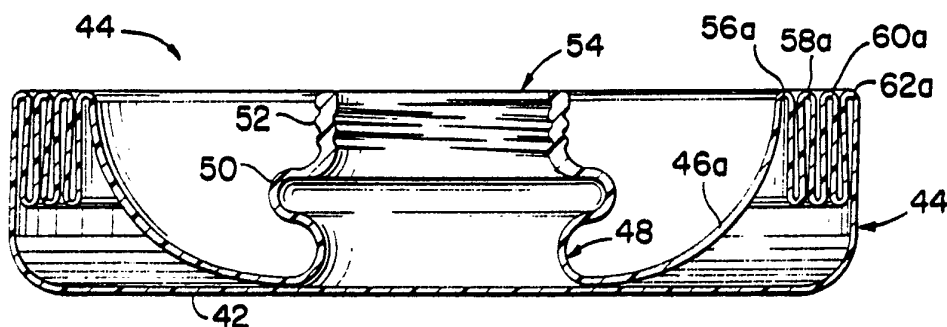




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(21) International Application Number: PCT/US91/06222 (22) International Filing Date: 30 August 1991 (30.08.91) (30) Priority data: <table border="0"> <tr> <td>576,080</td> <td>31 August 1990 (31.08.90)</td> <td>US</td> </tr> <tr> <td>598,385</td> <td>18 October 1990 (18.10.90)</td> <td>US</td> </tr> <tr> <td>706,853</td> <td>29 May 1991 (29.05.91)</td> <td>US</td> </tr> <tr> <td>2,043,958</td> <td>5 June 1991 (05.06.91)</td> <td>CA</td> </tr> <tr> <td>719,711</td> <td>26 June 1991 (26.06.91)</td> <td>US</td> </tr> </table> (71)(72) Applicant and Inventor: ROBBINS, Edward, S., III [US/US]; 459 North Court, Florence, AL 35630 (US). (74) Agent: KEENAN, Michael, J.; Nixon & Vanderhye, 14th Floor, 2200 Clarendon Blvd., Arlington, VA 22201 (US).		576,080	31 August 1990 (31.08.90)	US	598,385	18 October 1990 (18.10.90)	US	706,853	29 May 1991 (29.05.91)	US	2,043,958	5 June 1991 (05.06.91)	CA	719,711	26 June 1991 (26.06.91)	US	(81) Designated States: AT (European patent), AU, BE (European patent), BR, CA, CH (European patent), DE (European patent), DK (European patent), ES (European patent), FR (European patent), GB (European patent), GR (European patent), IT (European patent), LU (European patent), NL (European patent), SE (European patent). Published <i>With international search report.</i> <i>Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i>
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(54) Title: COLLAPSIBLE CONTAINER AND RELATED METHOD AND APPARATUS

**(57) Abstract**

Containers and related method and apparatus are provided, the containers having peripheral wall thicknesses permitting controlled collapse to a compact configuration. The containers are sufficiently strong to be self-supporting both filled and empty, and capable of stand-alone use. In collapsed and folded form, the containers have one or more folded portions (56a, 58a, 60a, 62a) concentrically adjacent one another in generally surrounding relationship to discharge opening portions (54) of the containers. The apparatus includes inner and outer, concentrically arranged and relatively movable pusher members for forming the folded portions of the container.

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⁺ Any designation of "SU" has effect in the Russian Federation. It is not yet known whether any such designation has effect in other States of the former Soviet Union.

COLLAPSIBLE CONTAINER AND RELATED
METHOD AND APPARATUS

TECHNICAL FIELD

This invention relates generally to plastic bottle or container constructions, and particularly to thin walled bottles or containers with or without additive cups which are collapsible and foldable, but fully capable of stand-alone use, as well as to a process and apparatus for collapsing such bottles or containers.

BACKGROUND

In the container industry, there are a number of known applications for relatively thin, flexible bottles or containers, some of the more well known of which relate to the shipment and retail sale of beverages such as milk, water, juice, etc., as well as liquid or powdered cleaners, detergents and the like. There are also a variety of applications where separate ingredients (concentrates, powdered mixes, etc.) or contents are provided which are to be mixed by the user.

It is often the case that such containers must be shipped over considerable distances to distributors who fill and then ship the filled containers to retail concerns. During the initial shipment to distributors, the empty containers, for example one gallon containers, take up so much space that, from a volume standpoint, the manufacturer is shipping mostly air.

At the same time, there is great concern in the environmental arena for plastic materials which for the most part are not biodegradable, and which therefore pose significant disposal problems, particularly in light of the ever expanding utilization of plastics in virtually every area of technology. The problem is especially acute in the container industry, not only with respect to the amounts of plastic disposed of, but also the sheer volume of such waste. There is also now a national environmental issue of source reduction, i.e., how to reduce the amount of plastics utilized in the production of various products.

DISCLOSURE OF INVENTION

This invention seeks to alleviate the above described concerns by:

- 1) providing a plastic bottle or container constructions which, in some instances, require only approximately one half of the plastic currently used in most plastic containers, particularly those larger containers, i.e., one gallon or larger, which typically carry milk, water, juice, detergents (liquid or powder) and other liquids and/or particulates, powdered mixes, etc. but which are fully capable of stand-alone use; and

- 2) shaping the containers in such a way as to facilitate machine-aided, controlled collapse and folding to a compact size which results in a two or more to one increase in shipping and inventory capacity and, by facilitating non-machine-aided (or random) collapse by the consumer after use, achieving

similar orders of magnitude reduction in post-consumer waste volume.

A further concern addressed by this application relates to the present practice of shipping/selling powdered or frozen concentrates or mixes (for beverages such as fruit juices, diet drinks and the like) in one container and mixing it in another. In other words, the present practice in this area requires two containers, with attendant manufacturing, shipping and disposal costs and related problems. Thus, in another aspect, the invention disclosed in this application provides a one-container system where, for example, frozen, liquid or powdered concentrate is shipped/sold and later mixed by the consumer in a single container.

For purposes of this invention, the term "container" refers to plastic containers or bottles having shapes as disclosed herein. In accordance with a preferred embodiment of the invention, the thin walled plastic containers are manufactured by an extrusion or injection blow molding process, incorporating a thin walled construction which permits the normally self-supporting container to be collapsed and a portion or portions concentrically folded to provide a compact, nestable and/or stackable container for efficient shipment as well as disposal.

The containers of this invention generally each have a bottom wall, a peripheral side wall, and an upper, open end serving as a discharge opening, closed by, for example, a removable screw cap.

The container side wall in one exemplary embodiment is provided with peripheral, vertically

spaced steps or shoulders, with or without a slight taper, which serve to increase the side wall diameter from top to bottom, and which facilitate axial collapse and subsequent concentric folding of portions of the side wall to provide a collapsed and folded container article with at least two and as many as four or more "layers" of side wall arranged in a zig-zag or S-shaped configuration, in generally surrounding relationship to tapered shoulder and narrow neck portions of the container.

The container side wall may also be formed with a smooth, tapered or even straight peripheral side wall and nevertheless collapsed and folded as will be explained further herein.

The peripheral side wall of the container alternatively may be provided with a plurality of shoulders or steps which serve to decrease the diameter of the container at each stem in a direction from top to bottom of the container. This configuration permits outward and downward folding of the upper portion of the peripheral side wall of the container so as to provide a double layer fold lying radially outwardly of the lower unfolded and uncollapsed portion of the peripheral side wall of the container. This folding is achieved by an upward collapsing of the container from the bottom toward the top. In one exemplary embodiment, after the peripheral folded portion has been formed, the tapered shoulder and narrow neck discharge portions may be pushed downwardly to further collapse the upper portion of the container so that the upper discharge opening of the container is substantially

horizontally aligned with the uppermost edge of the concentric folded portion.

It will be appreciated from the description above, that the peripheral steps or shoulders (or smooth wall tapers) can be designed to increase or decrease the diameter of the peripheral side wall, and the direction of diameter reduction will determine the type of concentric fold which will be effected upon axial collapse of the container.

A plurality of containers collapsed and folded in the manner described above may be arranged in the form of a stack for easy and efficient shipment, sale and disposal.

It is also a feature of the invention that the container as a whole as well as the axial extent of the peripheral folded portion may be sized to permit the holding of a predetermined amount of liquid or solid concentrate or mix (frozen or unfrozen) within the unfolded portion of the container. Thus, the container may be shipped ready for use, with concentrate added in the correct amount either before or after the container has been compressed to its collapsed configuration. At the same time, when the container is pulled to its fully extended and upright position for use, the remaining volumetric capacity of the container corresponds substantially to the amount of liquid to be mixed with the concentrate. In a preferred arrangement, an additional volumetric capacity is provided to permit shaking of the contents to insure complete mixing. As an example, the container may be sized to hold a half gallon of juice mix with an additional 20% volumetric capacity.

In another exemplary embodiment, containers as generally described above are provided with additive cups supported within the discharge opening in the upper portion of the container. Such additive cups may be utilized to hold concentrate powders, liquids, or other ingredients (referred to herein generically as "additives") which are to be poured from a first dispensing portion of the cup into the container for mixing with the contents of the container by the user. It is a significant feature of this invention, that the cup is provided with a second dispensing portion for dispensing the mixture of the container contents and additive upon pouring the additive into the container. In one exemplary embodiment, the cup is inverted after pouring the additive into the container and reattached thereto in order to serve as a dispenser of the mixture. In this exemplary embodiment, a replaceable screw cap with a removable panel therein is utilized to hold the cup in place within the discharge opening of the container, and to hold the cup in an inverted position on the container in its function as dispenser for the mixture.

In another exemplary embodiment, a cup is provided which is integrally formed with a screw-type cap, and which includes a removable seal across the upper open end of the cup. After the seal is removed and the additive emptied into the container, the cup may be reattached to the container in its original orientation. In this embodiment, the bottom portion of the additive cup is provided with a closable aperture designed especially to receive a straw or the like in order to facilitate dispensing of the mixture.

The invention disclosed in this application provides, in another embodiment, a one-container system where, for example, powdered concentrate is held within a cap applied to the container. The assembly is shipped/sold and later mixed by the consumer in a single container which incorporates all of the advantages of the invention disclosed in the above identified parent applications.

In still another embodiment, a one container system is provided for microwavable popcorn wherein unpopped corn, also held within the cap, is shipped and sold in a collapsed container which expands to full size as a result of the popping action of the corn when placed in a microwave oven.

It is also a feature of the invention, that the container as a whole as well as the axial extent of remaining unfolded portions are sized to permit the holding within the cap chamber of a predetermined amount of, for example, powdered concentrate or drink mix or other foodstuff material. In other words, the cap chamber wall may have an axial extent substantially equal to, or slightly shorter than, the axial extent of the unfolded portions of the container (which, in turn, may also be substantially equal to the axial extent of each fold) so that the cap provides axial support for the collapsed container, which is particularly advantageous for stacking.

In alternative exemplary embodiments of the invention, the top wall of the container may be substantially flat, with a relatively short but wider, i.e., larger diameter dispensing opening or mouth. In this arrangement, vertical stacking is

made possible by providing recesses in the bottom walls of the containers as described in greater detail herein.

In still another exemplary embodiment of the invention, the thin walled, flexible and collapsible that stand alone container adapted particularly for use with petroleum products such as motor oil is provided which includes an integral, elongated spout portion. The spout portion itself may be bendable and may or may not be collapsible. The spout portion is sufficiently thin in any case to permit the spout or neck to be pinched so as to shut off flow from the container until the latter is in proper pouring position over, for example, the filler tube of the vehicle engine. The container body portion in this exemplary embodiment may be smooth and straight, i.e., not tapered, or alternatively, tapered in increasing or decreasing directions or provided with annular steps for shoulder which serve to increase or decrease the diameter in accordance with the controlled collapse concepts described above.

It will be appreciated from the above that the subject matter of this application permits compact shipment of containers from manufacturers to distributors/fillers, and equally compact shipment (with or without concentrate or mix added) to retailers. Of course, inventory and display at the point of sale are also facilitated by the compact arrangement.

After use, the containers in all embodiments may easily be collapsed in a random fashion for efficient disposal.

There is also disclosed for eventual (but optional) use with one or more embodiments of the invention a relatively rigid open-topped pitcher for receiving and holding the plastic container. The pitcher is formed with interior beads and/or steps about its periphery, which are designed to engage the corresponding steps or shoulders on the container side wall to thereby hold the container in place during pouring.

After initial manufacture, the containers are collapsed in a controlled manner by apparatus specially designed for this purpose. The controlled collapse provides a uniform, attractive appearance. After use, however, the container is intended to be collapsed in a random manner by the consumer to achieve post-consumer waste reduction. It will be readily evident that for disposal purposes, controlled collapse is unnecessary, particularly since the volume reduction is similar whether or not collapsing is controlled.

Accordingly, the invention in its broader aspects relates to a collapsible, thin wall, normally self-supporting plastic container comprising a bottom wall, an annular peripheral side wall and a top wall having a discharge opening, said peripheral side wall characterized by means for enabling stand alone use, both filled and empty, as well as controlled collapsing and folding of said peripheral side wall to a compact configuration where one or more portions of said side wall are folded radially inwardly or radially outwardly to form one or more folded portions concentric with said discharge opening.

An exemplary embodiment of an apparatus utilized to carry out the collapsing and folding operation for some of the disclosed embodiments (those which have a side wall which increases in diameter from top to bottom) generally includes a container holder and reciprocable fluid actuated tool members which act in sequence to form first and second folded portions of the container. A more detailed description of the apparatus appears further herein. In its broader aspects, the apparatus comprises means for supporting and holding the container in an upright position, said apparatus characterized by first forming means for engaging and exerting a downward force on the intermediate annular stepped portion and for effecting the formation of a first folded portion; and second forming means for engaging and exerting a downward force on the top wall for effecting the formation of a second folded portion.

Finally, the present invention relates to a method of forming a collapsed and folded container broadly comprising the steps of:

a) providing a flexible container of unitary construction and having a bottom wall, a peripheral side wall extending from the bottom wall and a top wall which may include a tapered shoulder section extending from the peripheral side wall, and a reduced diameter neck portion extending from the tapered shoulder portion and including a discharge opening; characterized by the step of

b) forming the peripheral side wall of a thickness which, upon exerting an axial force on a first portion of the peripheral side wall, will cause said side wall to collapse and fold so as to form at

least one folded portion located concentrically relative to said discharge opening, but which also permits said container to be sufficiently strong to be self-supporting, both filled and empty, and capable of stand-alone use.

It will be understood that containers in accordance with this invention may have different shapes than those described above. For example, the container top wall may be flat, with a smaller or larger discharge opening therein. In such case, the described method and apparatus would be modified accordingly.

From the above, it will be appreciated that the present invention provides significant benefits in terms of shipping and storage capacity and efficiency while, at the same time, provides for substantial savings in the amount of plastic used in the manufacture of plastic containers, the latter having a further beneficial effect in the matter of waste disposal.

Other objects and advantages of the invention will become apparent from the detailed description which follows.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGURE 1 is a partial cross sectional side view of an upright container in accordance with an exemplary embodiment of the invention;

FIGURE 2 is a cross sectional side view of a stack of containers of the type illustrated in Figure

1 but collapsed and folded in accordance with the invention;

FIGURE 3 is a side view of a container in accordance with a second exemplary embodiment of the invention;

FIGURE 4 is a side cross sectional view of a container of the type illustrated in Figure 3, collapsed and folded in accordance with the invention;

FIGURE 5 is a partial cross sectional side view of a container in accordance with a third and preferred embodiment of the invention, supported within a relatively rigid outer pitcher;

FIGURE 5A is a partial cross sectional side view of the container illustrated in Figure 5 but supported within a box;

FIGURE 6 is a partial cross sectional side view of a stack of containers of the type illustrated in Figure 5, collapsed and folded in accordance with the invention;

FIGURE 7 is a perspective view of an apparatus for collapsing and folding containers in accordance with the invention;

FIGURES 8-15 are partial side cross sectional views of the apparatus illustrated in Figure 7, in various stages of operation during a collapsing and

folding operation of the container of the type illustrated in Figure 5;

FIGURE 16 is a cross sectional side view of the apparatus in Figures 7-15, and showing an additional collapsing of the discharge portion of the container in accordance with another and preferred embodiment of the invention.

FIGURE 17 is a side view of a thin wall collapsible container in accordance with another exemplary embodiment of the invention;

FIGURE 18 is a side view of the container shown in Figure 17 but in a partially collapsed condition;

FIGURE 19 is a side view of the container illustrated in Figures 17 and 18 but in a fully collapsed condition;

FIGURE 20 is a side view of a pair of containers illustrated in Figure 19 but shown in a stacked arrangement;

FIGURE 21 is a partial perspective of a thin wall collapsible container in accordance with another second exemplary embodiment of the invention;

FIGURE 22 is a side view of a pair of containers of the type partially shown in Figure 21 but shown in a stacked arrangement;

FIGURE 23 is a perspective view, partially cut away, illustrating another embodiment of the invention, shown in packaged form;

FIGURE 24 is a perspective view of a collapsed and folded container of the type shown packaged in Figure 23;

FIGURE 25 is a side section view of a container of the type illustrated in Figure 24 but expanded to its normal upright position;

FIGURE 26 is a partial exploded perspective view illustrating the cap structure of the container illustrated in Figure 25, and a preferred manner of use thereof;

FIGURE 27 is a perspective view of a container in accordance with another exemplary embodiment of the invention;

FIGURE 28 is a partial cross sectional view of the upper portion of a container in accordance with another exemplary embodiment of the invention;

FIGURE 29 is a partial cross sectional view of an upper portion of a container in accordance with another embodiment of the invention;

FIGURE 30 is a partial cross sectional view of the container portion as illustrated in Figure 29 but after a seal and cup additive have been removed and a drinking straw inserted;

FIGURE 31 is a partial cross sectional view of an upper container portion as illustrated in Figure 30 but with the straw removed and a removable cap of the type shown in Figure 29 applied over the dispensing aperture thereof;

FIGURE 32 is a side view of a container in accordance with another exemplary embodiment of the invention with a removable cap shown partly in section;

FIGURE 33 is a side section of the container and cap assembly shown in Figure 32, but in a collapsed condition;

FIGURE 34 is a side sectional view of a container and removable cap assembly in accordance with another exemplary embodiment of the invention;

FIGURE 35 is a side view of a container body in accordance with another exemplary embodiment of the invention;

FIGURE 36 is a cross-sectional elevational view of the container embodiment shown in FIGURE 35, but depicted in a collapsed state;

FIGURE 37 is a collapsed side section of a container and cap assembly in accordance with another exemplary embodiment of the invention;

FIGURE 38 is a side sectional view of a container and removable cap assembly in accordance with another exemplary embodiment of the invention;

FIGURE 39 is a side sectional view of a container and tray assembly in accordance with another exemplary embodiment of the invention;

FIGURE 40 is a side sectional view of the container and cap assembly illustrated in Figure 39 but in a fully expanded position;

FIGURE 41 is a side sectional of a container and removable cap assembly in accordance with a seventh exemplary embodiment of the invention;

FIGURE 42 is a side sectional view of a container and removable cap assembly in accordance with an eighth exemplary embodiment of the invention; and

FIGURE 43 is a perspective view of a container and removable tray assembly of the type illustrated in Figure 10, but in a fully expanded state.

