 for supporting the bag against tilting relative to the base. The collar 180 has a circular lower end 182 which is secured to the base 122. A conical wall 184 extends up from the circular lower end 182 and surrounds the tapered lower end 148 of the bag 124. The conical wall 184 has an upper rim 186 with a generally rectangular configuration generally corresponding to the generally rectangular (e.g., square) cross sectional shape of the main body portion 146 of the bag 124. The conical wall 184 and rim 186 of the collar 180 are formed with large, inwardly extending corrugations or indentations 188 at locations in general vertical alignment with the locations at which the tension members 152, 158 are secured to the side walls 140 of the bag 124. It will be understood that such indentations 188 can be at locations other than in vertical alignment with the locations at which the tension members 152, 158 are secured and still be within the scope of the present invention. As shown in Fig. 12, the collar 180 further includes collar reinforcing bars 190 which extend across the indentations 188 to retain the rectangular configuration of the upper rim 186.

The collar 180 is preferably a split metal collar adapted for releasable attachment to the base 122. The split metal collar 180 comprises two collar halves 194, 196 each of which may be formed from two separate panels, each indicated at 198, secured together, as by welding. The collar halves 194, 196 are releasably fastened at adjoining side edges 200 by rivets indicated at 202 and a pair of adjustable screw connectors 204 adjacent the lower ends 182 of the collar halves. The bottom edge margins of the collar halves 194, 196 are bent to form an annular rim 206 which fits closely around the circular flange 136 of the pallet base 122, the arrangement being such that when one or both of the connectors 204 are tightened, the collar 180 is clamped

against the pallet base and thus secured thereto. As shown in Fig. 10, the lower end 148 of the bag 124 extends down on the outside of the base 122 between the rim 206 of the collar 180 and the flange 136 of the base 122. It will be apparent, therefore, that when the connectors 204 of the collar 180 are tightened, the rim 206 of the collar clamps the bag 124 against the base 122. A metal band 208 immediately below the collar 180 also surrounds the bag 124 and clamps it to the base 122. The band 208 is suitably affixed to the base 122 (as by screws). The bottom edge 148 of the bag 124 is formed with a hem 210 having two cords (not shown) therein which prevents the bag from being pulled up past the band 208. The clamping of the bag 124 against the base 122 by the rim 206 of the collar 180 and by the band 208 holds the bag securely on the base during conditioning (fluidization) of the load 26 and provides a seal against the leakage of gas and product from within the bag.

As shown in Fig. 11 and as disclosed in co-assigned U.S. Patent No. 4,149,755, each screw connector 204 comprises a first pair of upper and lower tubular barrels 212, 214 and a second pair of upper and lower barrels 220, 222 for receiving upper and lower bolts 216, 218. One pair of upper and lower barrels 212, 214 is secured to the lower end 182 of one collar half 194 and likewise, the other set of upper and lower barrels 220, 222 is secured to the lower end 182 of the other collar half 196. By tightening the bolts 216, 218, the collar 180 may be tightened a desired amount within the limits of the bolts. The screw connector 204 further includes a resilient tongue 224 of relatively thin gauge stainless steel or the like which is secured to one collar half 194 and extends under an edge of the other collar half 196 to protect the bag 124 from damage--such as being torn--when the connector is tightened. While the connector 204 has been described as a bolt tightening

arrangement, other type of tensioning devices, such as overcenter buckles and the like may be used.

To use a container 120 of this invention, a bag 124 and collar 180 are secured to the base 122. A load of fluent material 26 is then introduced into the bag 124 via the top opening 142 of the bag to fill the volume. The tension members 152, 158 within the bag 124 constrain the bag so that when it is filled it assumes a shape in which the main body portion 146 of the bag is generally rectangular in horizontal cross section, as shown in Fig. 7. The rigid collar 180 surrounding the tapered lower end 148 of the bag 124 stabilizes the bag and prevents it from tipping during handling, transportation and storage of the container 120. The generally rectangular configuration of the bag 124 also permits the containers 120 to be packed closely together in side-by-side relation without the wasted space inherent when packing cylindrically shaped containers next to one another.

To unload material 26 from the container 120, gas is introduced in the gas inlet and flows up through the membrane of the base 122 into the volume defined by the bag 124 to condition the product therewithin. During this process, the rigid collar 180 and metal band 208 securely hold the bag 124 in place on the pallet base 122 and in sealing relation therewith. Fluidized product 26 from within the bag 124 is discharged from the container 120 via outlet 138. As disclosed in the above-mentioned U.S. Patent No. 4,149,755, a discharge conduit or hose (not shown) is removably inserted into the discharge opening of the pallet 122 so that product 26 discharged therefrom can be conveyed to a desired location. The process described also applies to the container 120 having a rectangular base.

It will be understood that a variety of different films and bag configurations may be used in a container 20, 120 of this invention depending on the

quantity of product 26 to be contained in the bag 24, 124  
the characteristics (i.e., density, toxicity, etc.) of  
the product, the number of desired reuses of the  
container, and other parameters. It will also be  
5 understood that the number of sets of tension members  
(51, 53, 55, 57) or (152, 158) and their configuration  
within the bag may vary depending on the size of the bag  
24 or 124 and other considerations. In any event, the  
position and dimension of the tension members should be  
10 such that they constrain the shape of the bag so that it  
assumes a generally rectangular shape in horizontal cross  
when filled without significantly inhibiting the free  
flow of fluent material 26 in any direction within the  
bag 24, 124.

