Title: SELF-PRESSURIZED CONTAINER

Abstract

The current trend is to reduce the amounts of aerosol propellant in the atmosphere. The present self pressurized container solves this problem by providing an alternative to an aerosol container. The self pressurized container (10) is constructed from the liner/sleeve assembly containing a thin flexible radially expandable material (14) inside an elastomeric sleeve (16). The liner is cylindrical with longitudinally extending pleats (48) formed on the sidewall of the liner (14). The pleated liner (14) has memory so that it returns to a folded state when unstressed and is capable of holding nearly all of the product contained therein to be dispensed. The top assembly has valve (30) with a metallic cup (26) whose rim (66) is crimped around a ring (56) surrounding a central opening of a metallic dome (18), but with a part of the sidewall of the liner (14) clamped between the cup (26) and the dome ring (56) as a gasket to form a fluid tight closure.
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SELF-PRESSURIZED CONTAINER

RELATED APPLICATION
Applicant claims benefit of the filing date of earlier United States application 07/358,392 filed May 26, 1989. This application is a Continuation-in-Part of SN 07/358,392.

TECHNICAL FIELD
This invention relates to self-pressurized containers for containing and dispensing of fluid materials.

BACKGROUND ART
Aerosol containers for containing and dispensing of fluid materials are well known and widely used. Products sold in aerosol containers include, for example, foods such as whipped cream; toiletries such as shaving cream, deodorant and hair spray; and paints, just to name a few. Dispensing is accomplished with the aid of a propellant under pressure. Aerosol containers offer the advantages of convenience and nearly complete dispensing of the fluid product material from the container, even though there is some tendency for propellant pressure to subside and dispensing of the product to become erratic when the aerosol container is nearly empty.

A major concern over aerosol containers is the fact that the propellants used and the pressures required present environmental hazards. Aerosol cans fall into one of two categories as follows: 1) where the product and the propellant mix, which is a standard aerosol container and 2) where the product and the propellant are kept separated and that is known as a barrier pack. One of the concerns that exists with the barrier pack container is that propellant is locked into the container after the product has been expelled creating an extreme hazard in the incineration of that type of container because a cloud of propellant can be formed if too many containers are crushed at the same time creating an explosive situation. A point of fact is that the Recycle Energy
plant in Akron, Ohio has had several explosions due to too many of the barrier pack aerosols being crushed prior to incineration.

One of the principal classes of propellants are the fluorocarbons and chlorofluorocarbons (CFCs). Recent environmental concern regarding the use of these materials, and particularly the harmful effect on the ozone layer of the upper atmosphere, has prompted a search for replacement. In fact, some major manufacturers of these materials have pledged to phase out their production over the next decade or so. Another class of propellants are hydrocarbons, particularly the liquified petroleum gas (LPG) hydrocarbons such as butane and pentane. While these do not tend to deplete the ozone layer (as far as is known), they do present other hazards because of their flammability. Also, there are certain hazards in filling, transporting, storing and incineration of aerosol containers because of the high pressure required, no matter what propellant is used. These hazards are reflected in terms of costs, e.g., safety precautions in filling and handling, insurance costs, etc.

Self-pressurized containers have been suggested as an alternative to aerosol containers. Representative self-pressurized containers include those shown and described in U.S. Patent No. 4,387,833 to Venus, Jr. and 4,423,829 to Katz. These references, which are rather similar in their teachings, describe apparatus for containing and dispensing of fluids under pressure in which no propellant is used and in which the fluid material to be dispensed is contained in a flexible plastic liner which in turn is contained in (from the inside out) a fabric sleeve and an elastomeric sleeve, which surround the liner except for a small neck portion at the top. The liner (except for the neck portion) has a plurality of longitudinally extending folds. When the liner is filled under pressure with the desired product, the entire assembly expands radially. The liner, which has a star shaped configuration when folded and not under pressure, is nearly circular in cross section when fully expanded. The elastomeric sleeve stores energy as a result of its radial expansion. This stored energy in the sleeve causes fluid to be dispensed upon opening of the dispensing valve.
The container assembly contracts radially and the liner becomes folded, as it is emptied.