FIGURES 44 and 45 are perspective views of a container in accordance with another embodiment of the invention;

FIGURES 46 and 47 are perspective views of a container in accordance with still another embodiment of the invention;

FIGURE 48 is a side elevation of a container in accordance with still another embodiment of the invention;

FIGURE 49 is the side view, partially in section, showing the container of FIGURE 8 in combination with an associated carrier in a pouring orientation;

FIGURE 50 is a side view of a container in accordance with another embodiment of the invention;

FIGURE 51 is a side view of a container somewhat similar to that shown in FIGURE 50, but wherein the neck portion exhibits controlled collapse characteristics;

FIGURE 52 is a partial side view (partly in section) showing the spout of the container in FIGURE 51 in a collapsed condition; and

FIGURE 53 is a side view of a container in accordance with another exemplary embodiment of the invention.

DETAILED DESCRIPTION OF THE DRAWINGS

With reference to Figures 1 and 2, a thin walled, one gallon plastic container 10 in accordance with an exemplary embodiment of the invention includes a bottom wall 12, a peripheral side wall 14, and a top wall which may comprise a tapered shoulder portion 16, and a narrow neck portion 18. The neck

portion 18 may be provided with a radially outwardly directed flange 20 and a series of threads 22 at the uppermost end of the neck portion surrounding a discharge opening 24. The threads 22 are designed to receive a conventional screw type closure (not shown).

It will be appreciated that the tapered shoulder portion 16 may be omitted in favor of a substantially flat top wall, and the discharge opening 24 may be enlarged as desired within the top wall.

In a preferred embodiment, the bottle or container is a unitary structure formed by extrusion or injection blow molding or other conventional plastic forming process. The finished side wall 14 has a preferred thickness between .004 and .010 of an inch (4 and 10 mils), and the neck portion 18 has a preferred thickness between about .010 and .030 of an inch (10 and 30 mils). The bottom wall 12 has a thickness substantially the same as the side wall 14, i.e., between .010 and .025 of an inch (10 and 25 mils), but it may be slightly thicker as a result of the pinching off of the parison prior to blowing. Other thickness ranges are possible for the various container portions, the significant criteria being that the bottle be normally self-supporting but easily collapsed and folded in the manner described below.

One gallon containers formed with the above dimensions represent an approximate 50% reduction in the amount of plastic material required, as compared to conventional milk containers. Similar savings can be expected with containers of other sizes as well.

Suitable semi-rigid (or more flexible) plastics including high density polyethylene (HDPE) and PET

may be used for the container, but linear low density polyethylene (LLDPE) is presently preferred for all of the embodiments described herein.

In one exemplary embodiment, the peripheral side wall of the bottle or container is provided with an annular step or shoulder 26 to facilitate the collapsing and folding operation.

With reference now to Figure 2, a stack 28 of thin walled bottles 10 is illustrated, with each container 10 collapsed to a stackable and nestable configuration. As shown in Figure 2, each container includes an inwardly domed portion 30 and an outwardly and upwardly folded concentric portion 32 extending to an uppermost tip 36 which lies within the plane of the tapered shoulder portion 16 of the container 10. The inwardly and upwardly domed portion 30 extends into the tapered shoulder section 16 so that a recess 38 is formed in the lower portion of the container for receiving the neck portion 18 and part of the tapered shoulder portion 16 of adjacent container 10'. A series of such collapsed and folded containers may be stacked and nested as shown in Figure 2 so as to conserve significant space during shipping and/or storage prior to filling.

With reference now to Figure 3, another plastic container configuration in accordance with a second exemplary embodiment of the invention is illustrated. This second container 40 includes a bottom wall 42, a peripheral side wall 44, a tapered shoulder area 46 leading to a reduced diameter neck portion 48. Within this reduced diameter neck portion is provided a radially enlarged flange 50 and an uppermost portion including a threaded closure

receiving portion 52 surrounding a discharge opening 54. As in the previously described embodiment, a conventional screw type or snap-on closure (not shown) may be utilized in conjunction with the container 40.

This second exemplary embodiment of the invention is generally similar to the first described embodiment with the principal distinction relating to the formation of a plurality of annular steps or shoulders 56, 58, 60 and 62 in vertically spaced relationship along the peripheral side wall 44 of the container. These steps or shoulders serve to enlarge the diameter of the container in each adjacent lower portion, so that different diameter side wall portions 64, 66, 68, 70 and 72 are created by the series of steps or shoulders, to create an overall slightly tapered appearance.

The bottle as shown in Figure 3 may be collapsed to the configuration shown in Figure 4, with each of the steps 56, 58, 60 and 62, facilitating the formation of adjacent and concentric folded portions 56a, 58a, 60a and 62a, respectively. If desired, the shoulder section 46 may also be essentially inverted to the upward and outward configuration shown at 46a. By this arrangement, the neck portion 48 lies substantially flush with, or slightly below the uppermost edges of the folded portions 56a, 58a, etc., to provide an even more compact stacking arrangement.

Turning to Figure 5, a container 74 in accordance with a third embodiment of the invention is disclosed and includes a bottom wall 76, a peripheral side wall 78, and a tapered shoulder

portion 80 leading to a reduced diameter neck portion 82. Within the reduced diameter neck portion, there is a radially enlarged flange 84 and an uppermost portion including a threaded closure receiving portion 86 surrounding a discharge opening 88. As in the previously described embodiments, a conventional screw-type (or snap-on closure, not shown) may be utilized in conjunction with the bottle 74 in a conventional manner.

This embodiment of the invention is provided with an annular groove 90 and a pair of annular steps or shoulders 92 and 94 formed in vertically spaced relationship along the peripheral side wall 78 of the container. As in the previously described embodiment, the presence of groove 90 and steps or shoulders 92 and 94 serve to enlarge the diameter of the bottle in each adjacent lower portion so that different diameter side wall portions 96, 98 and 100 are created by the groove 90 and steps or shoulders 92 and 94.

It has been discovered that the container need not have the described one or more steps formed in the peripheral sidewall. Another workable arrangement is provided by a smooth tapered peripheral sidewall extending from a smaller diameter upper portion to a larger diameter lower portion.

It has also been found that a smooth substantially cylindrical sidewall can be collapsed and folded in accordance with this invention by introducing pressurized air into the container interior to bulge the sidewall radially outwardly so as to provide a surface engageable by the folding tool, as will be described further below.

In Figure 5, the container 74 is shown inserted within a pitcher 102. The pitcher 102, which is preferably made of relatively rigid plastic material, is formed with a bottom wall 104, a lower peripheral supporting bead 106 and a peripheral side wall 108 extending upwardly to an outwardly flared edge 110. The pitcher is also formed with an inwardly directed annular bead 112 and a pair of annular steps 114 and 116 which are located to align with and engage the corresponding groove 90 and steps or shoulders 92 and 94, respectively formed on the container. In this manner, the container 74 is retained within the pitcher 102 during pouring motions.

The pitcher 102 can be formed in a one-piece configuration, or it can be formed with a separately attached bottom wall spin welded, solvent bonded, or otherwise suitably secured to the peripheral side wall. Mechanical engagements between the bottom wall and side wall such as a snap engagement are also contemplated. In the event container 74 is used alone, without the pitcher 102, the groove 90 in the container side wall may be formed as a step similar to those shown at 92, 94.

It will be appreciated that the filled container can be used alone, with a pitcher such as that shown at 102, or with any number of other pitcher configurations. The filled container can, of course, be used in combination with a variety of outer package arrangements such as boxes, or the like. Figure 5A illustrates the use of an essentially rectangular paperboard or cardboard box 103 as a "carrier" for the container 74.

With reference now to Figure 6, a stack 118 of collapsed and folded containers of the type illustrated in Figure 5 is shown in a ready-to-ship configuration. Specifically, by collapsing and folding the containers in the manner described hereinbelow, peripheral folded side wall portions 120 and 122 are arranged about a fold edge 124 to form a first concentric folded portion, and peripheral side portions 126 and 128 are arranged about a fold edge 130 to form a second adjacent folded portion. This second folded portion lies radially inwardly of the first folded portion and connects via a fold 132 to the tapered shoulder portion 80 of the container 74. Thus, a collapsed and folded peripheral side wall is provided which includes four adjacent layers or thicknesses in a zig-zag or S-shaped arrangement generally surrounding the tapered shoulder section 80 and reduced diameter neck portion 82 of the container 74. The fold edges 124, 130 lie substantially flush with the upper portion of the radial flange 84 formed in the reduced diameter neck portion 82.

In stack form, the bottom wall 76 of each container 74 is supported on the peripheral edge of the discharge opening 88 of the next adjacent container to thereby provide a compact arrangement which significantly increases shipping and/or storage efficiency.

In a modification of the above described container, the tapered shoulder section 80 may be at least partially collapsed, as shown in Figure 6, so that the uppermost fold edges 124, 130 of the first and second folded portions are in substantial lateral alignment with the discharge opening 88 to facilitate

an even more compact stacking arrangement where the bottom wall 76 of one container rests on the peripheral edge of the discharge opening 88 as well as fold edges 124, 130.

With reference now to Figures 7 through 16, an exemplary apparatus is illustrated for carrying out a method of collapsing and folding a bottle or container of the type illustrated in Figure 5 to the folded and collapsed configuration shown in Figure 6.

Specifically, referring to Figure 7, the apparatus 140 is supported on a work table 142 or other suitable structure having a substantially flat supporting surface 144 and an aperture 145 of sufficient diameter to permit a container to pass therethrough, as explained in greater detail below.

A container holder device 146 for supporting the container during the collapsing and folding operation is mounted on the supporting surface 144, and includes a pair of opposed elements 148, 150 which are slidably mounted on guide bars 152, 154 for reciprocal movement toward and away from each other. The element 148 has a substantial semi-cylindrical configuration including a container supporting surface 156 and an upstanding peripheral wall 158. The supporting wall 156 is provided with a semi-circular cut-out portion 160. The other base supporting element 150 has a configuration substantially identical to the base element 148 so that when the two base elements engage, a substantially cylindrical supporting structure having an open end and a closed end is provided for supporting and confining the container.

Piston and cylinder assemblies 162, 164 are provided, with respective piston rods 166, 168 fixed to an associated one of the elements 148, 150 for moving the elements 148, 150 linearly along the guide rods or bars 152, 154 between open and closed positions.

The guide rods 152, 154 are suitably secured at either end within support blocks 170, 172 and 174, 176, respectively.

It will be appreciated that other container holder devices or arrangements, driven pneumatically or electrically, can be used to support the container.

Collapsing and folding tool elements are supported above the work surface 144 on a stationary platen 178 supported by a set of four tie bars, three of which are shown in Figure 7 at 180, 128 and 184 which are rigidly secured at first ends to the table 142, and at second ends to the stationary platen 178 by bolts or other suitable fastening means 186. The stationary platen 178 is located sufficiently above the work surface 144 to permit a bottle or container of the type illustrated in Figure 5 to be supported on the container holder 146 for folding and collapsing into the configuration shown in Figure 6. Platen 178 is provided with a pair of cut-outs or notches 188 along opposite edges of the platen for reasons described below.

A main cylinder assembly 190 is supported on the platen 178 by any suitable means. This is a double acting cylinder assembly, with tubular piston rod portions 192, 194 (see Figure 8) extending from the top and bottom, respectively, of the main cylinder 190. The upper tubular piston rod portion 192 is

fixedly secured (by threaded engagement or other suitable means) to a lower horizontal member 196 of an open rectangular frame 198, which includes the lower horizontal member 196, an upper horizontal member 200 and a pair of side elements 202, 204.

A top cylinder assembly 206 is secured to the upper horizontal member 200 by any suitable means, and includes a piston rod 208 which extends through the member 200 and is fixed to an adaptor 210 which, in turn, is connected to a pneumatic pancake cylinder 212. The cylinder 212 is attached at its lower end to an air supply manifold 214. With reference to both Figures 7 and 8, it will be seen that a hollow tube 216 extends from the air supply manifold 214, through the upper and lower tubular piston rod portions 192, 194 and is fixed at its lower end to an upper bushing 218. The piston rod 220 (and/or integral or joined extension thereof) of the pancake cylinder 212 passes through the tube 216 and is fixed to a lower bushing 222. Located between the upper and lower bushings 218, 222, there is an expandable, rubber (or other resilient synthetic material) plug 224 which serves to engage and seal the discharge opening of the container as will be described further below.

As best seen in Figures 8 and following, the lower end of the lower tubular piston rod portion 194 of the main cylinder assembly 190 is fixed to a first inner container engaging pusher member 226 by suitable means, such as screws 228 or the like. The inner pusher member 226 includes an upper movable platen 230 and a substantially cylindrical lower portion 232 which is formed with an annular tapered

surface 234 at its lowermost end which is adapted to engage the shoulder portion of the container. The lower cylindrical portion 232 is also formed with a central recess 236 which receives the expandable plug 224 when the piston rod 208 of the cylinder 206 is in its uppermost or retracted position.

A pair of identical side cylinder assemblies 238 are mounted at opposite ends of the upper movable platen 230, and have piston rods 240 which extend through the upper movable platen 230 and are fixed (by threading or other suitable means) to opposite ends of a lower movable platen 242 of a second outer container engaging pusher member 244 which is concentrically arranged relative to the inner pusher member 226.

The outer pusher member or sleeve 244 comprises the lower movable platen 242 and a depending annular skirt portion 246 having a lower annular edge 248.

A plurality (preferably four) stop pins 250 are fixed to the support surface 144, in alignment with the lower movable platen 242 to provide a stop limiting downward movement thereof. Other stop arrangements including a solid ring may be employed. The upper movable platen 230 is also aligned with the lower movable platen 242 so that the latter limits downward movement of the former as described below.

A plurality of guide bars 252 may be utilized to insure straight line reciprocatory movement of the inner and outer pusher members 226, 244, the guide bars 252 being fixed to the upper side of the lower movable platen 242 and extending through the upper movable platen 230 and the stationary platen 178, as best seen in Figure 7.

The manner in which the above described apparatus functions to collapse and fold a bottle or container in accordance with an exemplary embodiment of the invention will now be described in detail.

With reference again to Figure 7, a conveyor 254, or other suitable workpiece transport means, may be utilized to feed a plurality of containers 74 to the collapsing and folding apparatus 140. For example, the conveyor 254 can be arranged to feed the containers below the table 142 to a position directly beneath the aperture 145. The position of the various components including the container 74 in this initial position is shown in Figure 8.

In a less automated system, the containers may be manually located beneath the aperture 145 on a lower work table surface (not shown).

With reference to Figure 7, the main cylinder assembly 190, provided with inlet and outlet lines 256, 258, is shown with its tubular piston rod portions 192, 194 in their upwardmost position. Thus, the upper movable platen 230 is shown in engagement with the stationary platen 178 while the lower movable platen 242 is maintained at a predetermined spaced distance below the upper movable platen 230 by the side cylinder assemblies 238 (provided with inlet and outlet lines 260, 262) which are in their fully extended position. At the same time, the top cylinder assembly 206, provided with inlet and outlet lines 264, 266, is also in a retracted position so that the expandable plug 224 is received within the recess 236 formed in the cylindrical portion 232 of the inner pusher member 226.

With reference now to Figure 8, prior to loading the container 74 onto the surfaces 156 of the container holder assembly 146 (omitted from Figure 8 for clarity), the main cylinder assembly 190 is actuated to move its tubular piston rod portions 192, 194 to their downwardmost position. In doing so, the top cylinder 206 and the open rectangular frame 198 are also moved to a lowermost position. At the same time, the lower piston rod portion 194 moves the inner and outer pusher members 226, 244 downwardly until the lower movable platen 242 engages the stop pins 250. At this point, the lower piston rod portion 194 continues to move downwardly, overriding the resistance of the side cylinders 238 so that the inner pusher member 226 continues downwardly until the upper movable platen 230 engages the lower movable platen 242.

With the discharge opening of the container 74 in vertical alignment with the expandable plug 224, the top cylinder 206 is then actuated to extend the tube 216 and rod 220 downwardly until the expandable plug 224 is exposed below the work table 142 as shown in Figure 9. The container 74 may then be manually pushed onto the plug 224, with the plug inserted within the discharge opening 88. In a fully automated system, extension of plug 224 could be timed with the arrival of the container 74 via conveyor 254, and the plug would then be inserted directly and automatically into the opening 88 via actuation of the top cylinder 206.

In any event, once the plug 224 is located within the discharge opening 88 (Figure 9), the pancake cylinder assembly 212, provided with an inlet

line 268 and outlet line 270, is actuated to retract the rod 220, thereby drawing the lower bushing 222 toward the upper bushing 218, causing the plug 224 to expand radially outwardly into gripping and sealing relationship with the reduced diameter neck portion 82 of the container 74 (as shown in Figure 10).

With reference now to Figures 10 and 11, the top cylinder assembly is reversed to draw the expandable plug 224 along with the container 74 upwardly into the aperture 145. Simultaneously, or shortly thereafter, the main cylinder assembly 190 is actuated to move its piston rod portions 192, 194 along with inner and outer pusher members 226, 244 as well as plug 224 (and the now attached container 74) upwardly into their original position as illustrated in Figure 7.

The cylinders 162 and 164 of the container holder assembly 146 are then actuated to move the split holder sections 146, 150 into supporting engagement beneath the container 74 as partially illustrated in Figure 11.

Air is then supplied from the manifold 214 via line 264 into the space between tube 216 and rod 220 downwardly through the center of the plug 224 and through apertures 272 provided in a lower bushing 222 into the interior of the container 74, as indicated by the arrows in Figure 11. The air supplied to the container is preferably at very low pressure, for example .2 to 2 psi (preferably about .3 psi) and insures that there are no wrinkles, creases or dents in the container 74 which would otherwise interfere with the collapsing/folding operation.

It will be appreciated that just prior to collapsing/folding, the air manifold 214 must be opened to permit the controlled escape of air during the folding and collapsing operation (as indicated by the arrows in Figures 12, 13, etc).

With reference again to Figure 11, the container 74 is shown in position for the collapsing and folding operation to commence. In this regard, it is noted that the lowermost edge 248 of the outer pusher member 244 lies immediately adjacent or in engagement with the intermediate peripheral step 92 on the peripheral side wall 78 of the container 74.