15 In view of the above, it will be seen that the  
several objects of the invention are achieved and other  
advantageous results attained.

As various changes could be made in the above  
constructions without departing from the scope of the  
20 invention, it is intended that all matter contained in  
the above description or shown in the accompanying  
drawings shall be interpreted as illustrative and not in  
a limiting sense.

Claims

## WHAT IS CLAIMED IS

1. A container for holding fluent material comprising:

a bag of flexible material defining a volume for containing a load of said material, said bag having  
5 four side walls, a top opening in communication with said volume for loading of fluent material into the container to fill said volume, and a bottom,

a rigid base for supporting said bag, and  
constraining means within the bag for  
10 constraining the bag to assume a shape in which the bag is generally rectangular in horizontal cross section when a load is contained within said volume,

said constraining means comprising at least one set of tension members within the bag, said set  
15 comprising a first elongate flexible tension member extending across the interior of the bag between a first side wall and a second side wall of the four side walls of the bag, and a second elongate flexible tension member extending across the interior of the bag between a third  
20 side wall and a fourth side wall of the four side walls of the bag, respective ends of respective tension members being connected to respective side walls of the bag for constraining outward bulging of the side walls when a load is contained within said volume so that the bag  
25 assumes a generally rectangular horizontal cross section when a load is contained within said volume,

the elongate tensions members of said set being so positioned relative to one another and so dimensioned in transverse cross section that they do not  
30 significantly inhibit free flow of said fluent material within said volume in any direction with respect to the bag, and



the flexibility of the tension members permitting collapse of the bag when a load is not contained within said volume.

2. A container as set forth in claim 1 wherein the tension members of said set extend generally at right angles to one another.

3. A container as set forth in claim 2 wherein the tension members of said set cross one another generally on the central vertical axis of said volume.

4. A container as set forth in claim 1 wherein said first tension member extends between two adjacent side walls of the bag, and wherein said second tension member extends generally parallel to the first tension member between two adjacent side walls of the bag, said first and second tension members being located generally adjacent a first pair of diagonally opposite corners of the bag.

5. A container as set forth in claim 4 wherein said set of tension members further comprises a third tension member extending between two adjacent side walls of the bag, and a fourth tension member extending generally parallel to the third tension member between two adjacent side walls of the bag, said third and fourth tension members being located generally adjacent a second pair of diagonally opposite corners of the bag.

6. A container as set forth in claim 1 comprising a plurality of sets of said tension members, each set being vertically spaced from each other set inside the bag.

7. A container as set forth in claim 1 wherein the ends of said tension members are attached to connectors secured to respective side walls of the bag.

8. A container as set forth in claim 7 wherein each connector extends from the outside of the bag to the inside of the bag through an opening in a side wall of the bag.

9. A container as set forth in claim 8 wherein said opening in said side wall of the bag is a generally horizontal slit.

10. A container as set forth in claim 8 further comprising a cover sheet sealed to the bag on the outside of the bag in a position overlying said connector to seal the opening in said side wall through which the connector  
5 extends.

11. A container as set forth in claim 10 wherein said cover sheet is heat sealed to the bag.

12. A container as set forth in claim 11 wherein the bag is constructed of a fabric coated with a heat sealable synthetic resin material, and wherein said cover sheet is secured to the bag by heat seals.

13. A container as set forth in claim 8 wherein each connector is secured to the side wall by a strap which extends through the connector on the outside of the bag and which is affixed to the bag, said strap being  
5 heat sealed to the bag.

14. A container as set forth in claim 12 wherein said connector comprises a coupling secured to

the side wall of the bag and a clevis attached to the coupling and the tension member.

15. A container as set forth in claim 14 wherein said coupling comprises a base disposed on the outside of the bag and a body extending from the base to the inside of the bag through the opening, said body  
5 having a hole therein.

16. A container as set forth in claim 15 wherein said connector further comprises a pin extending through the clevis and hole in the body of the coupling so that the clevis can pivot relative to the connector  
5 about a generally vertical axis.

17. A container as set forth in claim 1 wherein said first and second tension members comprise two relatively narrow web members.

18. A container as set forth in claim 1 wherein said first and second tension members comprise two cables.

19. A container as set forth in claim 18 wherein said tension members further comprise a sheath covering each cable.

20. A container as set forth in claim 1 wherein the base is generally circular in shape and the bag, when filled with a load of said material, has a lower end which tapers downwardly toward the base to provide a  
5 transition from said generally rectangular cross sectional shape of the bag to the generally circular shape of the base.

21. A container as set forth in claim 20 further comprising a rigid collar extending up from the base and surrounding the bag at its tapered lower end for supporting the bag against tilting relative to the base.

22. A container as set forth in claim 21 wherein said collar has a circular lower end secured to the base and a conical wall extending up from the base and surrounding the tapered lower end of the bag, said  
5 conical wall having an upper rim with a generally rectangular configuration generally corresponding to said generally rectangular cross sectional shape of the bag.

23. A container as set forth in claim 22 wherein the conical wall and rim of the collar are formed with inwardly extending corrugations at locations in  
5 said tensions members are secured to the bag side walls.