A disadvantage of self-pressurized containers of this sort is that an appreciable quantity of product remains inside the liner when it has been emptied as far as possible. This, of course, is costly. This may be attributable to the fact that the liners in the Venus and Katz structures are formed (e.g., by blow molding) in a smooth, essentially cylindrical configuration, and the folds or creases are then formed afterward. Since the preferred plastic materials have "memory", in the completely folded state not the natural state, and the liner resists becoming completely folded, which is essential to substantially complete expulsion of the product.

A further disadvantage of the Venus and Katz structures lies in the valve assembly at the top of the container. In this valve assembly, a cylindrical wall of a valve body is joined solely to the neck portion of the liner, with no additional support structure.

The neck portion of the liner is made thicker than the rest of the liner and is designed to use only one valve assembly.

DISCLOSURE OF THE INVENTION

This invention according to one aspect thereof provides a reusable and recyclable, self-pressurized container comprising:

(a) a radially expandable flexible plastic liner open at one end and closed at the other end, said liner having upper sidewall means adjacent to the open end and a regularly convoluted portion comprising a plurality of longitudinally extending convolutions extending from the upper sidewall means toward the closed end;

(b) an elastomeric sleeve surrounding at least a major portion of the liner in tight-fitting relationship;

(c) a housing comprising a sidewall and an essentially rigid annular dome having a central opening and a ring surrounding said opening;
(d) a valve assembly including valve means for dispensing fluid material from the interior of said plastic liner, a tubular discharge stem for discharge of said fluid material, and an essentially rigid cup having an opening therethrough for said stem and including a bottom portion and an upstanding sidewall, the upper end of the sidewall means being crimped against the ring of said annular dome with the upper end of the liner clamped between the sidewall of the cup and said ring.

This invention according to another aspect thereof provides a fluid dispensing assembly for a self-pressurized container, comprising a radially expandable liner and an elastomeric sleeve surrounding the same as above described.

This invention according to a further aspect provides a method for making a self-pressurized container as above described, which comprises:

(a) molding a moldable material into a flexible liner open at one end and closed at the other end and having upper sidewall means adjacent to the open end and a regularly convoluted portion comprising a plurality of regularly spaced convolutions expanding longitudinally from the sidewall means toward the closed end;

(b) inserting said liner into an elastomeric sleeve having an inside diameter substantially smaller than the exterior diameter of the liner in its folded state and an axial length less than that of the liner, so that at least part of the sidewall means of the liner protrudes from the sleeve;

(c) placing an annular rigid dome having a central opening and a ring encircling said opening so that said ring is in touching engagement with the outside surface of the neck portion;

(d) placing a valve assembly which includes a metal cup having a bottom portion and an upstanding sidewall so that said sidewall is in contact with the inside surface of the neck portion of the liner;

(e) crimping the upper end of the sidewall portion against said ring, with the upper end of said liner clamped therebetween; and

(f) assembling any remaining housing components to form said container.
BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings:
Fig. 1 is an elevational view, with parts shown in longitudinal section, of a container according to this invention.

Fig. 2 is an elevational view of a liner according to this invention in its normal or folded state.

Fig. 2A is a fragmentary elevational view of a modified form of liner according to this invention.

Fig. 3 is an elevational view of a liner according to this invention in its expanded state.

Fig. 4 is a cross-sectional view, taken along line 4-4 of Fig. 2, of a liner of this invention in its folded state.

Fig. 5 is a cross-sectional view, taken along line 5-5 of Fig. 3, of a liner of this invention in its expanded state.

Fig. 6 is an elevational view, with part shown in longitudinal section, of a sub-assembly comprising a fluid dispensing assembly (or a liner/sleeve assembly) and a dome.

Fig. 7 is a fragmentary elevational view, with parts shown in section, of a portion of the sub-assembly of Fig. 6, shown in a later stage of assembly.

Fig. 8 is a vertical sectional view, taken along line 8-8 of Fig. 7, showing an enlarged detailed, not to scale, joint among the dome, liner and valve assembly of this invention.

BEST MODE FOR CARRYING OUT THE INVENTION

This invention will now be described in detail with particular reference to the best mode and preferred embodiment thereof.