Referring now to Figure 12, actuation of the main cylinder assembly 190 causes both the inner and outer pusher members 226, 244, respectively, to move downwardly. This is because the outer pusher member is supported by reason of the side cylinder assemblies 238 on the upper movable platen 230. During this initial downward movement of the lower tubular piston rod portion 194 of the main cylinder assembly 190, the inner and outer pusher members 226, 244 are maintained a predetermined spaced distance apart by the biasing force of the piston rods 240 of the cylinder assemblies 238.

As the lower edge 248 of the outer pusher member 244 pushes downwardly on the annular step 92 of the side wall 78, the first folded portion is formed about edge 124 between the depending cylindrical skirt portion 246 and the inner cylindrical surface of the container holder assembly 146. During this collapsing and folding step, the axial length of the container 74 will shorten so that as the inner pusher member 226 follows or rides along with the outer

pusher member 244, the latter does not exert any axial pressure on the tapered shoulder section 80 of the container 74. Also during this initial forming step, and as noted above, air is exhausted in a controlled manner from the interior of the container 74 through the apertures 272 and tube 216 as indicated by the arrows in Figure 12.

Turning now to Figure 13, the outer pusher member 244 is shown to have reached its lowermost position, where the lower movable platen 242 has engaged the stop pins 250 and with the first folded portion completed. As the lower tubular piston rod portion 194 continues to move downwardly, the force exerted by the main cylinder assembly 190 overcomes the opposing resistive forces of the cylinder assemblies 238 so that the inner pusher member 226 continues downward movement relative to the now stationary outer pusher member 244. With reference to Figures 14 and 15, during this continued downward movement of the inner pusher member 226, the tapered surface 234 engages the tapered shoulder portion of the container and pushes the container downwardly to effect a second folded portion about a fold edge 130, between the outer peripheral surface of the cylindrical portion 232 of the inner pusher member 226 and the inner peripheral surface of the depending skirt portion 246 of the outer pusher member 244. The upper and lower shoulders or steps 90 (groove 90 is shown as a step here), 94, respectively, formed in the container side wall 78, serve to facilitate the collapsing and folding action during this second forming step.

When the upper movable platen 230 of the inner pusher member 226 has bottomed out against the lower movable platen 242 of the outer pusher member 244, as best seen in Figure 15, the second folded portion of the peripheral side wall 78 is completed. This second folded portion lies concentrically adjacent and radially inwardly of the first folded portion with the uppermost fold edges 124, 130 at substantially the same height.

At this stage of the operation, the container holder device 146 may be opened or retracted, and the top cylinder 206 actuated to extend the tube 216 and rod 220 downward to push the collapsed and folded container away from the inner and outer pusher members 226, 244. Thereafter, the pancake cylinder assembly 212 may be actuated to extend the rod 220 to thereby contract the expandable plug 224 so that the collapsed and folded container may be removed from the apparatus.

It may advantageous, however, to effect an additional collapsing step as illustrated in Figure 16. Thus, after the lower piston rod portion 194 of the main cylinder assembly 190 has reached its lowermost position with both inner and outer pusher members 226, 244 as shown in Figure 16, the top cylinder 206 may be actuated to partially extend the tube 216 and rod 220 so that the expandable plug 224 is driven downwardly to at least partially collapse the tapered shoulder section 80 of the container 74 to thereby position the discharge opening 88 of the container 74 at approximately the same height as the uppermost edges 124, 130 of the first and second folded portions. This arrangement permits an even

more compact and efficient stacking arrangement for shipment and/or storage purposes. Removal of the container would then be achieved as described above.

It is also within the scope of this invention to modify the interior surface 234 of the inner pusher member 226 so that the tapered shoulder section 80 of the container 74 is at least partially collapsed during the formation of the second folded portion by the inner pusher member 226. This type of arrangement would avoid the necessity of having to extend the plug 224 downwardly via top cylinder 206 in a separate step as described above.

Other modifications in accordance with the invention relate to the shape of the container side wall. For example, the apparatus as described above may be utilized to form a collapsed and folded container as illustrated in Figures 6, 14 or 16 from a container having a smooth tapered surface or from a container having a smooth cylindrical surface. In the former case, the natural taper of the side wall provides the frictional engagement with the lower edge 248 of the outer pusher member 244 required to initiate the folding action. In the latter case, the introduction of air under pressure prior to commencing the collapsing/folding operation, can be used to bulge the side wall of the container outwardly, again providing the frictional engagement necessary to initiate folding.

With reference to Figures 17 and 18, a thin walled, plastic container 310 in accordance with another exemplary embodiment of the invention includes a recessed bottom wall 312, a peripheral side wall 314, and a top wall which, in this first

exemplary embodiment, may comprise a tapered shoulder portion 316, and a narrow neck portion 318. The neck portion 318 may be provided with a radially outwardly directed flange 320 and a series of threads 322 at the uppermost end of the neck portion surrounding a discharge opening 324. The threads 322 are designed to receive a conventional screw type closure (see Figure 20).

Preferably, the bottle or container is a unitary structure formed by extrusion or injection blow molding or other conventional plastic forming process. The finished side wall 314 has a preferred thickness between 4 and 10 mils, and the neck portion 318 has a preferred thickness between about 10 and 30 mils. The bottom wall 312 has a thickness substantially the same as the side wall 314, i.e., between 10 and 25 mils, but it may be slightly thicker as a result of the pinching off of the parison prior to blowing. Again, other thickness ranges are possible for the various container portions, the significant criteria being that the bottle be normally self-supporting but easily collapsed and folded in the manner described herein.

In this exemplary embodiment, the peripheral side wall of the bottle or container is provided with a pair of vertically spaced annular steps or shoulders 326, 328 to facilitate the collapsing and folding operation.

As will be appreciated from Figure 17, the side wall 314 of the container tapers slightly downwardly and inwardly from shoulder portion 316 to the bottom wall 312. Steps or shoulders 326, 328 serve to further reduce the diameter, and are located axially

along the side wall 314 so as to correspond to, and in fact form, the folds in the collapsed container as described below. The tapered side wall 314 and shoulders 326, 328 may be used separately or in combination to achieve the controlled side wall collapsing/folding described below.

With reference now to Figure 18, a partially collapsed thin walled container 310 is illustrated, with an outwardly and downwardly folded concentric portion 330 extending from the tapered shoulder portion 316 to substantially the bottom 312 of the container.

It will be appreciated that the outwardly and downwardly directed, concentric folded portion 330 is defined at its lowermost end by the step or shoulder 328 and at its uppermost end by the shoulder or step 326. By slightly reducing the diameter of the container from top to bottom, sufficient space is provided for upward collapsing movement of the bottom portion of the container to form the folded portion 330, and the latter remains substantially the original diameter of the upper portion of the container.

With reference to Figure 19, after the outwardly and downwardly directed concentric portion 330 is formed, the tapered shoulder 316 and discharge neck 318 of the container may be pushed downwardly toward the bottom wall 312 to effect a fully collapsed condition as best seen in Figure 19. In the fully collapsed condition, the uppermost edge of the container at the discharge opening 324 lies just below the uppermost edge 332 of the folded portion 330 to thereby provide a compact arrangement for

shipping purposes when the cap is in place, as shown in Figure 20.

It will be appreciated that, upon manufacture, the containers may be collapsed empty and shipped to the distributor/filler for addition of the concentrate. Upon receipt by the distributor/filler, the concentrate 333 may be added to a level 334, adjacent the reverse fold 336 without first expanding the container. The concentrate may then be frozen (if necessary), and the container made ready for shipment/distribution and sale. Between manufacture and sale, the container 310 may remain in the collapsed configuration.

The container 310 may be sized to accommodate a predetermined amount of concentrate 333 and to further accommodate the amount of liquid required to be mixed with the concentrate by the consumer after purchase. In other words, the container is sized and the steps or shoulders 326, 328 are located so that in the fully collapsed configuration, the unfolded portion of the container will be substantially filled with the concentrate. In the event 16 oz. of concentrate is intended to produce, for example, one half gallon of a beverage, the uncollapsed portion of the container is sized to hold 16 oz. of concentrate, and the overall volumetric capacity of the container will be substantially one half gallon. In a preferred arrangement, and in the example given above, the container would in reality have a volumetric capacity of one half gallon plus about 20%. This additional volumetric capacity permits shaking up of the contents of the container to insure

good mixing of the concentrate and subsequently added liquid.

In Figure 20, a stacked arrangement of collapsed containers 310 of the type shown in Figure 19 in accordance with the invention is illustrated. Because the cap 338 is substantially flush with the uppermost edge 332 of the folded portion 334, a fully seated stacking arrangement is presented where uppermost edge 332 is engaged by the lower edge 328 of the folded portion 330 of the overlying container. At the same time, the recessed portion of the bottom wall 312 is engaged by the cap 338, and the outer rim 340 of the bottom wall 312 is engaged by the reverse folded tapered shoulder 316. This provides a stable and compact shipment configuration, particularly when the containers are weighted by the concentrate.

With reference now to Figure 21, another exemplary embodiment of the invention is illustrated wherein the container 340 has a substantially flat top wall 342 and a discharge opening (covered by cap 344) substantially larger in diameter than the earlier described embodiment. Otherwise, the container 340 and the manner in which it may be collapsed and expanded is identical to that described hereinabove. It will be appreciated that the discharge opening may also be substantially equal in size to the upper end of the container.

Referring to Figure 22, there is illustrated a pair of stacked containers 340 of the type shown in Figure 21. Notice in this embodiment that the bottom wall 346 of the container 340 is recessed at 348 to a greater degree than the embodiment shown in Figures

1-4, so that the upstanding neck and cap 344 of an underlying container 340 can be accommodated, thereby enabling full annular engagement of the lower folded edge 350 and bottom wall rim 352 with the flat top wall 342 of the underlying container 340.

It will be appreciated by those of ordinary skill in the art, that modifications or alternative arrangements may be provided which are nevertheless within the scope of this invention. For example, while the annular steps or shoulders 326, 328 facilitate the folding and collapsing operation, a similar foldable and collapsible container may be provided with a smooth tapered peripheral side wall.

In addition, it will be appreciated that additional folded portions may be employed particularly with larger containers in order to provide a compact configuration.

Apparatus suitable for forming the above described containers will be similar to the apparatus previously described above, but with suitable modifications to fold and collapse the container from below as opposed to as above as described therein. In other words, the apparatus will be substantially a mirror image of the apparatus disclosed in the parent application (in terms of vertical orientation of the components).

If desired, the thin film container of this invention may be used in conjunction with an outer, rigid supporting pitcher of a type shown, for example, in U.S. Patent Nos. 4,982,868 and 4,982,869, or in copending U.S. application Serial No. 07/680,532 filed April 4, 1991.

In use, the containers 310 or 340 may be manufactured and then shipped to a distributor/filler in the collapsed configuration, saving considerable shipment space and thus improving efficiency. The distributor/seller can then substantially fill the unfolded portions of the collapsed containers with concentrate 333, followed by freezing (if appropriate). It will be appreciated that the concentrate could also be added with the container in a fully expanded configuration, although this is a less desirable procedure. The filled and collapsed containers 310 or 340 may then be restacked and shipped to retail concerns for sale to customers. The customer, when ready to use the container 310 or 340, simply pulls the container to its fully expanded configuration and adds the required amount of liquid. The additional volumetric capacity of the container allows the beverage to be shaken so as to fully mix the container contents. After use, the container may be collapsed again and disposed of with significant reduction in waste volume.

Referring now to Figure 23, a package or box 410 is shown enclosing a plurality of folded and collapsed containers 418 constructed in accordance with another exemplary embodiment of the invention. The package or box 410 is shown to be of square configuration (other configurations may also be employed) and includes a bottom wall (not shown), a top wall 414 and four identical side walls 416. The package or container 410 can be constructed of any conventional material, such as cardboard, paperboard, plastic film wrap, and the like.

The folded and collapsed containers 418 each have the folded and collapsed configuration illustrated in Figure 24, and are placed one atop the other to form a stack which is easily packaged in a container such as that shown at 410.

It will be appreciated that the general configuration of the containers 418, including preferred materials, wall thicknesses, etc. and the manner in which such containers may be collapsed and folded to the configuration shown in Figure 2 is substantially as shown and described above.

With reference now to Figure 25, the container 418 is shown in its normal uncollapsed and upright condition. The container 418 has a unitary plastic body including a bottom wall 420, a tapered peripheral side wall 422 having a plurality of annular shoulders or steps 422' a shoulder section 424, which could be tapered as shown in Figure 25, or flat or any other suitable configuration, and a narrow neck portion 426 which includes an upstanding discharge portion 428 provided with a series of external threads 430. The upstanding discharge portion 428 defines a discharge opening 432 as best seen in Figure 26.

A cup 434, constructed of plastic or other suitable material, is shown supported on the uppermost edge of the container 418, surrounding the opening 432. The cup 434 has a peripheral side wall 436, an upper, radially outwardly flange 438, a lower tapered portion 440 and a lower discharge portion 442 closed by an integral but removable bottom wall 444. The cup 434 is substantially hollow and includes an

opening 446 defined by an interior annular surface of the flange portion 438.

With reference especially to Figure 25, it may be seen that the cup 434 is intended to hold an additive material 435 (such as powdered concentrate or the like) to be mixed with the contents (not shown) of container 418, and is sealed about the opening 446 by a flat, flexible foil or other suitable seal 448 which may be adhesively secured in a conventional manner to the flange 438. The seal 448 is provided with a finger gripping portion 450 to enable the seal to be torn or peeled away from the flange 438 and cup opening 446.

A cap 452, having a peripheral side wall 454 and a top wall 456, including a punch-out panel portion 458, may be applied to the container 418 by means of screw threads 460 on the interior surface of the peripheral side wall 454, which threads are adapted to engage the exterior screw threads 430 provided on the upstanding discharge portion 428 of the container 418. Thus, the cap 452 serves to hold the cup 434 in the position as shown in Figure 25 until the container 418 is ready for use. At that time, the screw cap 452 is removed and the cup 434 may then be lifted out of the container 418. The seal 448 is then removed from the cup 434 and the additive poured into the container 418 as illustrated in Figure 26 for mixture with the container contents.

Once the additive 435 has been mixed with the contents of the container 418, the cup 434 may be inverted so that the opposite side of the flange 438 now rests on the uppermost edge of the upstanding dispensing portion 418. The punch-out portion or

panel 458 of the cap 452 is then removed and the cap is reapplied to the container with the major portion of the cup extending upwardly through the hole in the cap 452 as best seen in Figure 27. By thereafter severing the closed lower end portion 444 to provide a second dispensing opening in portion 442 at the opposite end of the cup from opening 446 (but concentric therewith), the cup 434 has now been reconfigured as a narrow neck dispensing structure and, as shown for example in Figure 27, a straw 462 may be inserted within the opening for use in a conventional manner. In an alternative arrangement, the user may discharge the contents of the container directly from the opening in portion 442 of cup 434 without the additional use of a straw.

Referring back to Figures 23 and 24, it will be appreciated that the cup 434 (and cups as described below in additional embodiments) are left undisturbed during the collapsing and folding of the container 418 and during stacking, packaging and shipping.

The container 464 illustrated in Figure 27 is similar to that illustrated in Figure 25, the principal differences relating to the number of annular steps or shoulders 468, provided in the peripheral side wall 470, and the provision of an axial shallow groove or recess 472 to facilitate gripping of the container by the user.

With reference now to Figure 28, an alternative embodiment of the concentrate cup is disclosed which may be used with containers 418 or 464. The cup 474 is formed integrally with the screw-on cap so that the cup is useful only in a single orientation relative to the container as shown in Figure 28.

Thus, the cup 474 includes a cup portion 476 having a bottom wall 478, an annular peripheral side wall 480, an outwardly extending top wall or flange 482, and an annular depending skirt portion 484. The latter is provided with screw threads 486 on the interior surface thereof for engagement with complimentary threads on the narrow neck portion of the associated container (such as threads 428 of container 418). An adhesively secured, removable seal 88 closes the opening 490.

The cup portion itself is provided on bottom wall 478 with a hollow, upstanding projection 492, extending upwardly and concentrically relative to side wall 480, and sealed at its upper open end by a removable seal element 494. In this way, the additive 498 is sealed within the cup 474.

In use, the cup 474 may be removed from the container, the upper seal 488 removed. The additive 498 may then be poured into the container. The cup may then be re-attached to the container. Thereafter, the seal 494 over the opening 496 may be removed and a straw inserted therein for easy dispensing of the contents of the container.

In another exemplary embodiment, illustrated in Figure 29, a cup 500 is similar to cup 474 with the exception that a hollow upstanding projection 502 formed in the bottom wall 504 extends the full height of the cup, terminating flush with a top wall or radial flange 506. Thus, a single, removable seal 508 can be employed to seal opening 510 in the cup portion 512, and opening 514 in the projection 502. A further distinction relates to the incorporation of

an integral cap 516 which is integrally attached to the cup 500 by a thin, breakable web 518.

In use, after cup 500 has been removed from the container, and after the seal 508 has been removed from the cup 500, the additive 520 may be poured into the container for mixing with the contents thereof. Cup 500 can then be replaced and straw 522 inserted in opening 514 for convenient dispensing of the container contents (see Figure 30). If some contents remain, the removable cap 516 may then be removed from cup 500 and inserted over the opening 514 to reseal the same as best shown in Figure 31.

It will thus be seen that the above described invention provides a simple, low cost and easy-to-use container assembly which allows additives such as concentrates and the like to be incorporated into the container into which they are to be mixed, and which at the same time, enables the use of the concentrate cup as a dispenser for the container mixture.

With reference to Figures 32 and 33, a thin wall plastic container 610 in accordance with another exemplary embodiment of the invention includes a substantially flat bottom wall 612, a peripheral side wall 614, and an upper open end 616 provided with screw threads 618 adapted to receive a removable screw cap 620.

In one arrangement, the bottle or container 610 is a unitary structure formed by extrusion or injection blow molding or other conventional plastic forming processes. The finished side wall 614 has a preferred thickness range of between 2 and 12 mils, (with a preferred thickness of about 6 mil) while the upper open end 616 and particularly in the area of

screw threads 618, has a preferred thickness of between about 10 and 90 mils. The thickness in the neck portion may vary considerably depending on the manufacturing process. For example, if the neck area is blow molded with the remainder of the container, its thickness may be in the area of 25 mils while if the upper threaded portion of the neck is compression molded, the thickness in this area may be 90 mils.

The bottom wall 612 has a thickness substantially the same as the side wall 614, but may be slightly thicker, i.e., up to about 25 mils, as a result of pinching off of the parison prior to blowing. As in the earlier described embodiments, other thickness ranges are possible for various container portions, so long as the container is normally self-supporting, i.e., capable of stand-alone use, and of sufficient strength but easily collapsed and folded in the manner described below.