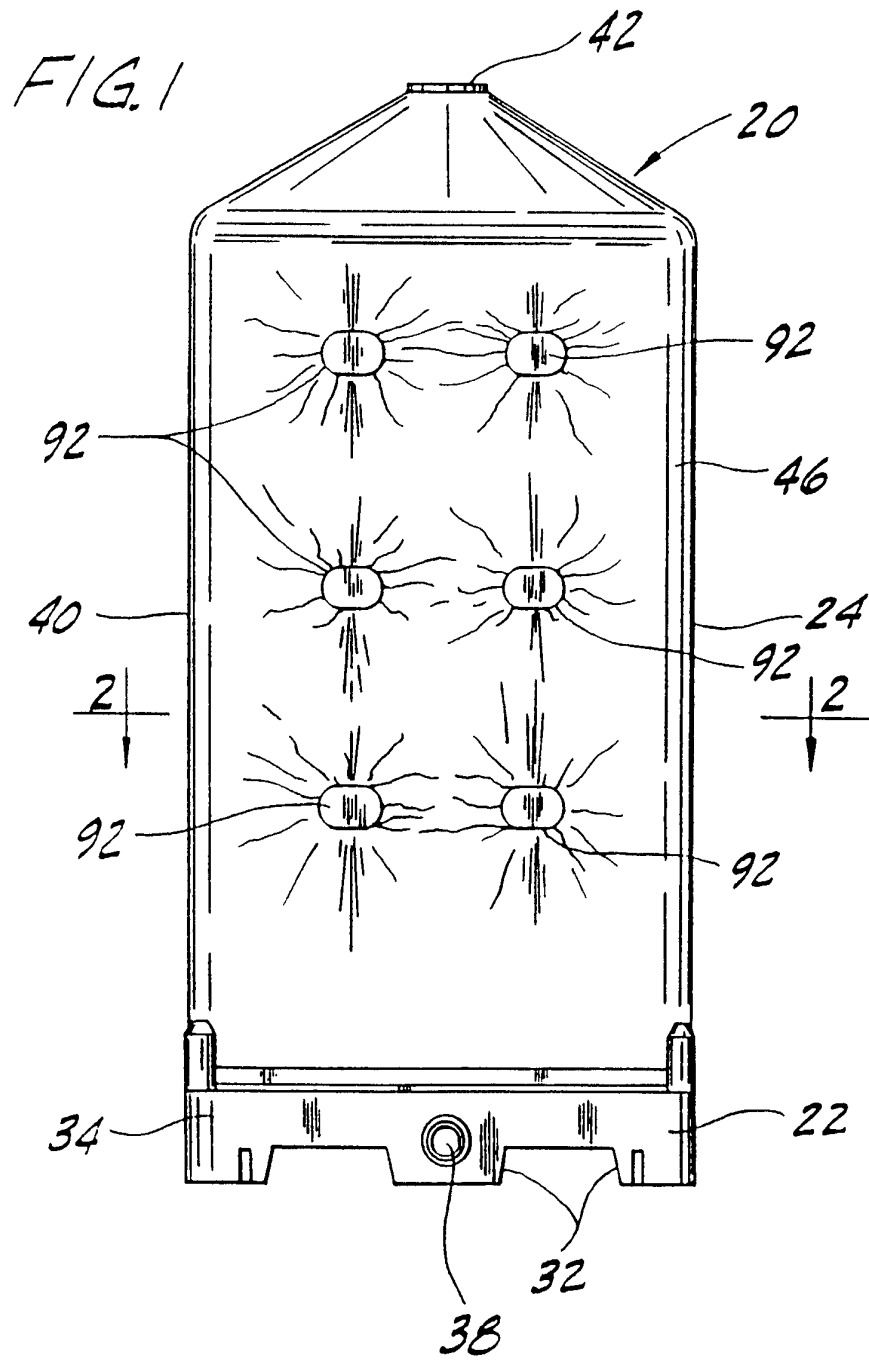


FIG. 2

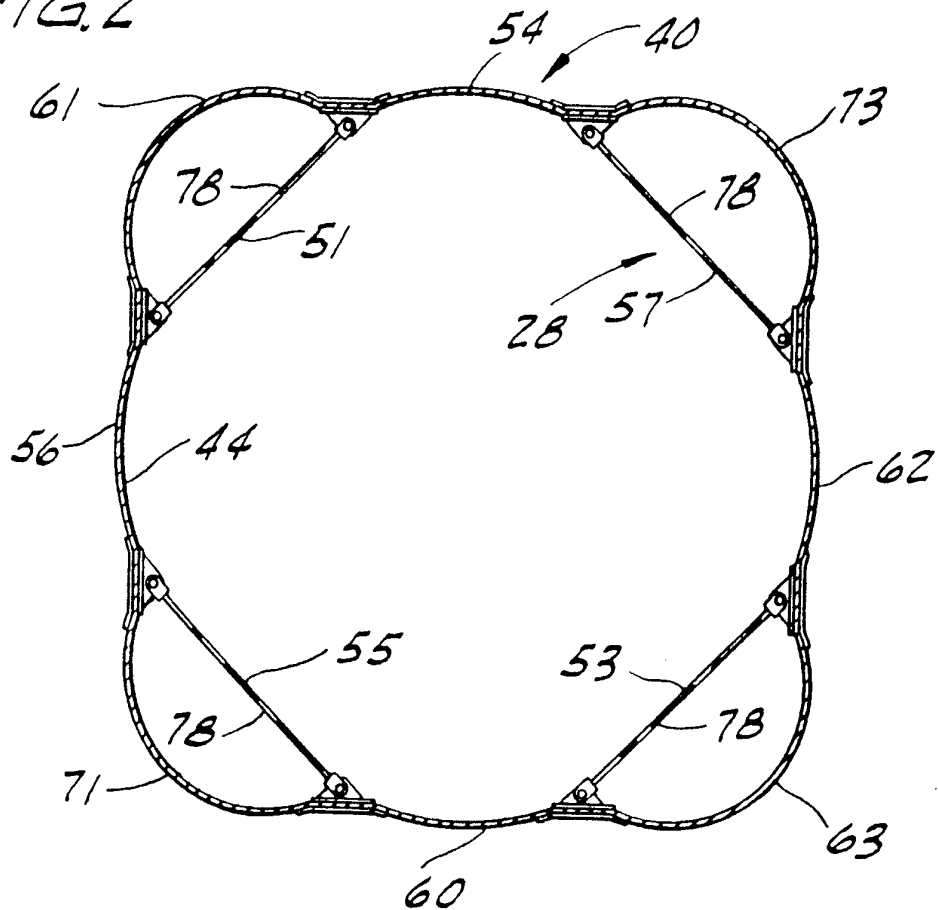


FIG. 4