The container of this invention as a whole is shown in Fig. 1. Referring to Fig. 1, container 10 is a self-pressurized container for dispensing of fluid materials, which comprises a fluid dispensing assembly 12 including an expandable liner 14 having a major portion which is pleated, and an elastomeric sleeve 16 surrounding a major portion of the liner in tight-fitting
relationship; a housing which comprises an annular dome 18, a
cylindrical sidewall or outside shell 20, and a bottom wall 22; and
a valve assembly 24 which comprises a cup 26, a valve (not shown),
a vertical tubular stem 28 for discharge of fluid product from
liner 14, a collar 29 surrounding the lower portion stem 28 just
above cup 26, a valve 30 (shown in Fig. 8), and a cap 31 (shown in
phantom lines) which is optional. Valve 30 may be a conventional
spring pressed reciprocating valve similar to those used in aerosol
containers.

Fig. 1 shows liner 14 and sleeve 16 in their normal position,
i.e., when liner 14 is empty. When liner 14 is pressurized and
filled with product to be dispensed, the sleeve 16 assumes the
contour shown in phantom line.

The liner 14 will now be described in detail with particular
reference to Figures 2-5. Referring now to Fig. 2, liner 14 is an
elongated, generally cylindrical, radially expandable flexible
plastic article, open at one end (the upper end) and closed at the
other end (the lower end), and has upper sidewall means (or upper
portion) 32 adjacent to the open end, and an elongated, regularly
convoluted portion 34 which extends from the upper sidewall means
32 to the closed end. The lower part of convoluted portion 34 is
tapered inwardly, and the liner 14 terminates in a blunted or
rounded point 36 at its closed end.

The upper sidewall means 32 of liner 14 is devoid of pleats and
comprises a frustoconical flange 38 at the open end, a pair of
concentric cylindrical sections 40 and 42, the former being of
larger diameter than the latter and being disposed closer to the
open end, and a frustoconical transition section 44 linking the
cylindrical sections 40 and 42. The smaller cylindrical section 42
may be provided with beads 46 as shown in Fig 2A. if desired for
gripping, as will be hereinafter described. However, beads 46 are
not necessary for good frictional engagement between the liner 14
and the sleeve 16, and may be omitted. Cylindrical section 42 may
be of very short axial length and can be omitted entirely, so that
frustoconical section 44 is adjacent to the upper end of the
convoluted portion 34.
Convoluted portion 34 comprises a plurality of longitudinally extending pleats or convolutions 48, best seen in Fig. 4. These convolutions form alternating ridges 50 and valleys 52. The ridges and valleys are creased forming a permanent pleat. The ridges and valleys (except the end portions thereof) define a pair of concentric right circular cylinders. The ridges taper toward upper sidewall means 32 at the upper end of convoluted portion 34. The valleys may either taper or not at the upper end of the convoluted portion 34. Both the ridges and valleys taper toward point 36 at the lower end. Thus, the greater part of the convoluted portion 34 (excluding the upper and lower ends thereof) is cylindrical and of uniform diameter. This cylindrical part of convoluted portion 34 constitutes a major portion of the overall length of liner 14. The contours of the peaks of pleats 48 when the liner 14 is in its normal or empty (i.e., non-pressurized) state may be seen in Fig.2. Fig 3 shows that contours of pleats 48 when the liner 14 is in its expanded or pressurized state (i.e., when filled with product to be dispensed).

The depth of convolutions or pleats 48 is uniform in the cylindrical middle part of convoluted portion 34. The depth of the pleats 48 decreases at either end of convoluted portion 34 as one approaches either the upper sidewall means 32 (at the upper end) or the point (at the lower end). The depth of pleats should be greater at the lower end than at the upper end for any given inner circle diameter (representing the diameter of the circle that connects the valleys). It is believed that this is beneficial in obtaining substantially complete expulsion of product from liner 14, as will be discussed in greater detail later.

While the convoluted portion 34 as shown is a generally cylindrical configuration, it may assume other configurations, e.g., ellipsoidal or spherical. In any case, the preferred configurations are surfaces of revolution, and in all cases the convoluted portion has regular longitudinally extending convolutions, which are permanent pleats.

Liner 14 is made of a flexible plastic material, which may be either elastomeric or non-elastomeric. A preferred material is
high density polyethylene (HDPE); other suitable materials include polyamide and "Barex" 218, which is an acrylonitrile available from British Petroleum. Liner 14 is a free standing member, i.e., it is not integrally joined to any other part or component of the container 10. Liner 14 is flexible over its entire length.