In the embodiment, illustrated in Figure 32, the peripheral side wall 614 of the container is provided with a series of vertically (i.e., axially) spaced annular steps or shoulder 622, 624, 626 and 628 to facilitate the collapsing and folding as described above. The thickness of the container side wall does not vary appreciably in the areas of these steps or shoulders.

As can be seen from Figure 32, the side wall 614 of the container tapers slightly outwardly from top to bottom and the steps or shoulders 622, 624, 626 and 628 are located axially along the side wall 614 so as to correspond to, and in fact form, the four folds in the collapsed container as described below.

The tapered side wall 614 and steps or shoulders may be used separately or in combination to achieve the controlled side wall collapsing/folding operation. Depending on the size of the container and the desired degree of compaction or collapse, a fewer or greater number of concentric folds may be formed in the container side wall.

The cap 620 includes a top wall 630, an outer depending skirt portion 632 provided with interior screw threads which cooperate with the mating threads 618 on the container body 610. The cap 620 is also provided with an interior depending skirt 634 which projects downwardly into the container body 610 as best seen in Figure 33. The skirt 634 thus forms a chamber 636 which is closed by a removable seal 638 which may be, for example, adhesively secured to the lowermost edge of the skirt 634. The chamber 636 has a volumetric capacity sufficient to hold a predetermined quantity of powdered concentrate or drink mix (or other foodstuff material) appropriate for the volumetric capacity of the container 610.

In this exemplary embodiment, the axial extent of the interior skirt 634 of the cap 620 also corresponds to a remaining unfolded portions 635, 637 of the container 610, and to the axial extent of each of the concentric folds, so that when in the collapsed condition, the lower edge of the skirt 634 engages the bottom wall 612 of the container thus providing support for the container. This is particularly advantageous when a plurality of such collapsed containers are stacked for shipment and/or storage.

With reference now to Figure 34, a modified cap 640 has a centrally depressed top wall 642 and a raised peripheral portion 644 which extends radially outwardly a distance substantially equal to or slightly greater than the radial extent of the four concentric folds illustrated in the collapsed container. Otherwise, construction of the cap is similar to that illustrated in Figure 32 in that a radially outer peripheral skirt 646 is provided with interior threads to cooperate with exterior threads on the upper end of the container, and an inner depending skirt 648 extends downwardly into the container with its lower open end being closed by a removable seal 650, lying adjacent a recessed portion 651 of the container bottom wall. The chamber 652 defined by the container top wall 642, skirt 648 and seal 650 contains a powdered concentrate or drink mix P. With this arrangement, the peripheral flange 644 not only protects the concentric folds of the container particularly when stacked, but also facilitates removal of the cap from the container by the consumer. In addition, the flange 644 serves to support an overlying container in a stack.

With reference now to Figure 35, an alternative container construction 654 is shown, the container including a recessed bottom wall 656, a peripheral side wall 658 and an upper open end 660 closed by a removable screw cap 657 (see FIGURE 36). The container upper end 660 is provided with screw threads 662 adapted to cooperate with threads on the cap 657. In this embodiment, a series of annular steps or shoulders 664, 666, 668 and 670 serve to decrease the diameter of the container from top to

bottom so that a series of concentric outwardly and downwardly folded portions can be created upon axial collapse of the container in the manner disclosed above in conjunction with Figure 17, and shown in FIGURE 36.

With reference now to Figure 37, an alternative construction includes a container 674 which is generally similar in construction to the container illustrated in Figure 32 with the exception that the upper open end of the container is provided with a radially inwardly directed shoulder portion 676 and, immediately thereabove, a radially outwardly directed hollow flange 678. A neck portion 680 of the container is provided with exterior through threads for mating engagement with threads provided on the interior of a screw cap 682. In this embodiment, the cap 682 has a recessed top wall 684 and an annular peripheral side wall 686 extending above and below the recessed top wall 684. Below the top wall 684, the inner surface of the peripheral side wall 686 is provided with screw threads for mating engagement with the threads provided on the neck portion 680 of the container. An upper flange 688 of the container supports a concentrate cup 690 which is itself provided with a bottom wall 692, a tapered side wall 694, an upper radially outwardly extending flange 696 and a removable seal 698 which closes the otherwise open end of the cup 690. The cup 690 is adapted to hold a predetermined amount of powdered concentrate P or drink mix (or other foodstuff material) within the cup for mixing with the contents of the container 674.

The upper radially outwardly directed flange 696 of the cup 690 is adapted to seat on the flange 688 of the container, sandwiched between the flange 688 and the recessed top wall 684 of the screw cap 682.

That portion of the peripheral side wall 686 of the screw cap 682 which extends above the recessed top wall 684 forms a chamber 698 which is closed at its otherwise open upper end by a peel-off seal 700. This chamber is utilized to hold a coiled straw 702 for use with the container. To further facilitate such use, an annular break-out portion 704 as defined, for example, by an annular score line 706, is provided within the recessed top wall 684 of the cap 682 to permit insertion of the straw within the container after the cup 690 has been removed.

In use, it will be appreciated that the screw cap 682 may be removed from the container, followed by removal of the concentrate cup 690 and the pouring of the contents thereof into the container 674. Thereafter, the screw cap 682 may be reapplied to the container (without the cup 690) and the contents thoroughly mixed by shaking in the usual manner. The straw 702 can then be inserted through the recessed top wall 684 of the cap via removable portion 704 (after having removed the seal 700).

In Figure 38, a modified version of the cap 682 is illustrated wherein the recessed top wall 684' of the cap 682' has a central portion 703 raised substantially to the height of the peripheral side wall 686' so that the straw 702' can be coiled about the recessed top wall 684' between the peripheral side wall 686' and the raised center portion 703. As in the previously described cap, a break-out portion

704', defined by score line 706', may be provided for facilitating the insertion of the straw 702' through the cap after the concentrate cup has been removed.

It will also be seen that in Figure 38, the axial extent of cup 690' is substantially equal to the axial extent of the upper unfolded portion of the container so that, due to the overall flexibility of the container, cup 690' will provide axial support for the container in the collapsed condition.

It will be appreciated that the cap structures 682 and 682' as illustrated in Figures 37 and 38 may be utilized with reverse fold containers of the type illustrated in Figure 35 as well.

Turning now to Figure 39, another exemplary embodiment of the invention is illustrated which is particularly designed to accommodate a foodstuff, such as microwavable popcorn. In this construction, a collapsible container 710 generally similar to the collapsed container shown in Figure 34, is essentially inverted so that the removable screw cap serves as a supporting tray 720, at least until the corn is in a popped state as will be described further hereinbelow. For convenience, the construction shown in Figures 39 and 40 will be described as depicted therein, with the usual reference to top and bottom, etc. It will be appreciated, however, that the arrangement as shown is similar to the construction illustrated in Figures 32 and 34 but inverted relative thereto. Accordingly, the container 710 is of thin wall, collapsible construction as described hereinabove, and includes a recessed top wall 712, a peripheral side wall 714 and a lower open end 716 which is

provided on its exterior surface with a threaded configuration adapted to receive corresponding threads on a removable tray 720. The thin wall container body which, as shown in Figure 40, decreases slightly in diameter from top to bottom, is provided with a series of axially spaced ribs or shoulders 722, 724, 726, 728, 730 and 732. These annular shoulders or steps serve to facilitate axial collapse and controlled folding into a series of six concentric folds as shown in Figure 39.

The removable tray 720 is formed with a bottom wall 734 and an intermediate upstanding skirt portion 736 which is provided on its interior surface with screw threads adapted to mate with the screw threads provided on the lower open end 716 of the container body 710. The tray 720 is also provided with an interior upstanding skirt portion 738 which extends upwardly into the container 710 to form a chamber 740 closed at its upper end by a removable seal 742. The chamber 740 is adapted to hold a predetermined amount of popping corn C in a pre or unpopped state.

In the above described embodiment, the interior upstanding skirt 738 extends upwardly into the container substantially to the height of the remaining unfolded portion of the container so as to provide support for the container in the collapsed state, and particularly during stacking.

The removable tray 720 is further provided with a radially outwardly extending flange 744 with an upturned radially outermost lip 746. The flange and lip 744, 746 accommodate the multiple concentric folds in the thin wall container in the collapsed state as best seen in Figure 39.

In use, the collapsed container 710 as shown in Figure 39 is grasped by the user and the tray 720 with the unpopped corn is removed from the container. The seal 742 is thereafter removed from the tray 720 and the tray is then screwed back into place within the container bottom 716. The collapsed container may then be placed in a microwave oven and the corn popped in the usual manner. The popping action will cause the container 710 to expand to its volumetric capacity as shown in Figure 40. Upon completion of the corn popping stage, the entire container may be inverted from the position shown in Figure 40 and the tray 720, which now serves as a removable screw cap, may be removed from the container, leaving an open bag of popped corn for use by the consumer.

With reference to Figures 41-43, a further embodiment of the invention is described which is also particularly adapted for use as microwave popcorn containers.

With reference now to Figure 41, container 748 includes a closed top wall 750 and a peripheral side wall 752 which extends downwardly to a lower open end 754 closed by a removable tray 756. In this embodiment, a lower and upper series of six concentric folds may be formed in the container on either side of a central portion 758 of the side wall. It will be appreciated that these folds are formed in a container shaped similarly to that shown in Figure 43, although the container in Figure 11 is not provided with a sufficient number of annular steps or shoulders to form the series of six folds shown in Figure 41. In any event, the double axial

fold arrangement illustrated in Figure 41 provides even greater expansion capacity for the container. The formation of these folds can be accomplished by first forming a lower or upper series of folds utilizing apparatus similar to that described herein. The remaining series of folds may be formed by inverting the container and utilizing the same apparatus, or using apparatus specifically set up to form upper and lower series of concentric folds.

The removable tray 756 as shown in Figure 41 is substantially identical to the removable tray 720 illustrated in Figures 39 and 40, with the exception that the top wall 760 extends radially only to the outer peripheral skirt 762 and does not radially cover the plurality of concentric folds. It will be understood, of course, that a cap similar to that illustrated in Figures 39 and 40 may also be utilized in the container construction illustrated in Figure 41. In use, it will be appreciated that during popping, the container 748 will expand upwardly to its full height, with the diameter increasing progressively upwardly to the center portion 758 of the side wall and then decreasing progressively to the closed top wall 750 (similar but not identical to the container illustrated in Figure 43).

With respect to Figure 42, a container 764 is shown to include a closed top wall 766, a peripheral side wall 768 and an open lower portion 770 closed by a removable screw cap 772. The container and cap construction of the embodiment illustrated in Figure 42 is substantially the same as that described above with respect to Figure 42 with the exception that the series of upper and lower concentric folds 774, 776,

respectively, are more loosely formed, adding to the overall diameter of the container assembly. This is merely intended to illustrate that as the angle of the individual folds becomes wider, the overall bulge or diameter of the container in the collapsed condition is increased.

With reference to Figure 43, a container 778 is illustrated which includes a closed top wall 780, a peripheral side wall 782 and an open lower end 784 closed by a removable screw cap 786. The peripheral side wall 782 of the container is shown to include annular steps or shoulders 788, 790, 792, 794 and 796. The diameter of the container increases progressively from the top wall 780 to the middle portion 798 of the peripheral side wall and then decreases progressively from the middle portion 798 to the lower open portion 784. As already noted above, this type of arrangement leads to a collapsed configuration similar to that illustrated in Figures 9 and 10. As also noted above, in conjunction with the embodiment illustrated in Figures 7 and 8, once the corn inside the container has fully popped, the container 778 may be inverted and the removable screw cap 786 removed leaving an open container of popped popcorn for the user.

Referring now to Figures 44 and 45, another exemplary embodiment of the invention is illustrated which includes a thin walled, flexible and collapsible but stand-alone container adapted particularly for use with petroleum products such as motor oil. The container includes a peripheral side wall 800, a substantially flat bottom wall 802, a tapered shoulder portion 804 extending from the upper

end of the peripheral side wall 800, and a dispensing portion 806. The dispensing portion 806 includes an expandable/contractible bellows portion 808 (which may be of the pop-out/pop-in type), a radially outwardly extending flange 810, and a threaded upper end enclosed by a removable screw cap 812.

A recess 814 is provided in the tapered shoulder section 804 as well as in the upper end of the peripheral side wall 800. This recess includes a substantially vertical wall 816, a portion of which has a radius of curvature at its inwardmost portion which corresponds substantially to the curvature of the dispensing portion 806. The recess 814 also includes a substantially flat bottom wall 818 as well as a groove 820 extending about the vertical wall 816. At the entrance to the recess, there are provided a pair of substantially vertical ribs 822.

For shipment and inventory purposes, the dispensing portion 806 may be bent over through an angle of substantially 180° and secured within the recess 814 as shown in Figure 45. In doing so, it will be appreciated that the groove 820 in the vertical wall 816 will receive the radial flange 810 of the dispensing portion 68 while the removable screw cap 812 is snapped in place behind the vertical ribs 822.

The container as described above is particularly advantageous not only in that the profile the container can be reduced for shipment and/or storage, but also in that the dispensing portion 806 can be expanded vertically to the extent permitted by the bellows portion 808, thereby facilitating pouring of the oil from the container into, for example, a

filler hole of a vehicle engine which is sometimes difficult to access with conventional oil containers.

After emptying the container of its contents, the dispensing portion 806 may again be tucked into the recess 814 and the remainder of the container easily collapsed in a random fashion to substantially reduce post consumer waste volumes.

It will be appreciated that the above described container has substantially the same differentiated wall thicknesses as described above in connection with other embodiments. In this instance, the thicker wall portion will commence in the tapered shoulder 804 and extend through the dispensing portion 806. It will also be appreciated that the container as described is also unitarily formed by any suitable plastic forming process (such as blow molding) and is preferably a low density polymer such as polyethylene.

A variation of the embodiment illustrated in Figures 44 and 45 is shown in Figures 46 and 47. For convenience, similar reference numerals as used in Figures 44 and 45 are used in Figures 46 and 47 to designate common components, but with the prefix 9 added. Thus, the container includes a peripheral side wall 900, a substantially flat bottom wall 902, a tapered shoulder section 904 and an upstanding dispensing portion 906. The dispensing portion 906 includes an expandable/contractible bellows portion 908, a radially outwardly extending flange 910 and an upper threaded end closed by a removable screw cap 912. This embodiment also includes a smooth extension 909 between the bellows portion 908 and the

flange 910 which serves to increase the "reach" of the dispensing portion 906.

A recess 914 is provided in the container in an area which overlaps the tapered shoulder section 904 and the upper end of the peripheral side wall 900. Unlike the recess 814 in the embodiment illustrated in Figures 44 and 45, recess 914 has a fairly shallow configuration, defined by a wall 916 which has a radius of curvature at its innermost end substantially similar to the curvature of the upstanding dispensing portion 906. The entrance to the recess 914 (substantially at the interface of tapered shoulder section 904 and peripheral side wall 900) is provided with a pair of outstanding lugs or ribs 922. For shipment/storage (as well as disposal) purposes, the dispensing portion 906 may be folded over and snapped into the recess 914 behind the lugs 922. The manner of use and the disposal procedures are otherwise similar to the embodiment illustrated in Figures 44 and 45.

It will be appreciated that variations of the above described containers are possible which nevertheless remain within the scope of this invention. For example, the manner in which the dispensing portions 806 or 906 are held within recesses 814 or 914 may merely include a friction fit or the use of cooperating ribs, detents, etc. In addition, the degree of expansion/contraction of the bellows portion of the dispensing portion 868 or 968 may also be varied to suit particular applications. It will further be appreciated that the size and shape of the containers may also be varied so long as the features of the invention, i.e., the reduction in

plastic required to form the container, its flexibility, collapsibility, and capability for stand-alone use, are retained.

Turning now to Figures 48 and 49, another container embodiment particularly well suited for use with petroleum products such as motor oil, includes a peripheral side wall 1000, a substantially flat bottom wall 1002, a tapered shoulder portion 1004 extending from the upper end of the peripheral side wall 1000, and a dispensing portion 1006. The dispensing portion 1006 is provided with a radially outwardly extending flange 1008 and a threaded upper end 1010 enclosed by a removable screw cap (not shown). As will be appreciated from Figure 48, this embodiment is generally similar to the embodiments illustrated in Figures 44 through 47 but does not include an expandable/contractible bellows portion in the upstanding dispensing portion, and does not include a recess for receiving the upstanding dispensing portion for shipment and/or storage. Otherwise, the container is similar in terms of both wall thickness dimensions, material, etc.

The containers illustrated in Figures 44 through 48 are fully capable of stand-alone use, i.e., no external rigid supporting carrier is required. It will be appreciated, however, that the container may be used with a relatively rigid outer carrier or funnel if so desired, particularly to facilitate pouring.

For example, in order to facilitate pouring of the liquid contents (such as motor oil) of the container into the filler tube of a vehicle engine, a relatively rigid container carrier or funnel 1012 may

be provided as shown in Figure 49, for supporting a container of the type shown, for example, in Figure 48. The funnel 1012 comprises a container supporting device, open at either end and adapted to support a container in a pouring orientation, i.e., at an angle relative to vertical to allow air to enter the container to facilitate pouring. The funnel 1012 includes a relatively smaller diameter discharge portion 1014 and a relatively larger container supporting portion 1016. The discharge portion 1016 is small enough to be received within a filler tube 1018 of a vehicle engine (not shown). The container supporting portion 1016 supports the container along its entire length and about a substantial portion of the periphery of the container. In the embodiment illustrated in Figure 49, the container supporting portion 1016 surrounds the container through more than 180° of the container periphery, although it should be understood that the extent of peripheral support may vary. The remaining portion of the container supporting portion 1016 is substantially open to allow easy insertion and removal of the container from the funnel.

In order to provide additional support for the container, an interior shoulder 1020 is provided within the funnel in a transitional area 1021 between the discharge portion 1014 and the container supporting portion 1016. The shoulder 1020 defines a circular opening 1022 sized to permit insertion of the threaded portion 1010 of the container but to engage the annular flange 1008, thus serving not only to limit the extent of insertion of the container within the funnel, but also to provide stability and

support for the dispensing portion 1006 of the container. This arrangement prevents wedging of the dispensing portion 1006 within the discharge portion 1014 of the funnel which might otherwise interfere with the free flow of liquid from the container.

Additional support for the container is provided for at least a part of the tapered shoulder portion 1004 of the container by the a supporting "shelf" 1024 integrally formed in the funnel between container supporting portion 1016 and discharge portion 1014. The supporting portion 1016 and shelf 1024 are configured to substantially match the angular relationship between the side wall 1000 and tapered shoulder 1004 of the container to provide maximum support without otherwise disturbing the shape of the thin walled container.