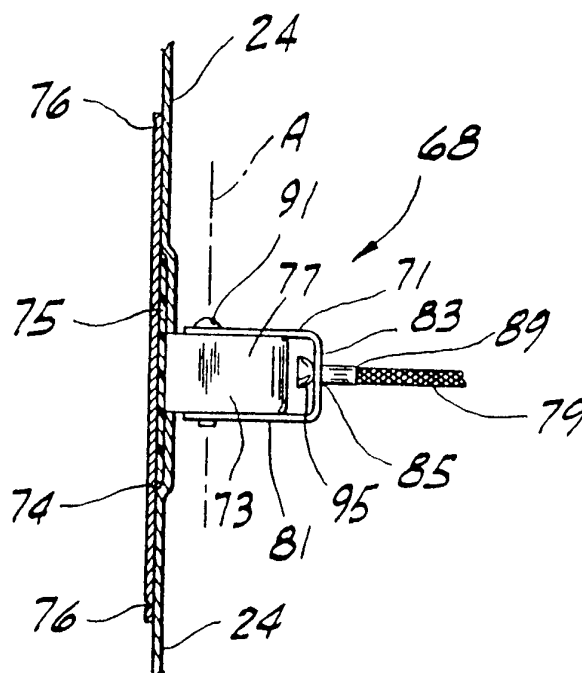


FIG. 3

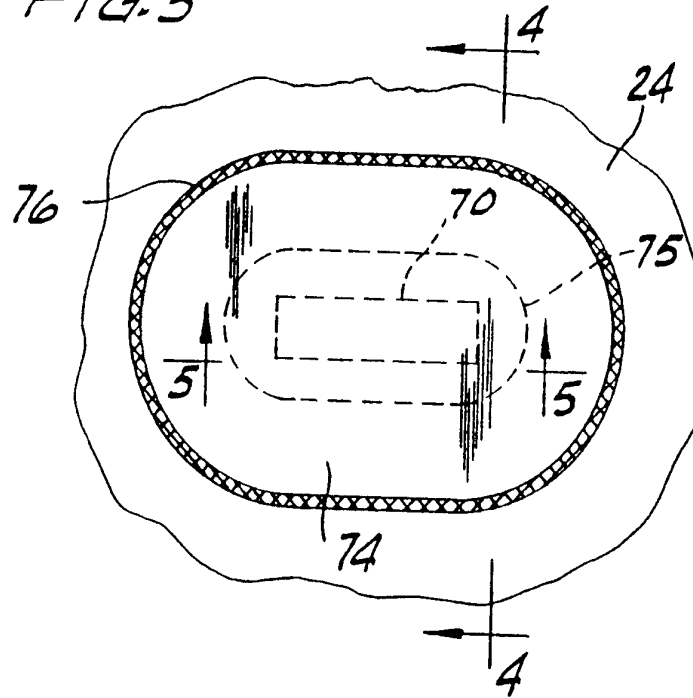
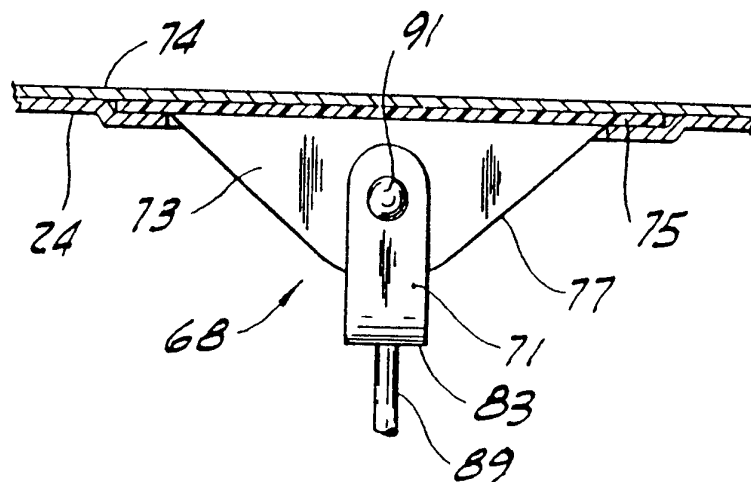