The liner should be of any suitable thickness, typically about 10 to 20 mils (0.010 to 0.020 inch) preferably about 0.012 to 0.018 inch. Except for the tapered portion near point 36, the liner should be of substantially uniform thickness over its entire length. (Minor variations in thickness, up to about 0.004 inch between the greatest and least thickness, are acceptable). The liner 14 is radially expandable by virtue of its folds or convolutions 48, even when it is made of a non-elastomeric material. When a fluid under pressure is introduced into the liner 14, it expands, assuming the configuration shown in Figs. 3 and 5. The circumference or perimeter of the liner in its expanded form is nearly circular as may be seen in Fig. 5. It should be noted that Figs. 4 and 5 are not drawn to the same scale. Fig. 4 is drawn to twice as large a scale as Fig. 5. Thus, Fig. 5 may represent an expanded liner 14 of this invention in its actual size (1.75 inch diameter), while Fig. 4 may represent the folded form of this same liner, drawn to twice its actual size. In other words, the outer diameter of the liner in its folded form (measured between two diametrically opposite ridges 50) is about one-half the diameter in the expanded form.

The liner may be formed by conventional plastic molding techniques, preferably by blow molding. The liner is molded in its folded form as shown in Figs. 2 and 4. Since the material forming the liner has memory, the liner will return to the folded form shown in Fig. 2 when no pressure or other stress is applied. This is important in order that the liner will have maximum effectiveness in expelling substantially the entire quantity of product contained in liner 14.

Liner 14 is placed inside a cylindrical elastomeric sleeve 16 which furnishes the energy required to dispense the product from
liner 14. Sleeve 16 is a tube, open at both ends, which stores energy as liner 14 is filled with product under pressure and which releases that energy as product is dispensed from liner 14. The wall thickness of sleeve 16 must be sufficient for this purpose. Sleeve 16 in its unstressed state is a tube of uniform diameter over its entire length. The inside diameter of sleeve 16 in its unstressed state is substantially smaller than the outside diameter of liner 14 in its folded state. (The outside diameter of liner 14 in its folded state is the diameter as measured between two diametrically opposite ridges). The diameter of sleeve 16 is expanded slightly over most of its length as shown in Fig. 6, after insertion of liner 14. The axial length of sleeve 16 is less than that of liner 14. The upper sidewall means 32 of the liner protrudes from one end of the sleeve 16 and the tapered lower end of the liner/(near point 36) protrudes from the other end of the sleeve, when the liner/sleeve assembly 12 is not under pressure. When the liner 14 is filled with product under pressure, sleeve 16 expands radially and elongates in the axial direction, assuming the outline shown in the phantom line in Fig. 1. When the liner 14 and sleeve 16 are so expanded, the lower end of sleeve 16 extends slightly beyond the point 36 of liner 14, as may be seen in Fig. 1. Sleeve 16 should be at least about 25 percent longer in its pressurized and expanded state than in its normal or relaxed state when the aspect ratio of the liner 14 (which is the ratio of its length to its diameter in the expanded state) is at least 3. The percentage of elongation required increases as the aspect ratio decreases. The liner will usually have an aspect ratio of at least 3 when its capacity is 12 ounces (340 grams) or less. Smaller aspect ratios are frequently preferred in larger containers.

The preferred elastomeric material for sleeve 16 is a synthetic rubber, and in particular Natsyn rubber. Natsyn rubber is cis-1,4-polyisoprene. A desirable characteristic of Natsyn rubber is that it is able to hold a high pressure per gram of material. Also, Natsyn rubber has less "die swell" than most rubbers, and considerably less than that of natural rubber. Rubbers tend to expand or swell dimensional as they come out of the die, and "die
swell" is the measure of this degree of swelling. Also, Natsyn rubber possess the ability to elongate as well as expand radially when pressurized. Any elastomeric material used to form sleeve 16 should exhibit both elongation and radial expansion when pressurized. The percentage of elongation required will vary somewhat depending upon the aspect ratio of the sleeve 16, is noted above. Since some relative longitudinal movement between the sleeve and the liner occurs during filling and dispensing, as is apparent from Fig. 1, it may be desirable to include a lubricant additive in the elastomer composition forming liner 16, as is apparent to those skilled in the art.