It will be appreciated that the carrier or funnel 1012 eliminates any difficulty which might otherwise be encountered in attempting to pour the contents of the container into a relatively small filler tube without undesirable spillage.

FIGURES 50 and 51 illustrate a thin walled, flexible and randomly collapsible but stand-alone containers which are also adapted particularly for use with petroleum products. In both FIGURES, the container includes a substantially smooth peripheral side wall 1100, a bottom wall 1102, a tapered shoulder portion 1104 extending from the upper end of the peripheral side wall 1100 and a dispensing portion or spout 1106. In FIGURE 50, the spout 1106 has an axially curved sidewall 1108 (it may also be straight) with an upper threaded portion 1110 adapted to receive a conventional screw cap 1112 (Fig. 51).

The dispensing portion 1106 is provided with an indicator 1114 instructing the user to pinch the thin walled neck portion (for example, having a thickness of about 4 to about 20 mils - the remaining portions have thicknesses similar to the other embodiments described herein, thereby enabling the flow of, for example, oil, to be shut off after removal of the cap and during inversion of the container to a normal pouring position over the filler tube of the vehicle engine.

In FIGURE 51, the dispensing portion or spout 1116 is provided with a series of shoulders or steps 1118 enabling the neck to be collapsed in a controlled manner in accordance with concepts of the invention described here and above. In this regard, FIGURE 52 illustrates the dispensing portion 1116 of the container in a controlled, collapsed condition.

In FIGURE 53, there is illustrated a controlled collapse container having a peripheral side wall 1200, a bottom wall 1202, a tapered shoulder portion 1204 and an extended and pinchable dispensing portion 1206 having a curved side wall 1208 and a threaded open end 1210. Indicator 1214 locates the area to be pinched by the user, thereby enabling the user to shut off the flow as described above. The peripheral side wall 1200 in this instance has a plurality of steps or shoulders 1212 which enable the container to be collapsed in a controlled manner, similar to the embodiment illustrated in Figure 17.

In essentially all of the above described embodiments, the thin walled containers and associated cap assemblies are characterized by reduced wall thickness and controlled collapsibility

to compact configurations which saves significant space not only during shipment but also in in-store displays, inventory, storage, etc. The containers are further characterized by their random collapsibility after use to thereby achieve decreased volumes of post consumer waste.

While the invention has been described in connection with what is presently considered to be the most practical and preferred embodiment, it is to be understood that the invention is not to be limited to the disclosed embodiment, but on the contrary, is intended to cover various modifications and equivalent arrangements included within the spirit and scope of the appended claims.

WHAT IS CLAIMED IS:

1. A collapsible, thin wall, normally self-supporting plastic container comprising a bottom wall, an annular peripheral side wall and a top wall having a discharge opening, said peripheral side wall characterized by means for enabling stand alone use, both filled and empty, as well as controlled collapsing and folding of said peripheral side wall to a compact configuration where one or more portions of said side wall are folded radially inwardly or radially outwardly to form one or more folded portions concentric with said discharge opening.
2. The container according to claim 1 wherein said peripheral side wall has a thickness between about 2 and 12 mils.
3. The container according to claim 2 wherein the bottom wall has a thickness of about 10 and 90 mils.
4. The container according to claim 1 wherein said container includes a tapered shoulder portion and a reduced diameter neck portion, wherein the reduced diameter neck portion has a thickness of between about 15 and 30 mils.
5. The container of claim 1 in combination with a supporting carrier having a bottom wall and a peripheral side wall.

6. The container of claim 1 or 2 wherein said means comprises a side wall which is reduced or enlarged in diameter from said discharge opening to said bottom wall.

7. The container of claim 4 wherein said tapered shoulder portion and said reduced diameter neck portion are collapsible.

8. The container of claim 1 or 2 in combination with a concentrate therein which lies within a portion of the container unaffected by said controlled collapsing.

9. The container of claim 1 or 2 and including a concentrate cup supported in said discharge opening.

10. The container of claim 1 or 2 and including a cap attachable to said container and a sealed concentrate compartment within said cap.

11. The container of claim 1 or 2 and including an elongated, collapsible dispensing spout.

12. The container of claim 1 or 2 and including an elongated dispensing spout having at least a portion of a thickness permitting said spout to be pinched to thereby preclude dispensing of contents from the container.

13. A collapsed thin wall container for facilitating compact shipment of a plurality of such

containers comprising a bottom wall, and a top wall including a discharge opening said peripheral side wall and characterized by at least one portion collapsed to form at least one folded portion located concentrically with respect to said discharge opening, said container normally self-supporting and capable of stand alone use.

14. The container according to claim 13 wherein said peripheral side wall has a thickness between about 2 and 12 mils.

15. The collapsed container according to claim 13 or 14 wherein a remaining unfolded portion of said peripheral side wall defines a partial volumetric space substantially filled with a concentrate.

16. The collapsed container according to claim 15 wherein the container is sized so that a remaining volumetric capacity is selected in accordance with an amount of liquid required to be mixed with said concentrate.

17. A container assembly comprising:
a container body including a bottom wall,
peripheral side wall and an open upper end adapted to receive a closure;

a cup detachably supported in said open upper end and adapted to hold an additive for mixing with contents of said main container body characterized on that container body is collapsible but normally self-supporting and in that, said cup has a first dispensing portion for pouring said additive into

said main container body, and a second dispensing portion for dispensing a mixture of said contents and said additive.

18. A container assembly according to claim 17 and including means for permitting said main container body to be collapsed and folded to a compact configuration wherein at least one concentric, folded peripheral side wall portion lies radially adjacent said cup.

19. Apparatus for collapsing and folding an upright container to a compact stackable configuration, the container having a bottom wall, peripheral side wall with at least upper, lower and intermediate annular stepped portions in the peripheral side wall, and a top wall having a discharge opening therein, the apparatus including:

means for supporting and holding the container in an upright position, said apparatus characterized by first forming means for engaging and exerting a downward force on the intermediate annular stepped portion and for effecting the formation of a first folded portion; and second forming means for engaging and exerting a downward force on the top wall for effecting the formation of a second folded portion.

20. A method of forming a collapsed and folded container comprising the steps of:

a) providing a flexible container of unitary construction and having a bottom wall, a peripheral side wall extending from said bottom wall, and a top

wall including a discharge opening; characterized by the step of

b) forming the peripheral side wall of a thickness which, upon exerting an axial force on a first portion of the peripheral side wall, will cause said side wall to collapse and fold so as to form at least one folded portion located concentrically relative to said discharge opening, but which also permits said container to be sufficiently strong to be self-supporting, both filled and empty, and capable of stand-alone use.

FIG. 1

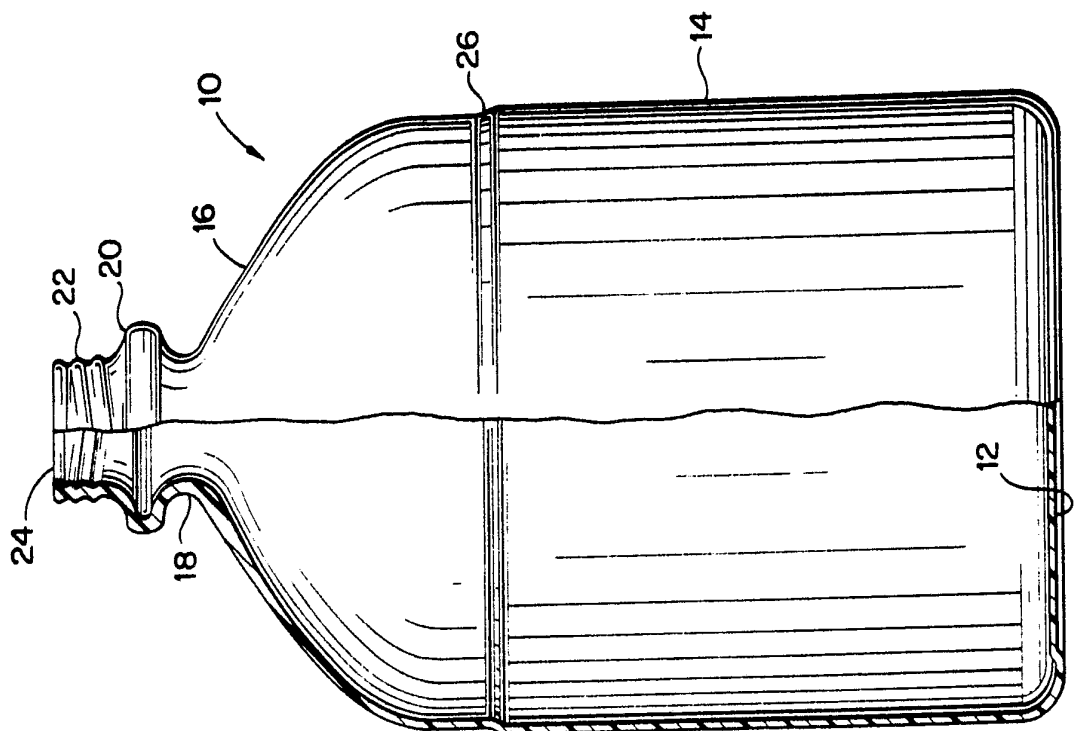
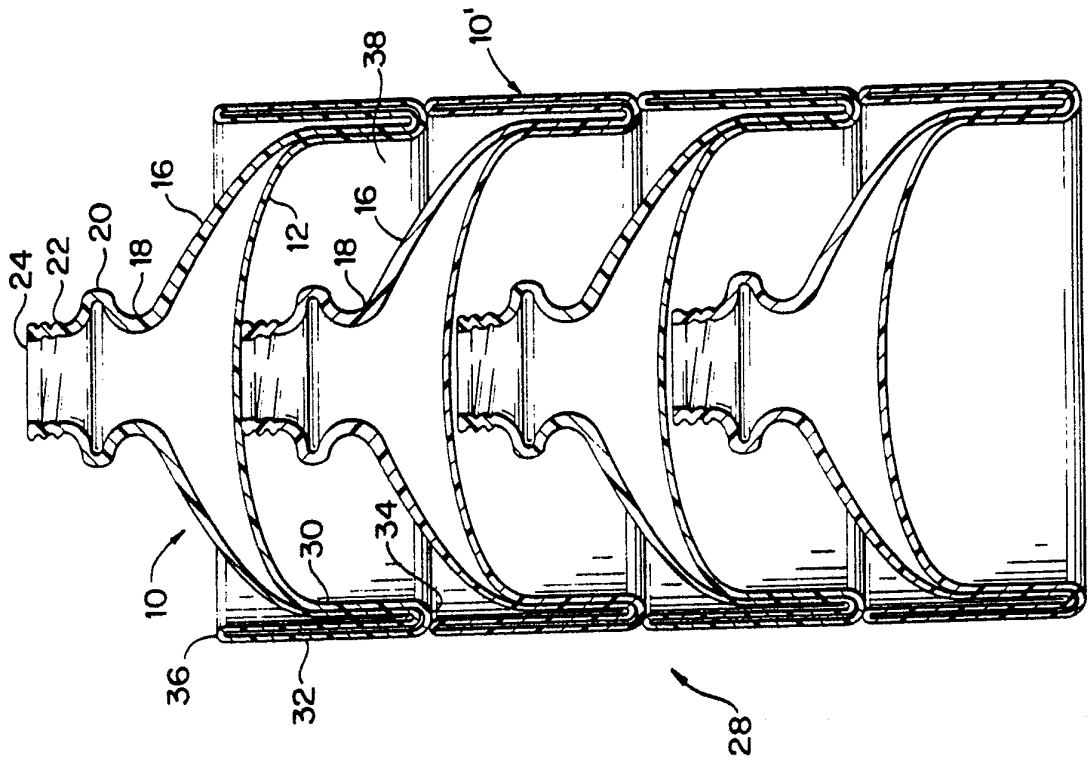


FIG. 2



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FIG. 3

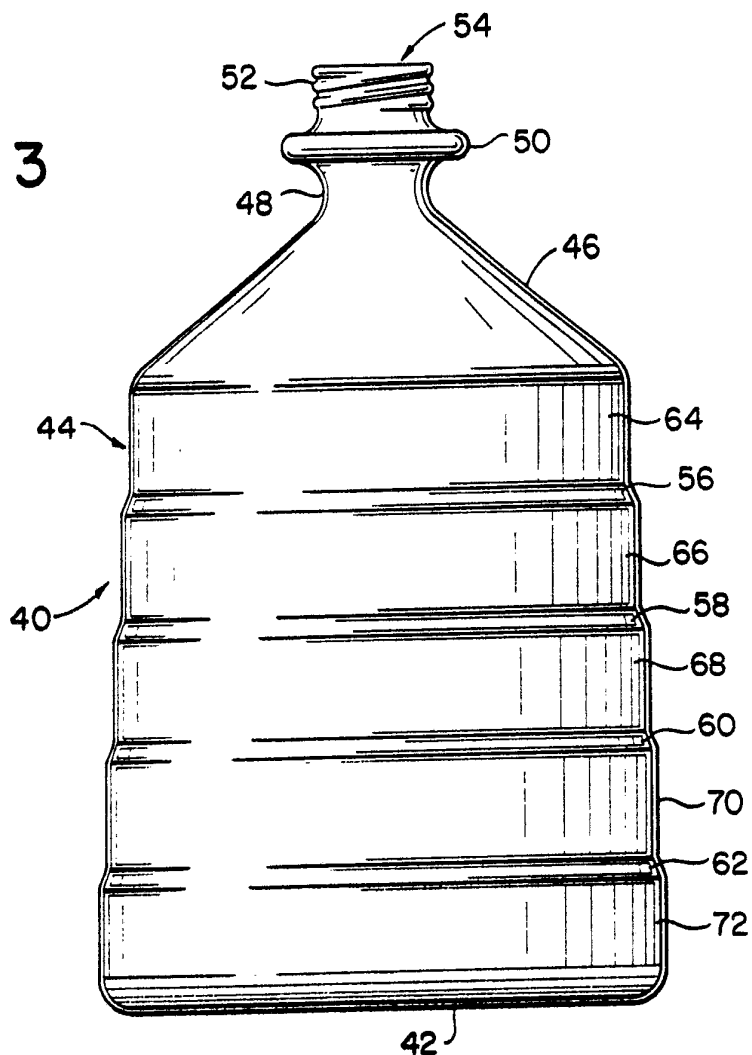


FIG. 4

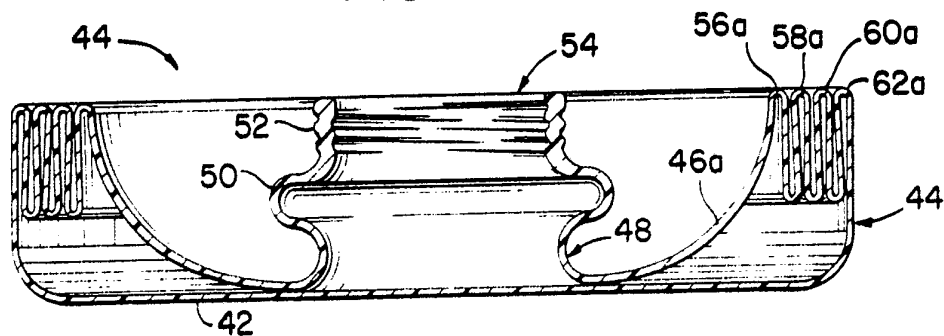


FIG. 6

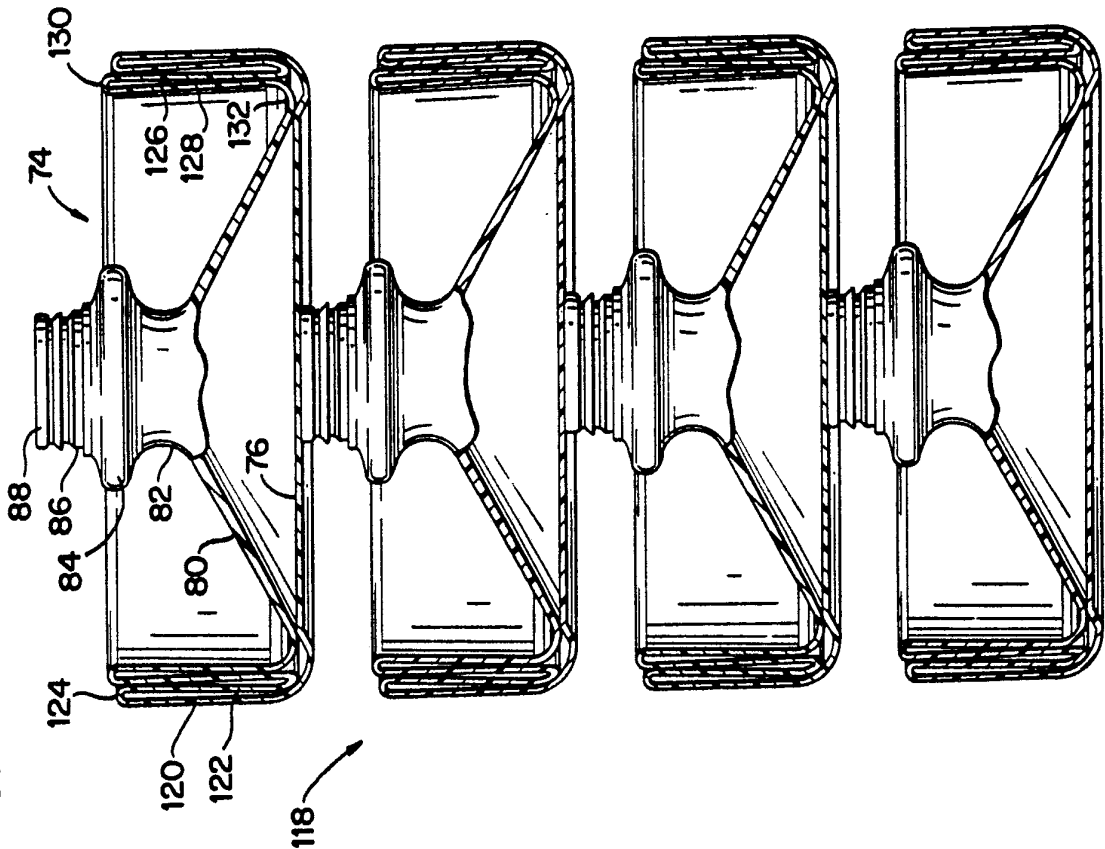
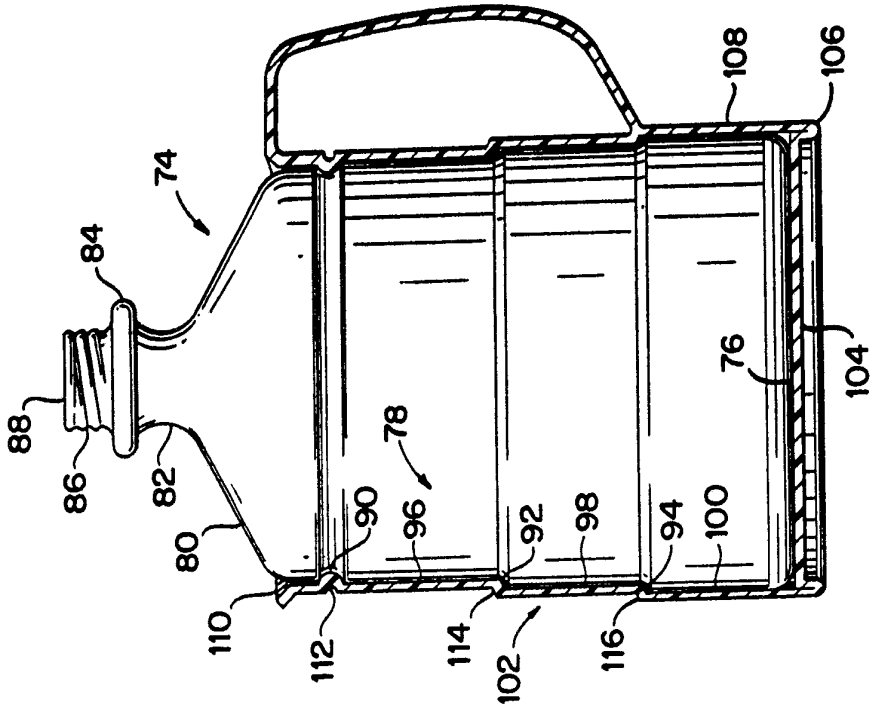