FIG. 5



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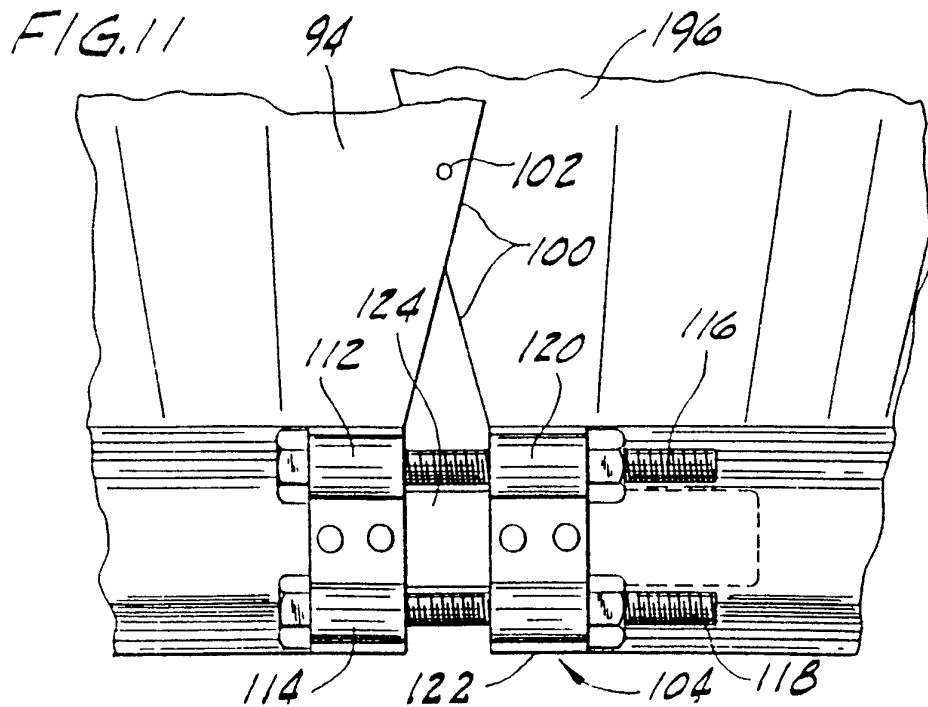