Referring now to Fig. 7, dome 18 is annular, may be bell-shaped as shown, has a central opening with a ring 56 around this central opening and also has a lip 58 extending around its circumference or outer edge and forming a locking device to accept an outside shell. Configuration of dome 18 may be substantially the same as that of the dome in a conventional aerosol container. Dome 18 is preferably metallic, and in any case should essentially be rigid and of sufficient strength and resilience to permit crimping of the outer edge or lip of cup 26 around ring 56, as will be hereinafter described. Similarly, cup 26 is preferably metallic and should be essentially rigid and sufficiently strong and resilient to permit crimping.

Fig. 8 shows the top assembly 60 of a container 10 according to this invention, with parts broken away and parts drawn to an exaggerated scale. Dome 18 has a central opening and a ring 56 extending around the central opening as previously explained. Cup 26 comprises a flat circular disk-like bottom portion 62 with a central opening for dispensing stem 28 and collar 29, and an upstanding sidewall 64 which is a surface of revolution. Sidewall 64 terminates at its upper (or outer) end in a rim 66. The upper edge or rim 66 of sidewall 64 is crimped against ring 56, with the upper part of the upper sidewall means 32 of liner 14 clamped between the crimped portion 66 of top sidewall 64 and the ring 56 of dome 18. This affords a fluid type closure of the upper or open...

The configuration of the entire top assembly 60 of container 10, including valve assembly 24 and ring 18, but excluding liner 14, is quite similar to that of a conventional aerosol container, the exception being that the outside edge will accept and lock an outside shell of a non-metallic material. The top assembly herein is quite different from those shown in the above referenced Patent Nos. 4,387,833 and 4,423,829.

A container can, according to this invention, may be assembled as follows:

First, a liner in its normal folded state, as shown in Fig. 2, is inserted into a sleeve 16, also in its normal state, to form a fluid dispensing assembly (or liner/sleeve assembly) 12 as shown in Fig. 6. The upper end of sleeve 16 surrounds the upper portion, of liner 14, and preferably overlaps cylindrical section 42 and is frictional engagement therewith. The tapered end 36 of liner 14 extends beyond the adjacent end of sleeve 16. The gripper rings 46 (when present) grip the inside of the sleeve 16 near its upper end, as an aid to retaining the liner inside the sleeve. Normally, however, frictional engagement between sleeve 16 and the upper sidewall means 32 (and particularly cylindrical section 42 thereof) of liner is sufficient so that rings 46 are not necessary.

Next, dome 18 is put in place. This is done by putting the liner/sleeve assembly, beginning at the end having the closed end 36 of line 14, through the central opening of the dome 18. This will bring the ring 56 into engagement with the larger cylindrical section 40 of neck portion 32 of liner 14, as shown in Fig. 6. The outside diameter of section 40 is essentially the same as the diameter of the central opening of dome 18. The liner/sleeve assembly 12 is then gently pulled until ring 56 is in contact with flange 38 of liner 14.

Third, the valve assembly with the sidewall 64 of cup 26 (not yet crimped) is put in place so that the upper edge or rim of cup sidewall 64 is substantially abreast of flange 38. Then the upper part of cup sidewall 64 is crimped against the ring 56 of dome 18,
clamping the upper end of liner 14 (including flange 38 and part of cylindrical section 40) in between the cup sidewall 64 and the dome ring 56. The upper part of cup sidewall 64 is formed into a lip 66 in the crimping process.

Finally, any remaining housing components, such as outer shell or sidewall 20 and bottom wall 22 (which may be pre-assembled), are assembled into place. This may be done by conventional means. Alternatively, this sidewall 20 and bottom wall 22 may be preassembled with dome 18, in which case the entire assembly shown in Fig. 6, i.e., liner/sleeve assembly 12 and top assembly 60, including dome 18 and valve assembly 24, may be inserted into this housing pre-assembly.