FIG. 5



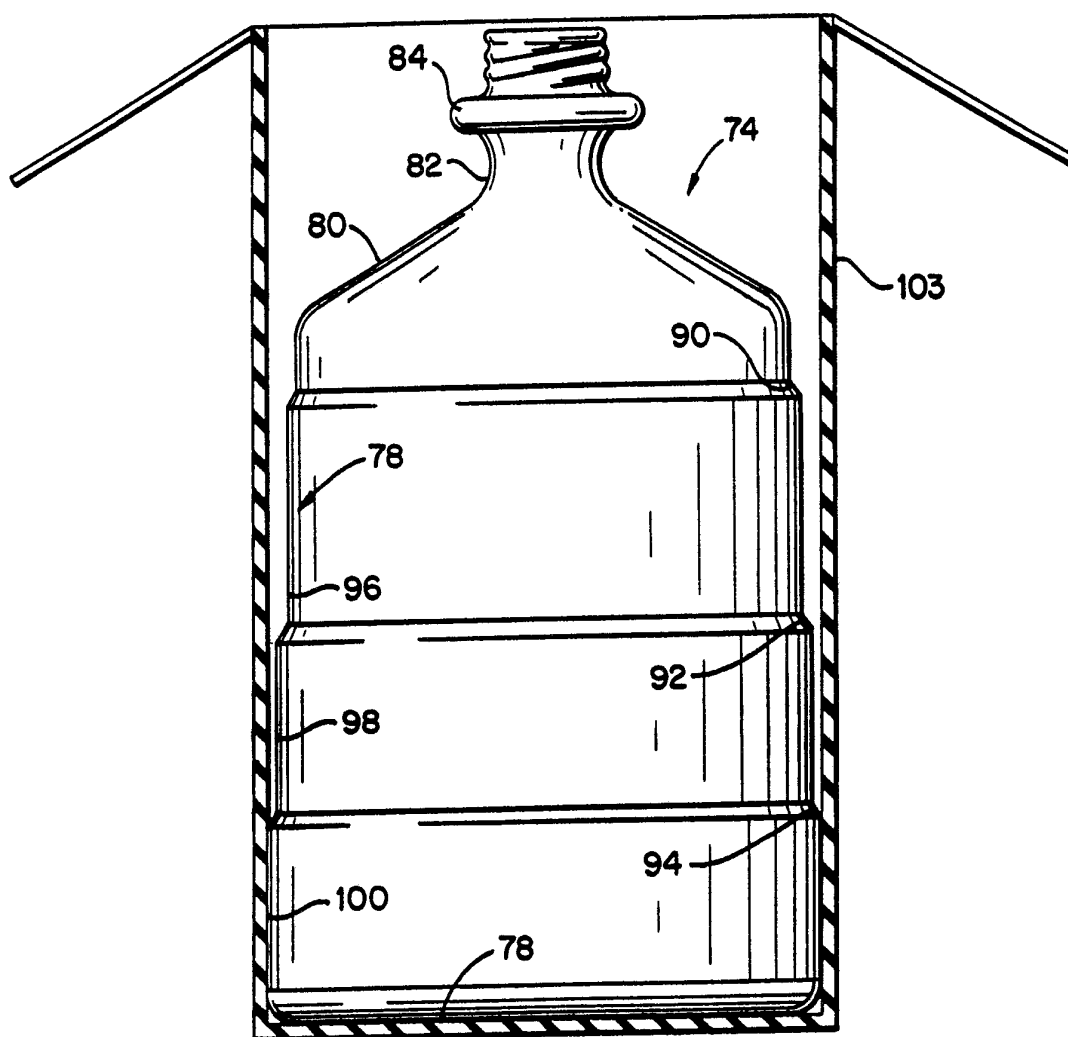
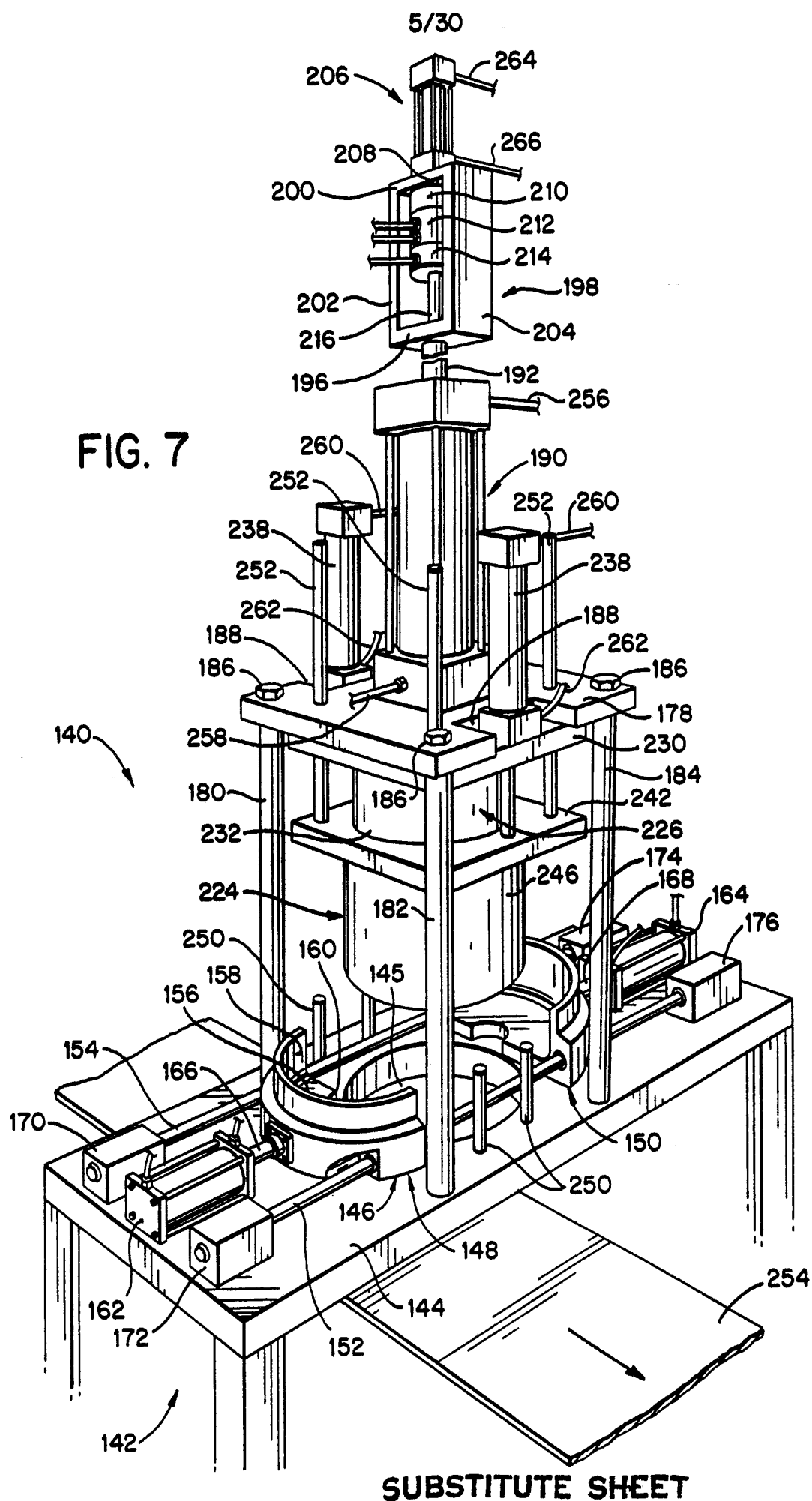


FIG. 5A



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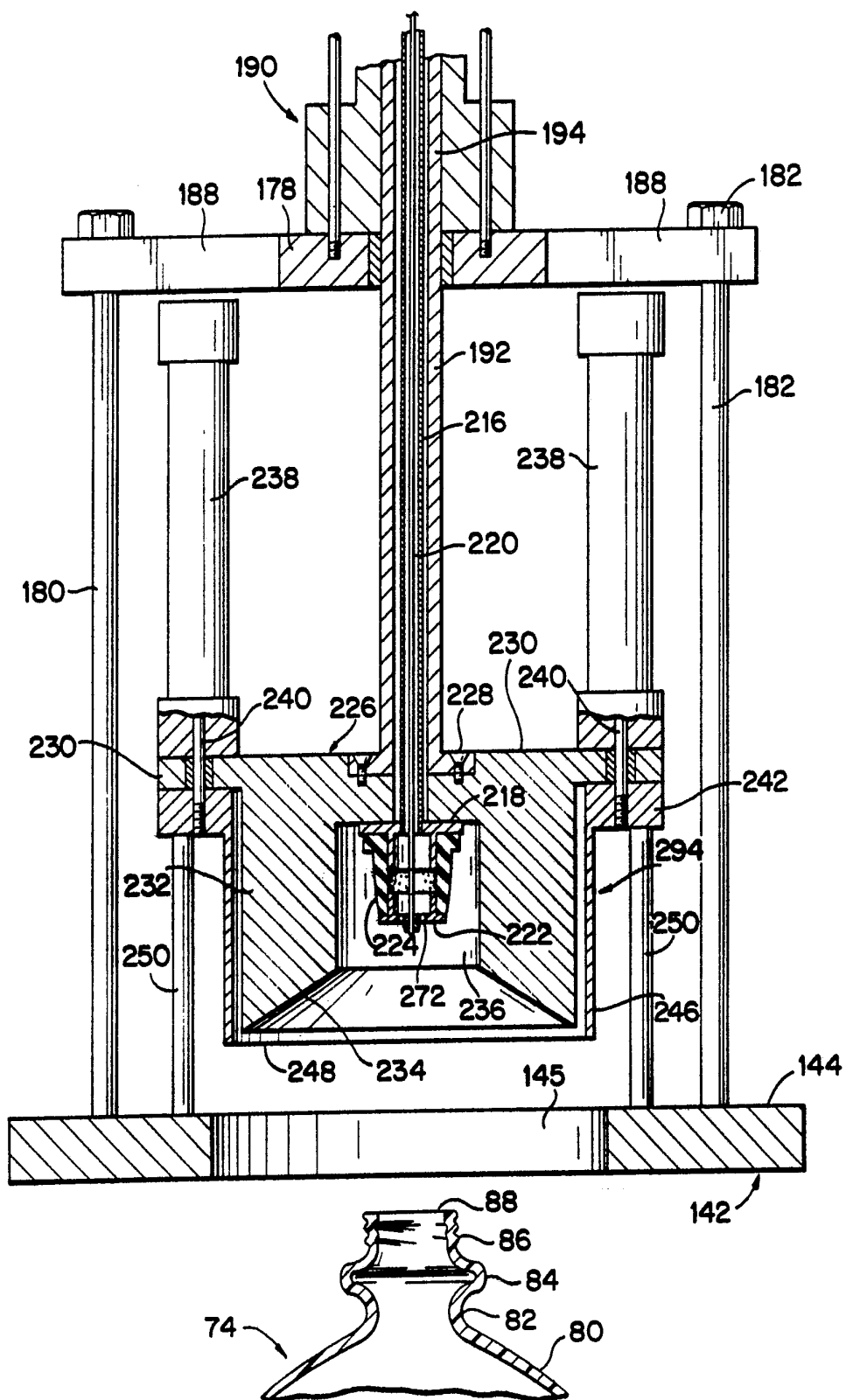


FIG. 8
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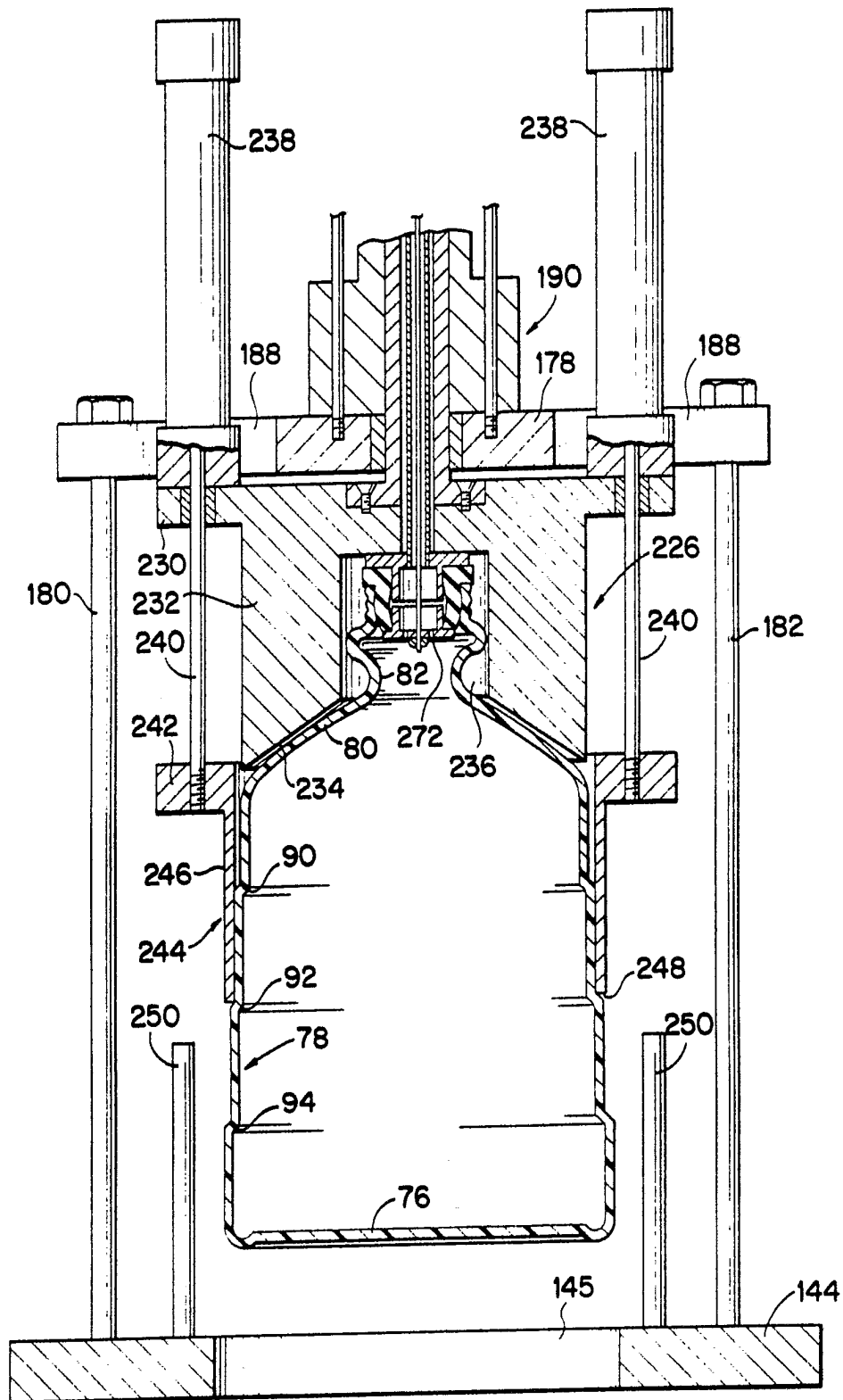


FIG. 10

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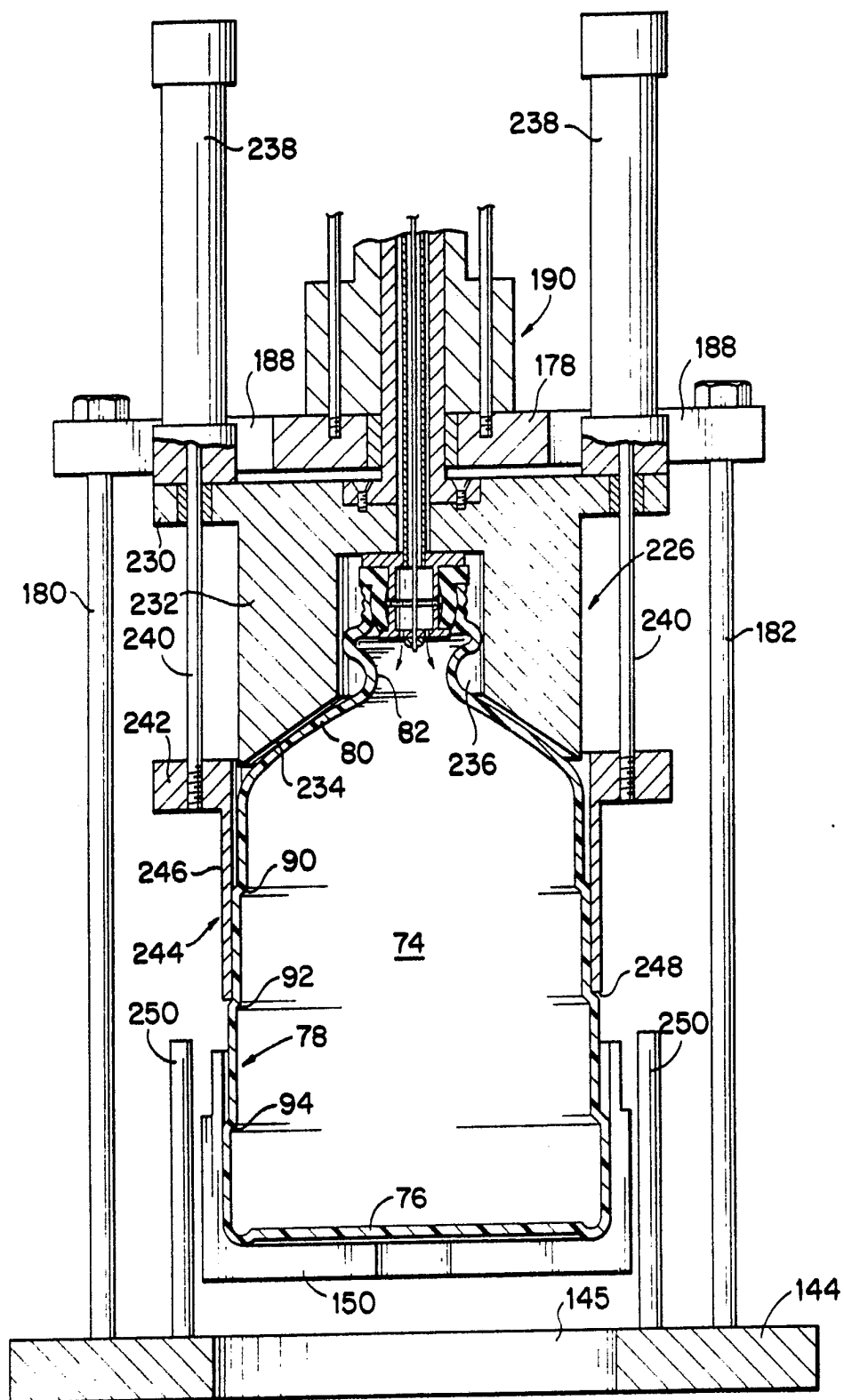