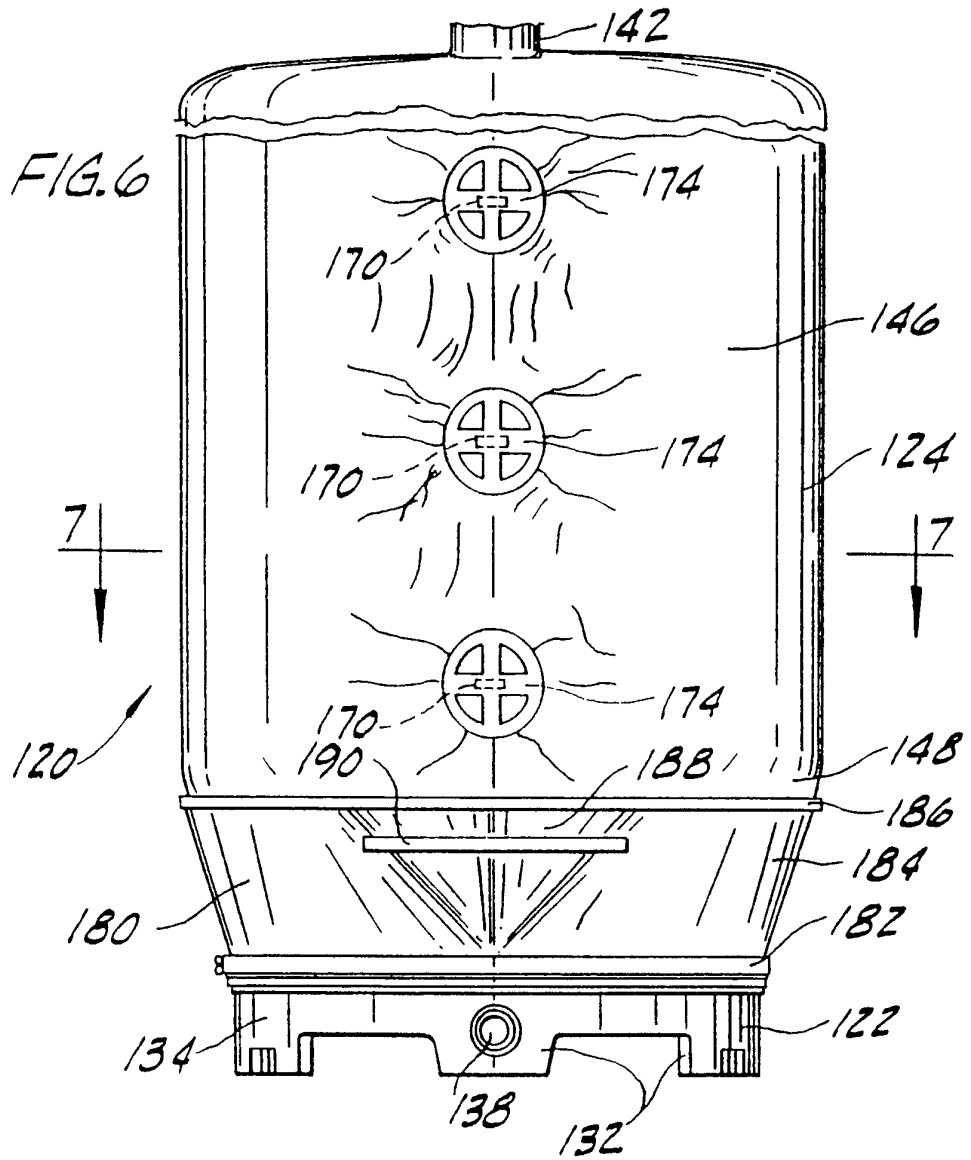
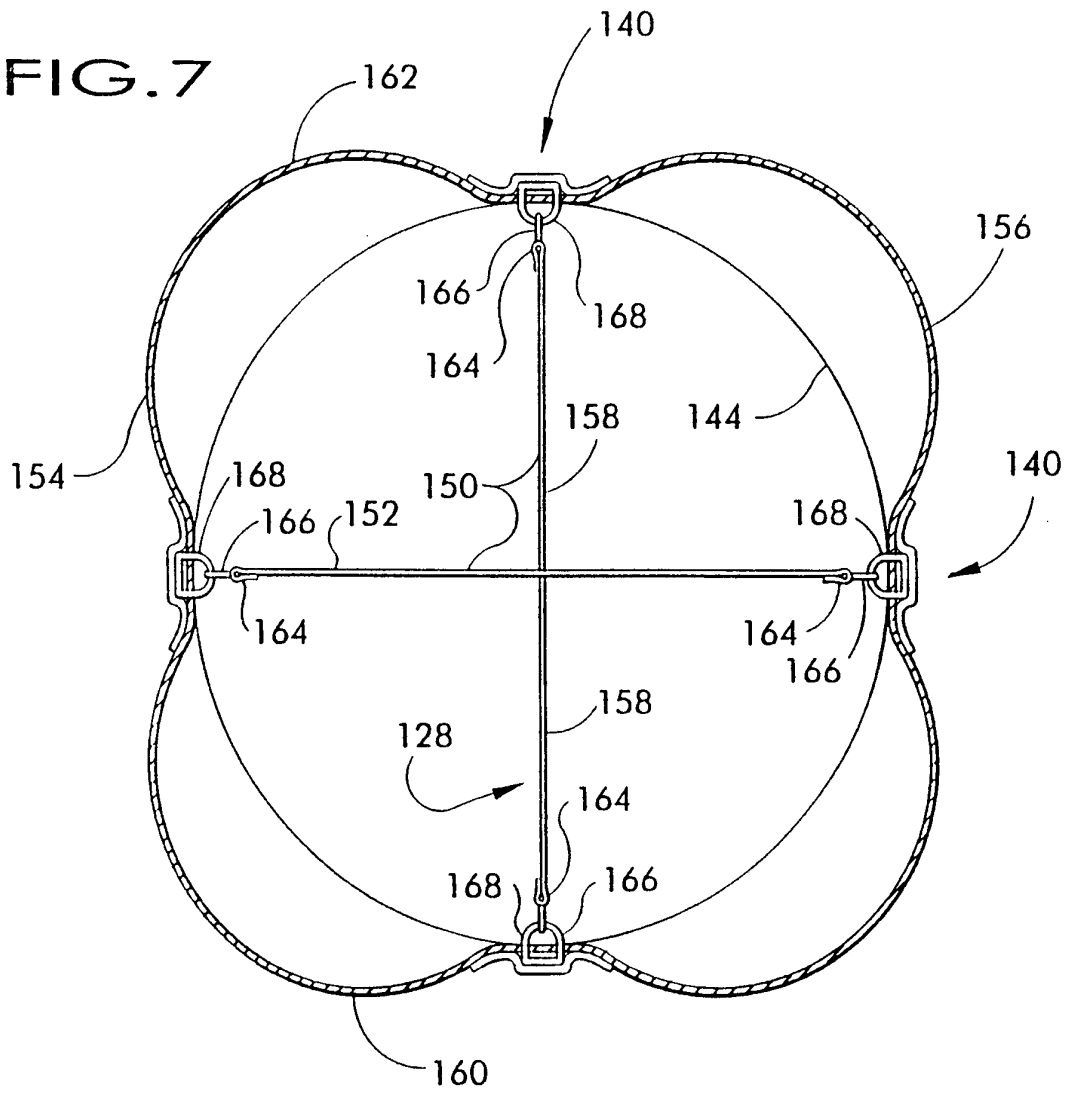
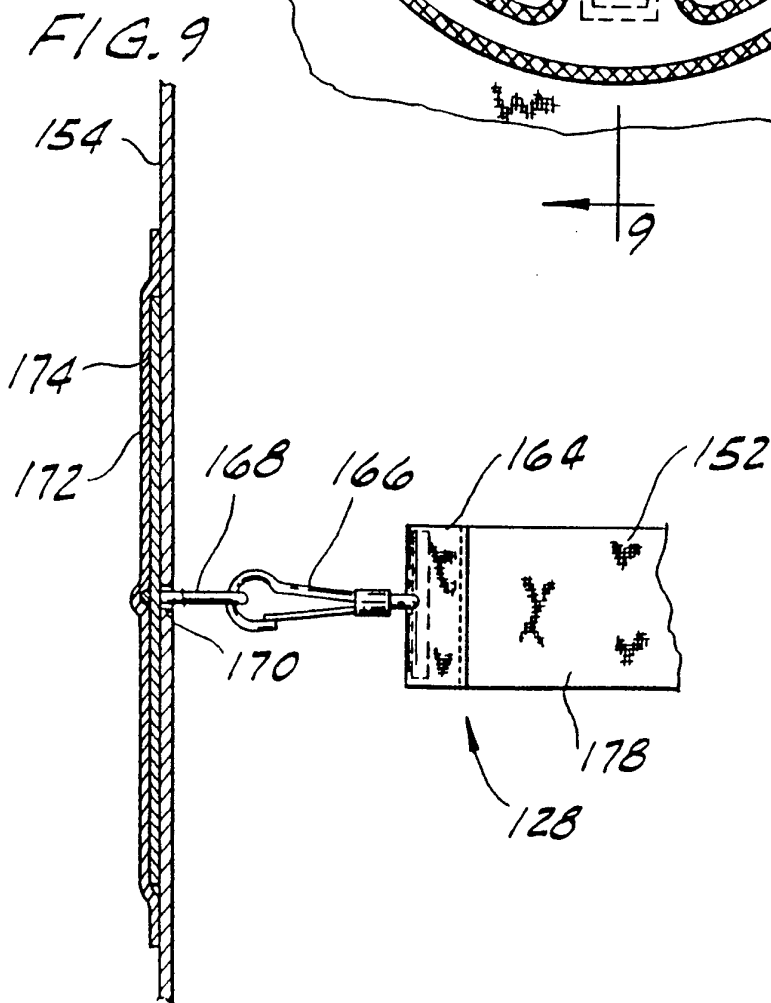