A container 10 according to this invention is filled with a fluid product by pumping the fluid product under pressure in through stem 28 into liner 14, and continuing such pumping until the liner expands to the position shown in Fig. 5. The sleeve 16 expands radially simultaneously with the liner 14. Radial expansion will ordinarily commence in the lower portion of liner 14 (e.g., just above the tapered lower part of convoluted portion 34 and remote from the upper end of sleeve 16). Sleeve 16 also elongates axially as the liner 14 is filled. No slippage between the sleeve and the liner occurs at the upper end of the sleeve, but the remainder of the sleeve elongates. The length of liner 14 remains substantially the same, whether liner 14 is folded (as in Fig. 2) or expanded (as in Fig. 3). Expansion of the sleeve 16 causes it to store energy. When the liner/sleeve assembly 12 is in its fully expanded state (and during expansion as well), the stress exerted by the fluid product is borne by the sleeve 16. The liner 14 is substantially unstressed and so is capable of withstanding the application of pressure by the fluid product contained therein, despite its thinness.

A user who wishes to dispense product from container 10 then causes the valve 30 to open in a conventional way, e.g., by tilting or depressing stem 28. When the user wishes to stop the flow of product, he or she lets go of stem 28, allowing it to return to its upright position, whereupon valve 30 closes and flow of product
stops. This can continue until the product is exhausted. The motive power for dispensing is furnished by the energy stored in sleeve 16. As product is dispensed, the liner 14 and the sleeve 16 gradually return to their original (unstressed) shape as shown in Fig. 6 reaching that shape when substantially all of the product has been dispensed. The upper end of sleeve 16 remains in position surrounding the upper portion of liner 14 with no slippage in this area as the liner size sleeve assembly 12 returns to its normal position. The pressure curve of sleeve 16 herein (i.e., the ratio of either percentage of radial expansion or percentage elongation to pressure applied) is substantially flat.

Substantially complete dispensing of the product is possible, since the liner 14 by virtue of memory returns to its folded position shown in Figs. 2 and 4; furthermore, sleeve 16 contains enough stored energy, even when the liner sleeve assembly has nearly returned to its normal position (Fig. 6), to expel product.

The container of this invention has several advantages over conventional aerosol containers. First, no propellant is required. The safety and environmental hazards associated with aerosol propellants are eliminated. Secondly, filling and storage are at lower pressures than is the case in the conventional aerosol container. Filling of a container of this invention is less costly than filling of an aerosol container, because the costs of necessary safety equipment and insurance costs are both reduced. Similarly, insurance costs during transportation are less. Finally, the container of this invention can be incinerated safely; it is at virtually atmospheric pressure when exhausted and therefore will not explode and there are no toxic combustion products. The container herein has the additional advantage of being refillable or reusable and has recyclable components.

Furthermore, the fluid tight joint between valve assembly and liner in previously known self-pressurized containers, such as those in the Venus and Katz patents. This invention has the advantage of material versatility in the liner, and because a standard aerosol
valve is being used, thousands and thousands of combinations are available between valve and spray head design.

While this invention has been described with reference to the best mode and preferred embodiment thereof, it is understood that this description is by way of illustration and not by way of limitation.
WHAT IS CLAIMED IS:

1. A self-pressurized container comprising:
   (a) a radially expandable flexible plastic liner open at one end and closed at the other end, said liner having upper sidewall means adjacent to the open end and a regularly convoluted portion comprising a plurality of longitudinally extending convolutions extending from said upper sidewall means toward the closed end;
   (b) a elastomeric sleeve surrounding at least a major portion of said liner in tight fitting relationship;
   (c) a housing comprising a sidewall and an essentially rigid annular dome, said dome having a central opening and a ring surrounding said opening; and
   (d) a valve assembly including a valve for dispensing fluid material from the interior of said plastic liner, a tubular discharge stem for discharge of said fluid material, and an essentially rigid top having an opening there through for said stem and including a bottom portion and an upstanding sidewall, the upper end of the sidewall being crimped against the ring of said annular dome with the upper end of the liner clamped between the sidewall of the cup and said ring.

2. A container according to Claim 1 wherein said cup and said dome are metallic.

3. A container according to Claim 1 wherein said liner is formed in the folded state wherein said convolutions are present and has memory, whereby said liner returns to the folded state when unstressed.

4. A container according to Claim 1 wherein said liner has an outwardly turned flange at the open end thereof, said flange being retained between said cup and said dome.

5. A container according to Claim 1 wherein at least the neck portion of said liner is essentially cylindrical.
6. A container according to Claim 5 wherein the normal inside diameter of said sleeve is substantially less than the expanded diameter of said liner.

7. A container according to Claim 5 wherein the axial length of said sleeve in the unstressed state is less than that of said liner.