FIG. 11

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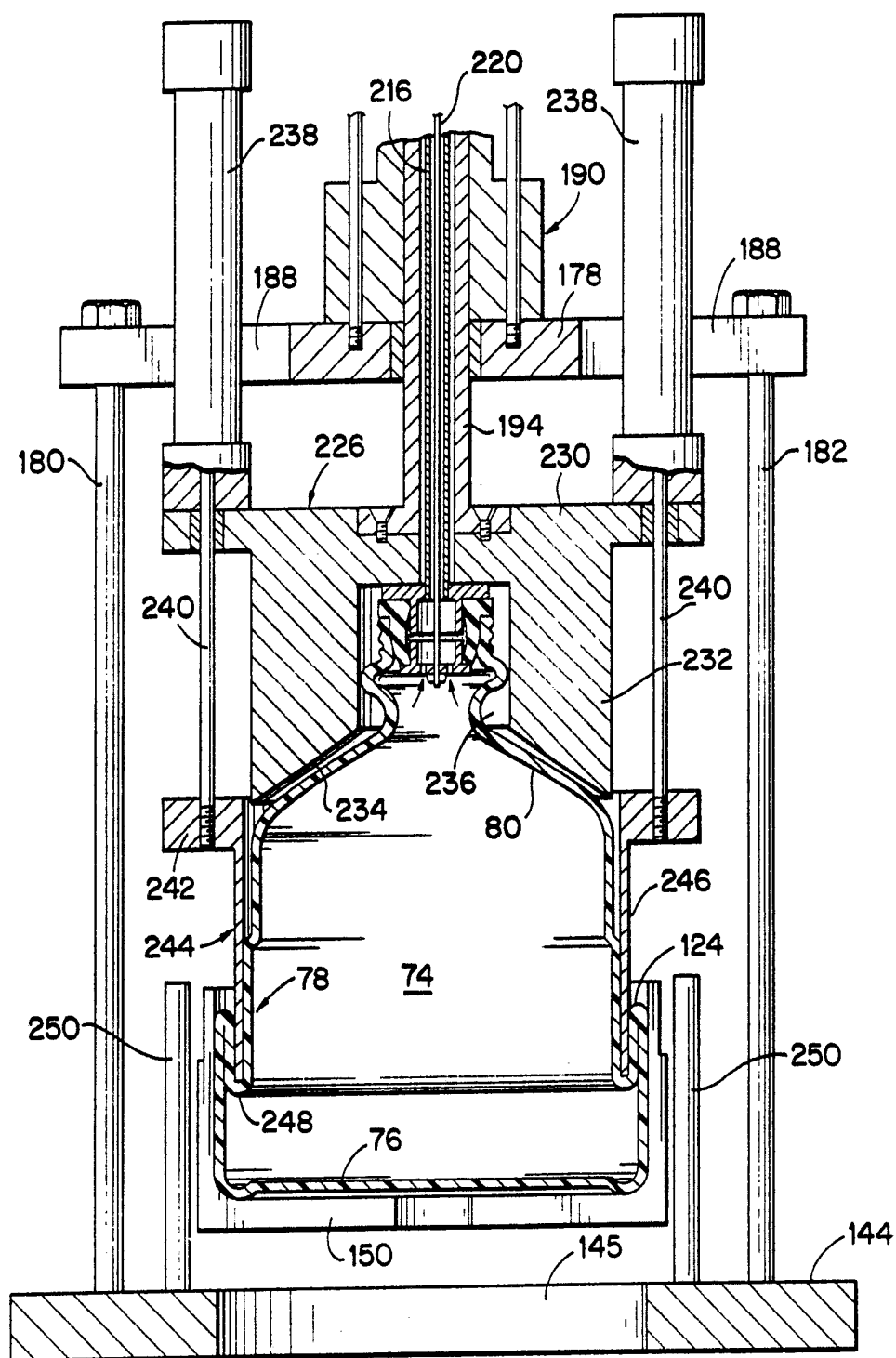


FIG. 12
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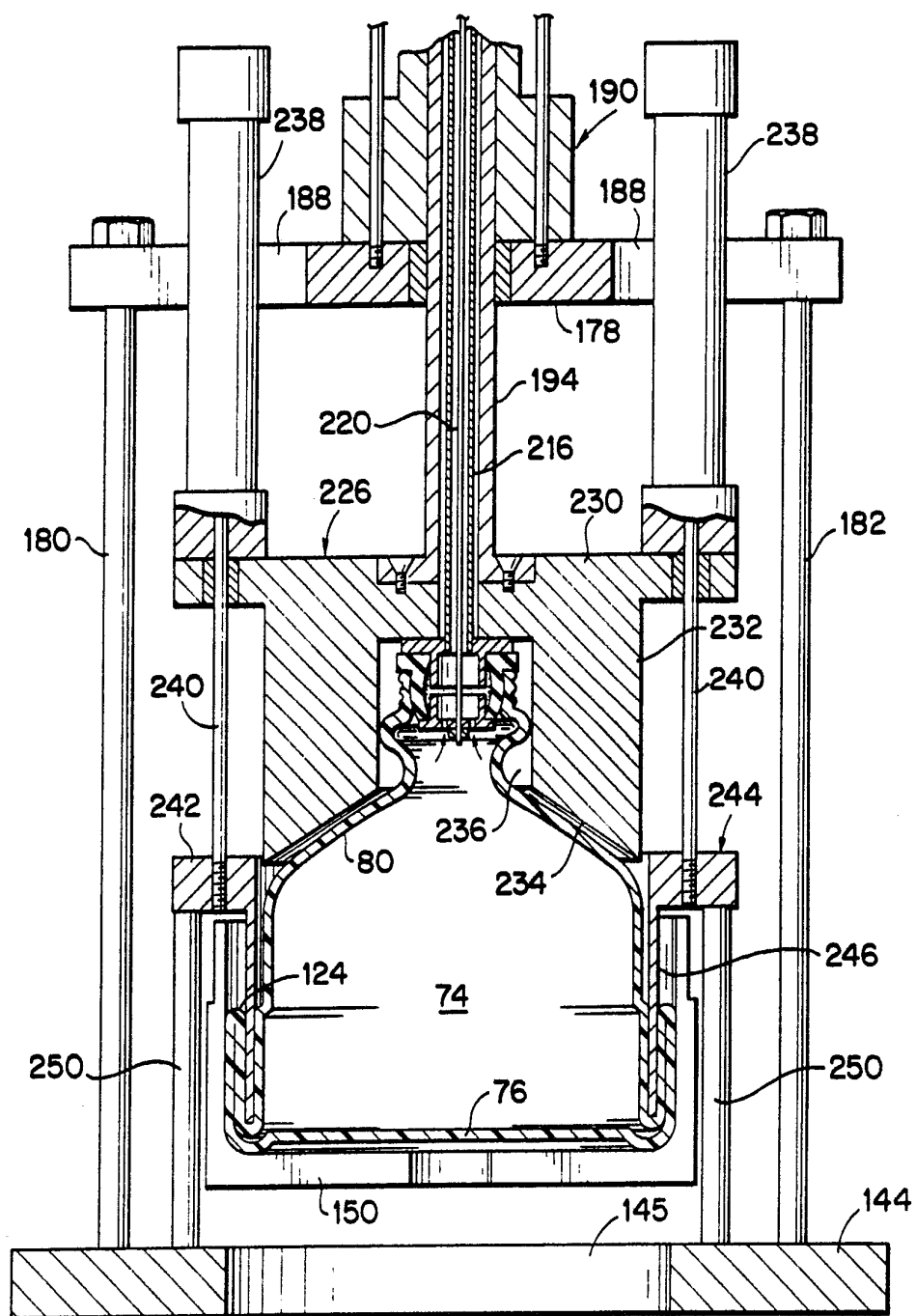


FIG. 13

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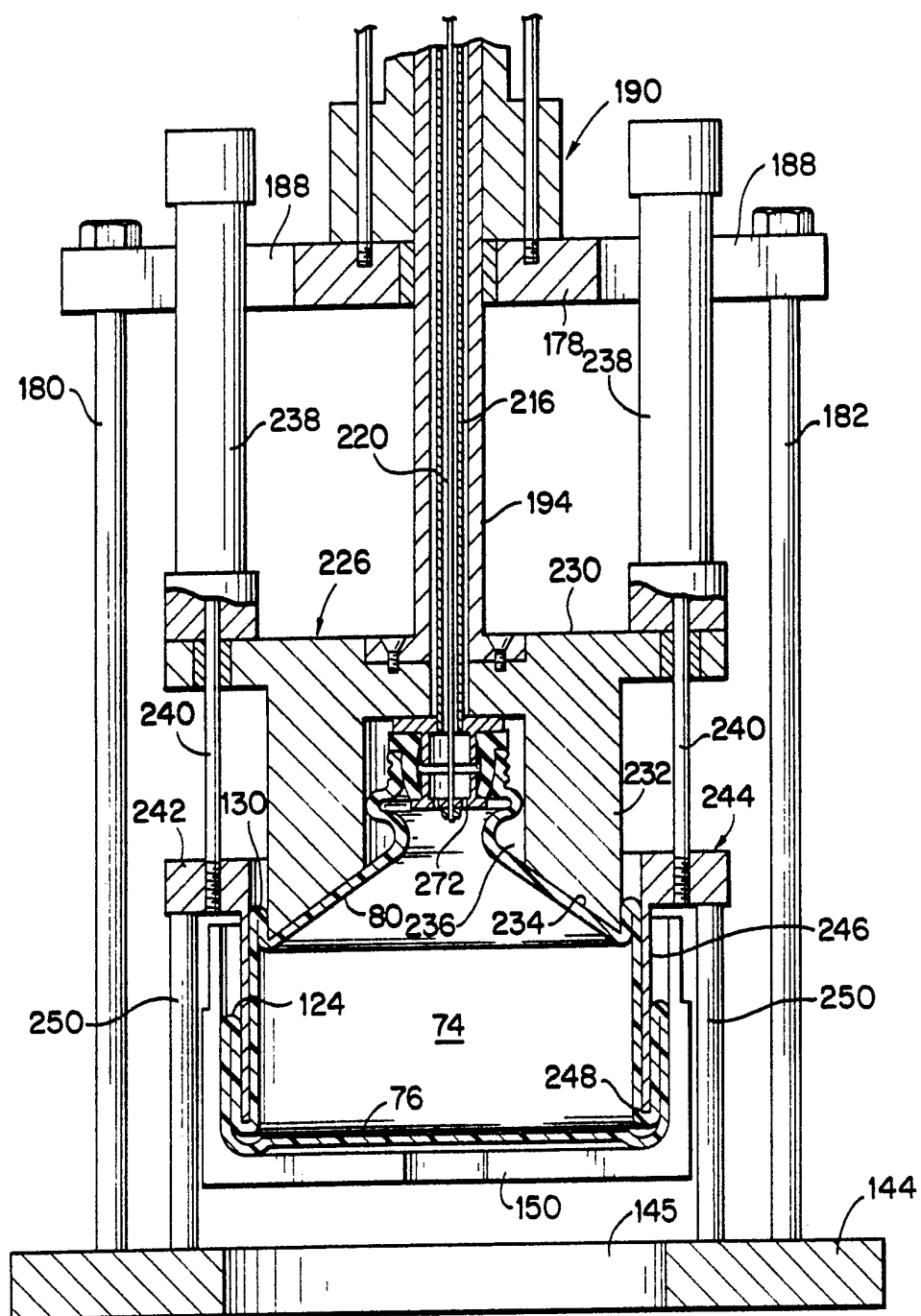


FIG. 14
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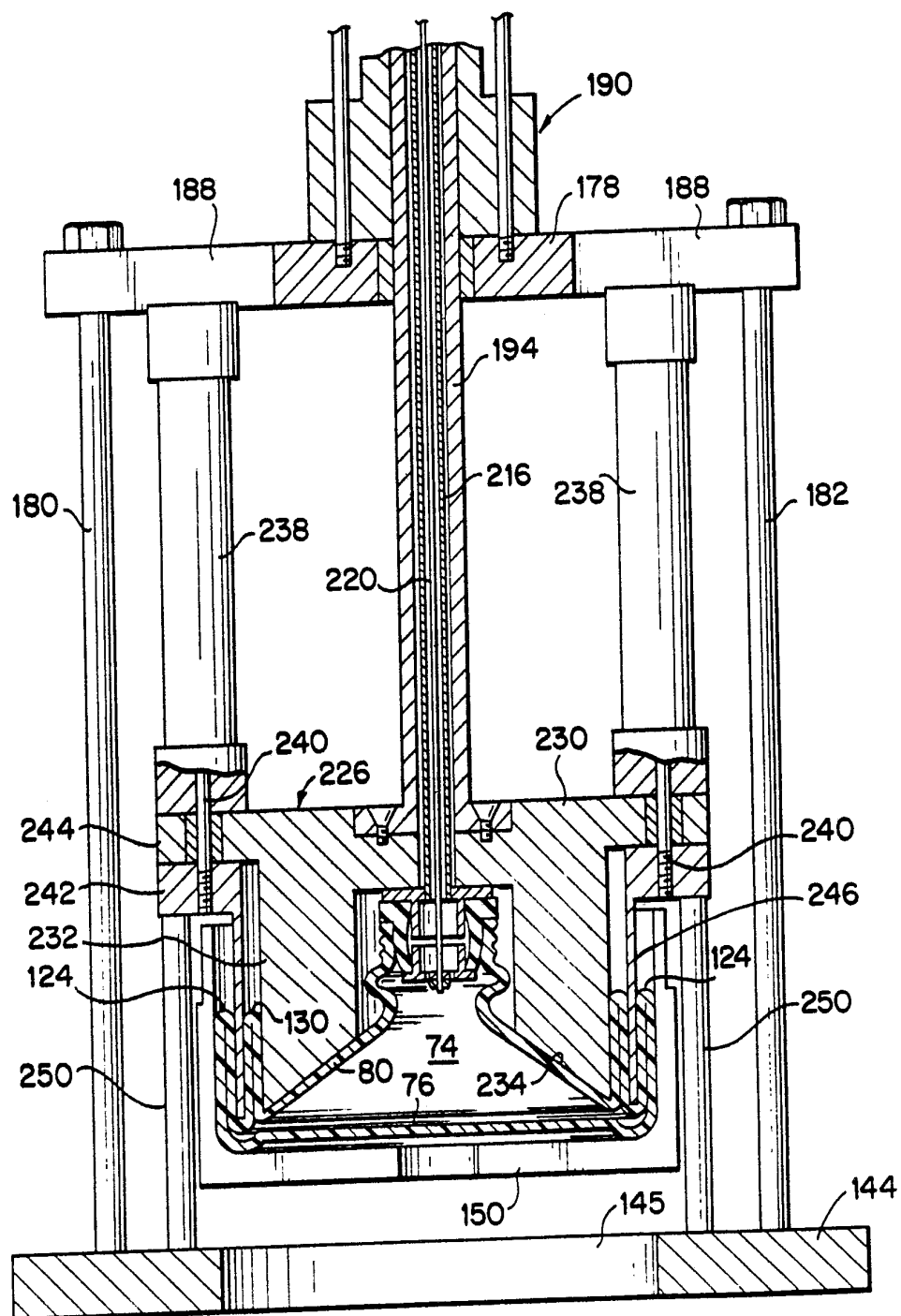