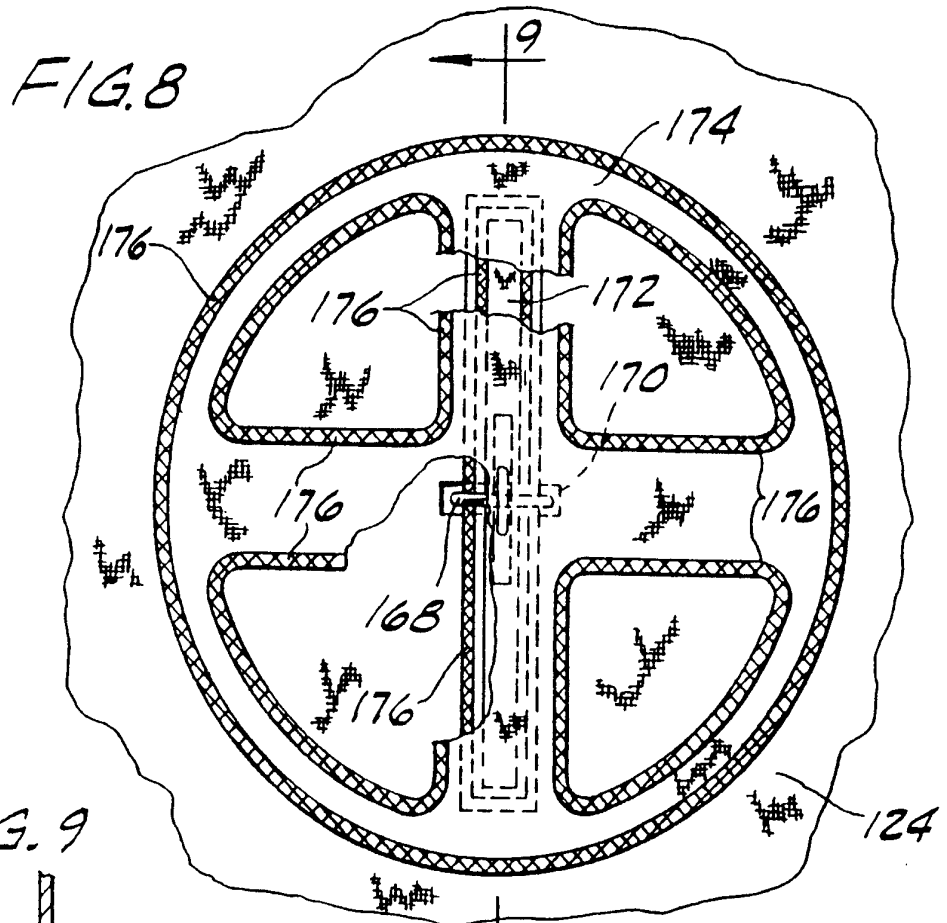
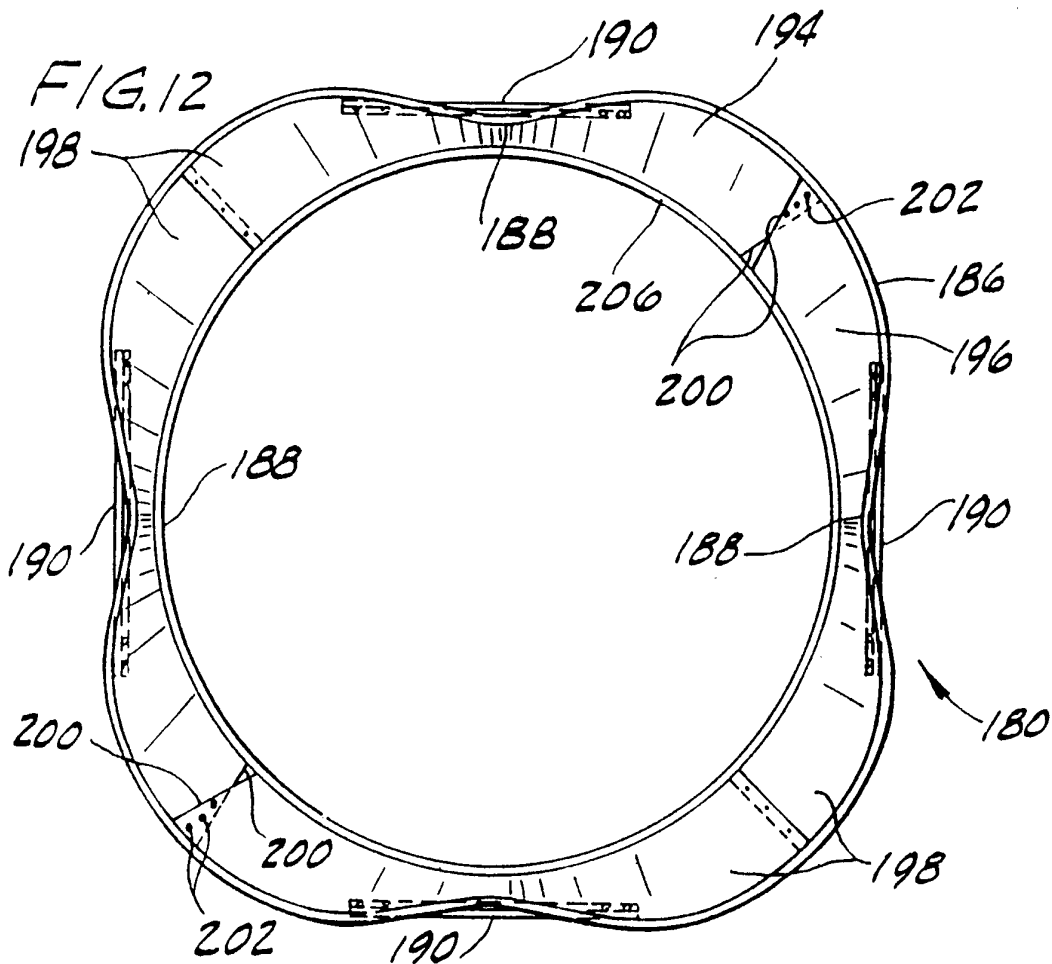
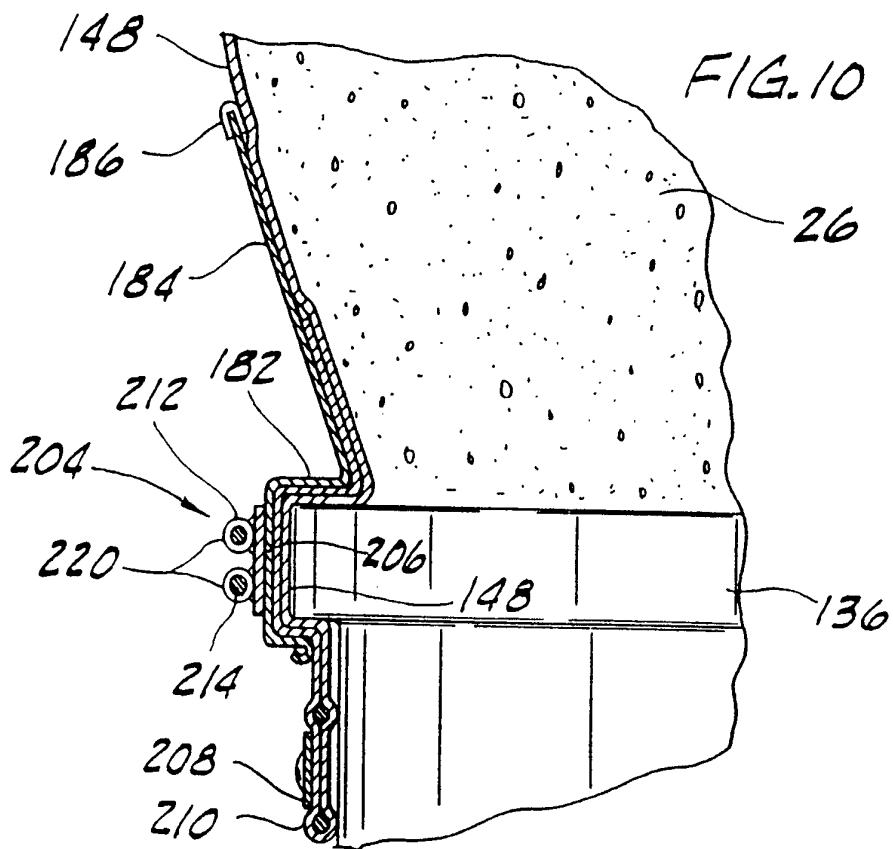