8. A container according to claim 1 wherein said sleeve is at least 25% longer when in the filled state than in the relaxed state.

9. A fluid dispensing assembly for a self-pressurized container, said assembly comprising: (a) a radially expandable flexible plastic liner open at one end and closed at the other end, said liner having upper sidewall means adjacent to the open end and a regularly convoluted portion comprising a plurality of longitudinally extending convolutions extending from said upper sidewall means towards the closed end; (b) an elastomeric sleeve surrounding at least a major portion of said liner in close fitting relationship.

10. A fluid dispensing assembly according to Claim 9 wherein said liner is formed in the folded state wherein said convolutions are present and has memory, whereby said liner returns to the folded state when unstressed.

11. A fluid dispensing assembly according to Claim 9 wherein said liner has an outwardly turned flange at the open end thereof.

12. A fluid dispensing assembly according to Claim 9 wherein said sleeve and a major portion of said liner are essentially cylindrical.
13. A fluid dispensing assembly according to Claim 12 wherein the normal inside diameter of said sleeve is substantially less than the expanded diameter of said liner.

14. A fluid dispensing assembly according to Claim 12 wherein the axial length of said sleeve in the unstressed state is less than that of said liner.

15. A fluid dispensing assembly according to claim 12 wherein the axial length of said sleeve is at least about 25% longer in the pressurized state than in the pressurized state.

16. A method for making a self-pressurized container which comprises:

(a) molding a moldable material, having essentially the same thickness throughout, into a flexible liner open at one end and closed at the other end and having as molded upper sidewall means adjacent to at the open end and a regularly convoluted portion comprising a plurality of longitudinally extending convolutions extending from said upper sidewall means towards the closed end;

(b) inserting said liner into an elastomeric sleeve having an inside diameter smaller than the exterior diameter of the liner in its folded state and an axial length less than that of said liner, so that the upper sidewall means of said liner protrudes from said sleeve;

(c) placing an annular essentially ridge dome having a central opening and a ring encircling said opening so that said ring is in touching engagement with the outside surface of the upper sidewall means;

(d) placing a valve assembly which includes a metal cup having a bottom portion and an upstanding sidewall means, so that said cup is in contact with the inside surface of the upper sidewall means of said liner;

(e) crimping the upper edge of the sidewall means of said cup against said ring, with the part of the upper sidewall means of
said liner membrane clamped therebetween as a gasket material to form a fluid tight seal between said cup and said liner; and

(f) assembling any remaining housing components to form said container.
# INTERNATIONAL SEARCH REPORT

**International Application No**: PCT/US90/03062

## I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all)*

According to International Patent Classification (IPC) or to both National Classification and IPC

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<th>IPC(5)</th>
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<td>B65D 35/28</td>
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## II. FIELDS SEARCHED

Minimum Documentation Searched

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<td>U.S.</td>
<td>222/95, 105, 386.5, 183, 405, 402.1, 402.26</td>
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Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched

## III. DOCUMENTS CONSIDERED TO BE RELEVANT**

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<tr>
<th>Category</th>
<th>Citation of Document, * with indication, where appropriate, of the relevant passages</th>
<th>Relevant to Claim No.*</th>
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<td>Y</td>
<td>US, A, 4,121,737 (Kain) 24 October 1978 See all of document</td>
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<td>Y</td>
<td>US, A, 3,700,136 (Ruekberg) 24 October 1972 See figure 3</td>
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<td>Y</td>
<td>JP, A, 63-294378 (Suzuki) 01 December 1988 See figures 1A and 1B</td>
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<td>A</td>
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<td>US, A, 3,371,854 (Casey) 08 May 1973 See figure 1</td>
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<td>US, A, 4,293,353 (Pelton et al) 06 October 1981 See figures 1, 4 and 6</td>
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* Special categories of cited documents:  
  *A* document defining the general state of the art which is not considered to be of particular relevance  
  *E* earlier document but published on or after the international filing date  
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  *X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step  
  *V* 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  
  *A* member of the same patent family

## IV. CERTIFICATION

Date of the Actual Completion of the International Search: 03 July 1990

Date of Mailing of this International Search Report: 13 SEP 1990

International Searching Authority: ISA/US

Signature of Authorized Officer: [Signature]

Form PCT/ISA/210 (second sheet) (May 1986)