FIG. 7







INTERNATIONAL SEARCH REPORT

International application No.  
PCT/US96/12143

**A. CLASSIFICATION OF SUBJECT MATTER**  
 IPC(6) :B65D 33/02, 88/16  
 US CL :206/597; 383/19, 119  
 According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**  
 Minimum documentation searched (classification system followed by classification symbols)  
 U.S. : 206/597; 383/19, 119

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X -- Y	US, A, 4,966,310 (HAWKINS) 30 October 1990, see col. 4, lines 30-36.	1-3, 7, and 17 ----- 4-6, 8, 9, 18, and 18
Y	US, A, 5,316,387 (POLETT ET AL.) 31 May 1994, see Fig. 2 and col. 3, lines 37-57	4-6
Y	US, A, 3,774,812 (LEMELSON) 27 November 1973, see col. 4, lines 3-17	8, 9, and 18
Y	US, A, 3,980,196 (PAULYSON ET AL.) 14 September 1976, see col. 8, lines 21-23	18 and 19

Further documents are listed in the continuation of Box C.  See patent family annex.

* Special categories of cited documents:	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A" document defining the general state of the art which is not considered to be of particular relevance	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E" earlier document published on or after the international filing date	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&" document member of the same patent family
"O" document referring to an oral disclosure, use, exhibition or other means	
"P" document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search 06 OCTOBER 1996	Date of mailing of the international search report 28 OCT 1996
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Name and mailing address of the ISA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. (703) 305-3230	Authorized officer for STEPHEN P. GARBE Telephone No. (703) 308-1207
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