FIG. 15

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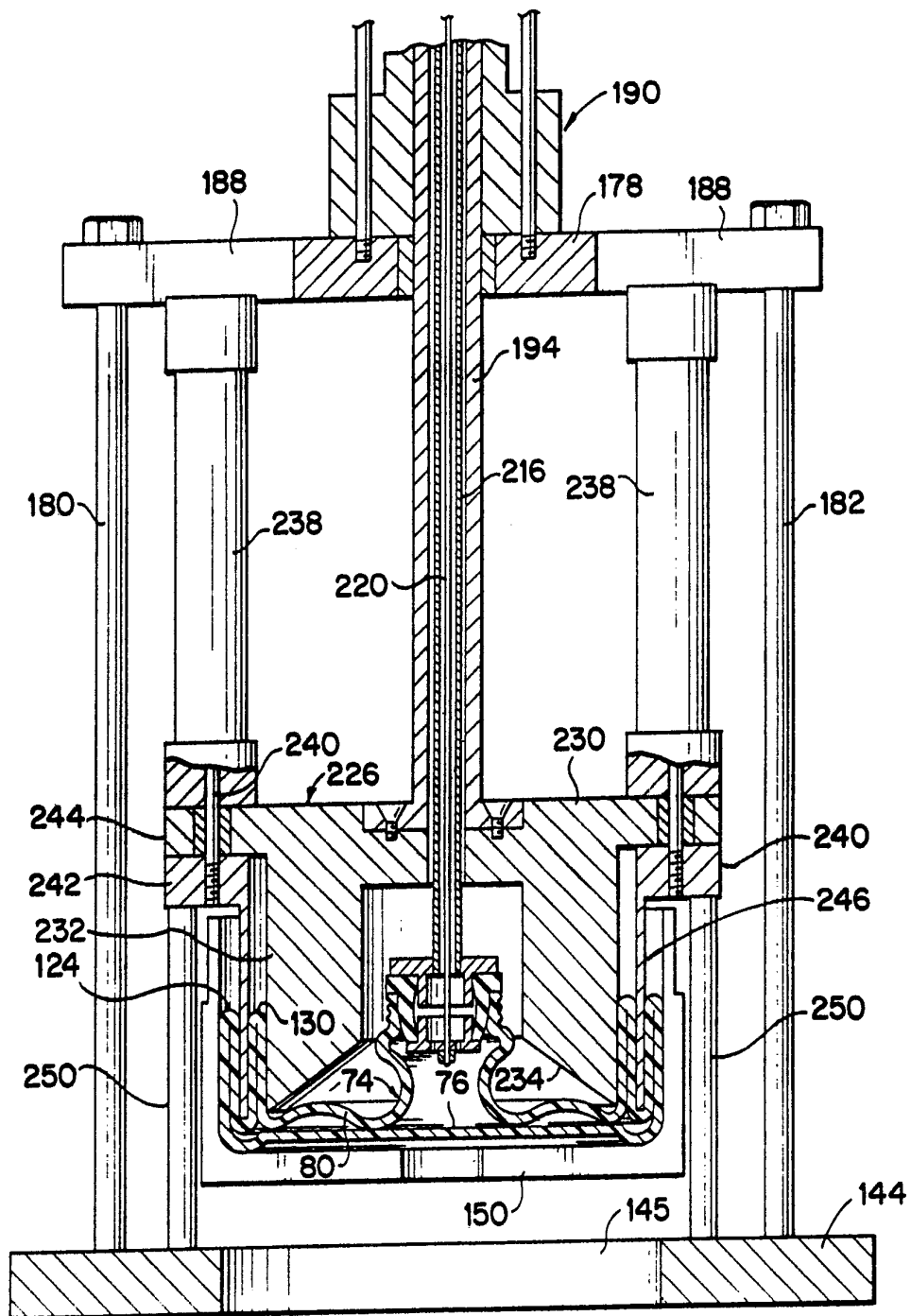
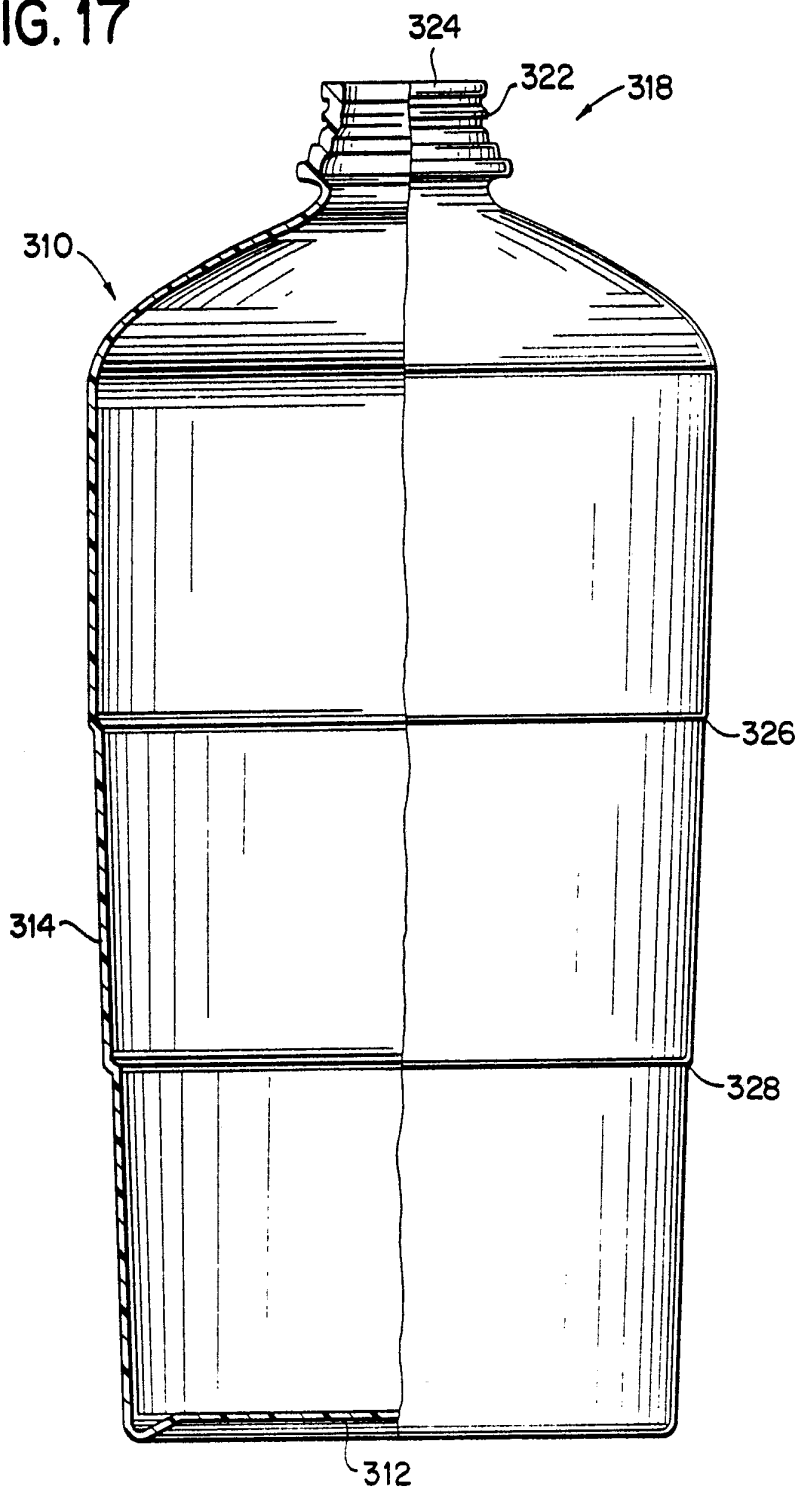


FIG. 16

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FIG. 17



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FIG. 18

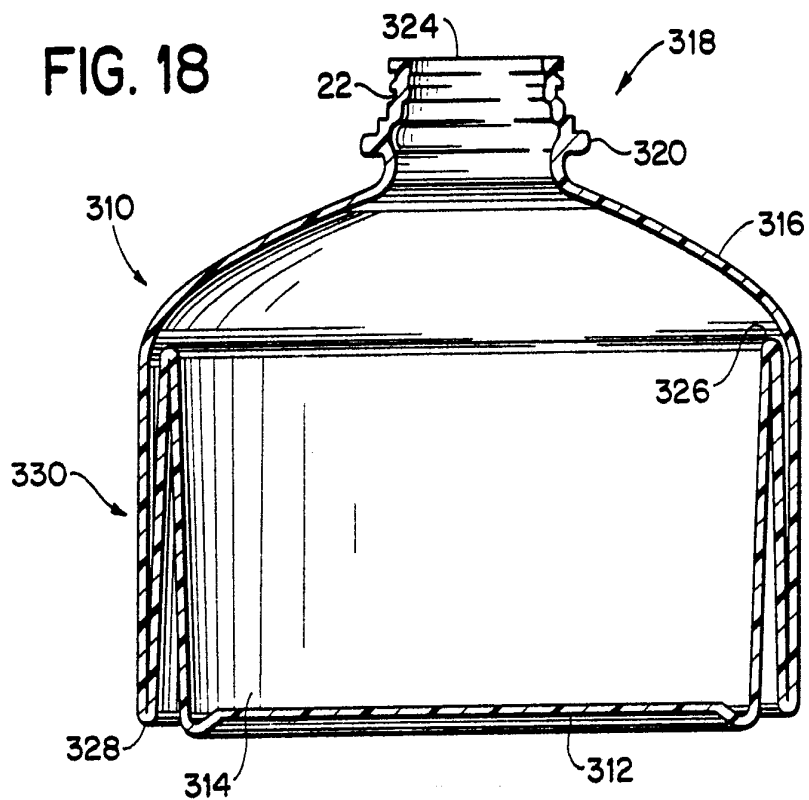
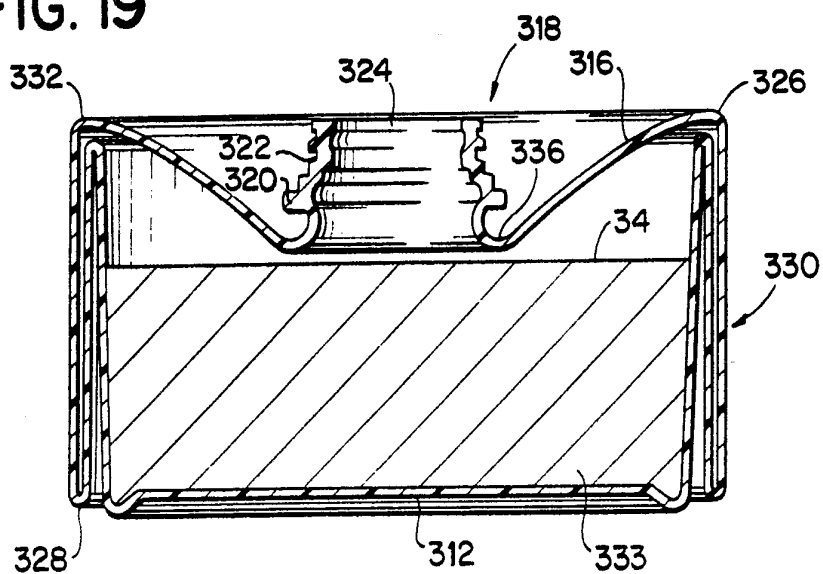
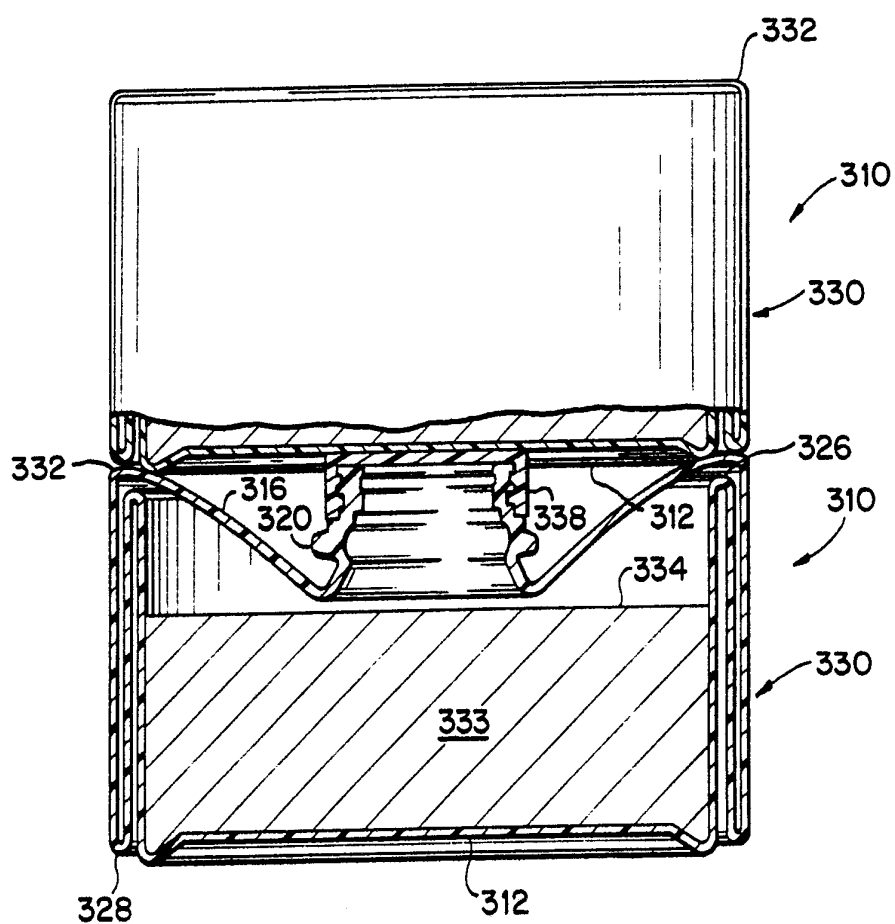


FIG. 19



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FIG. 20



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FIG. 21

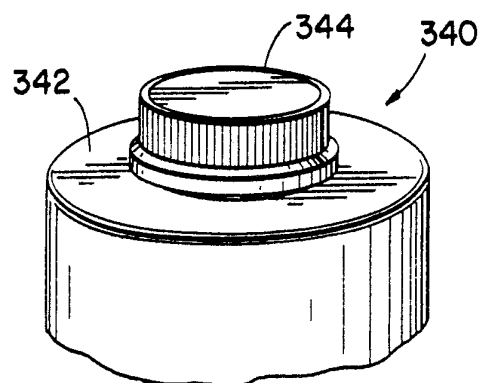
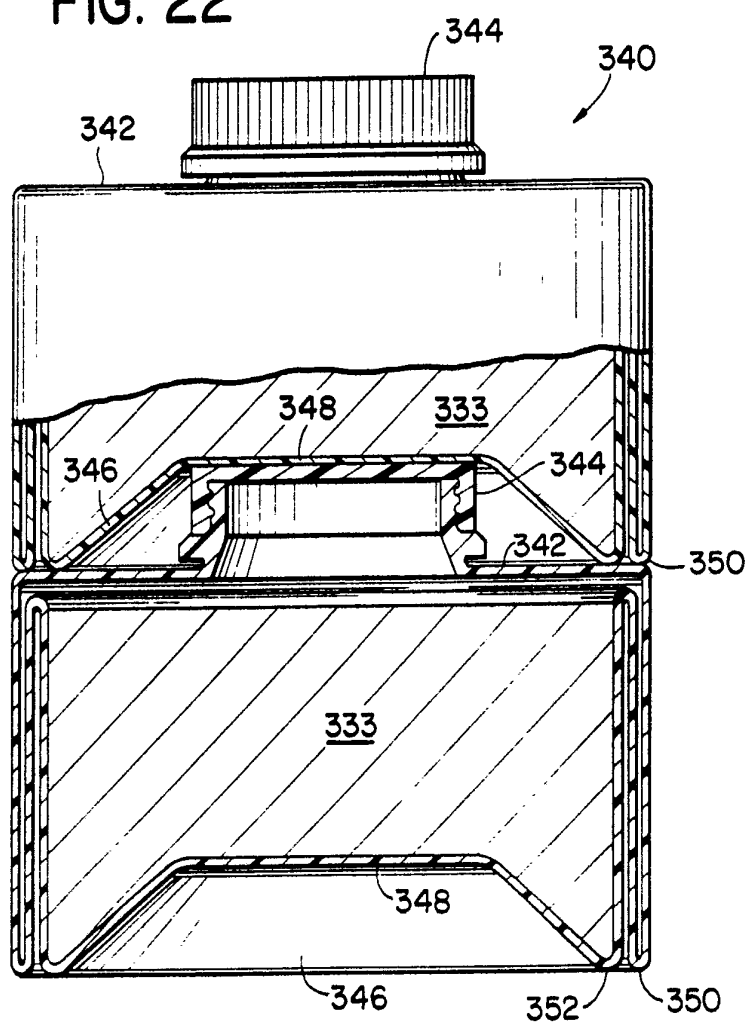
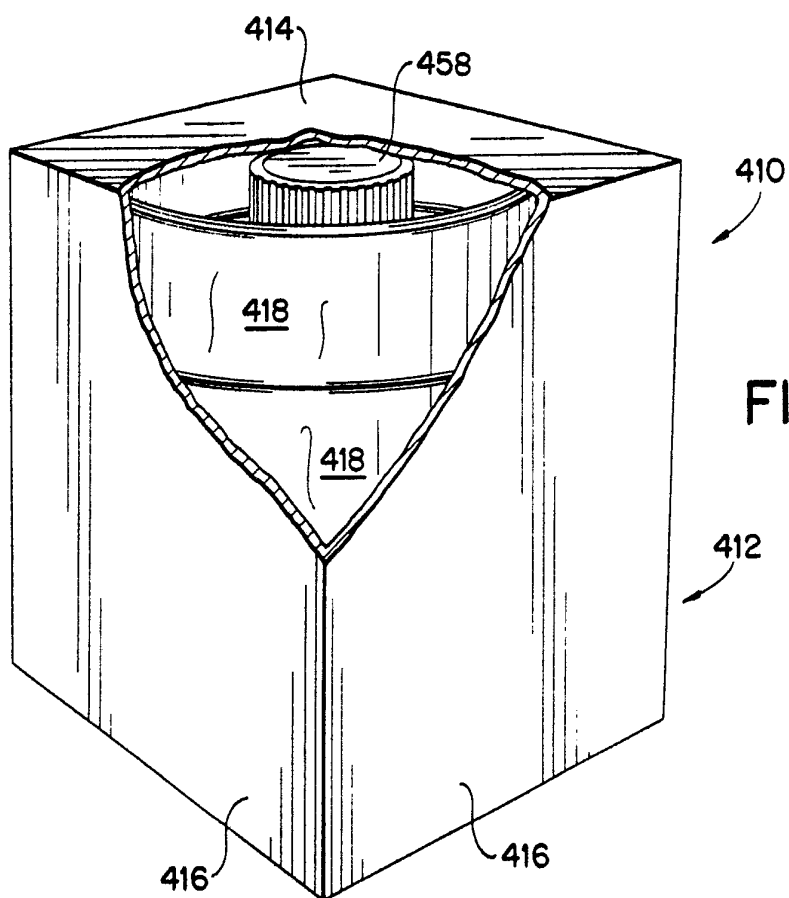
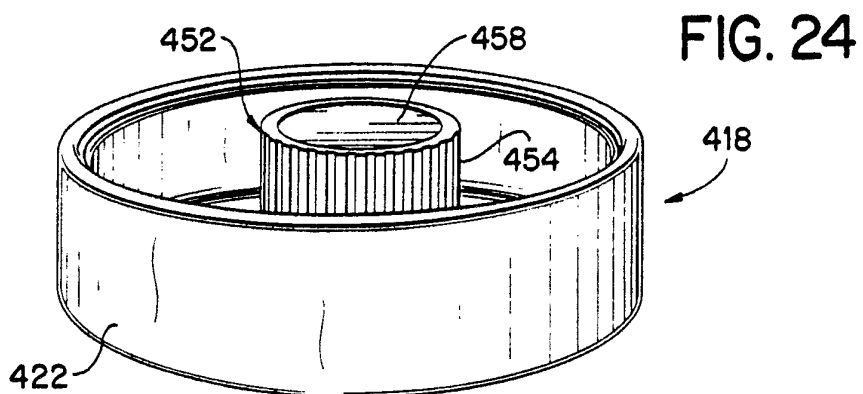


FIG. 22



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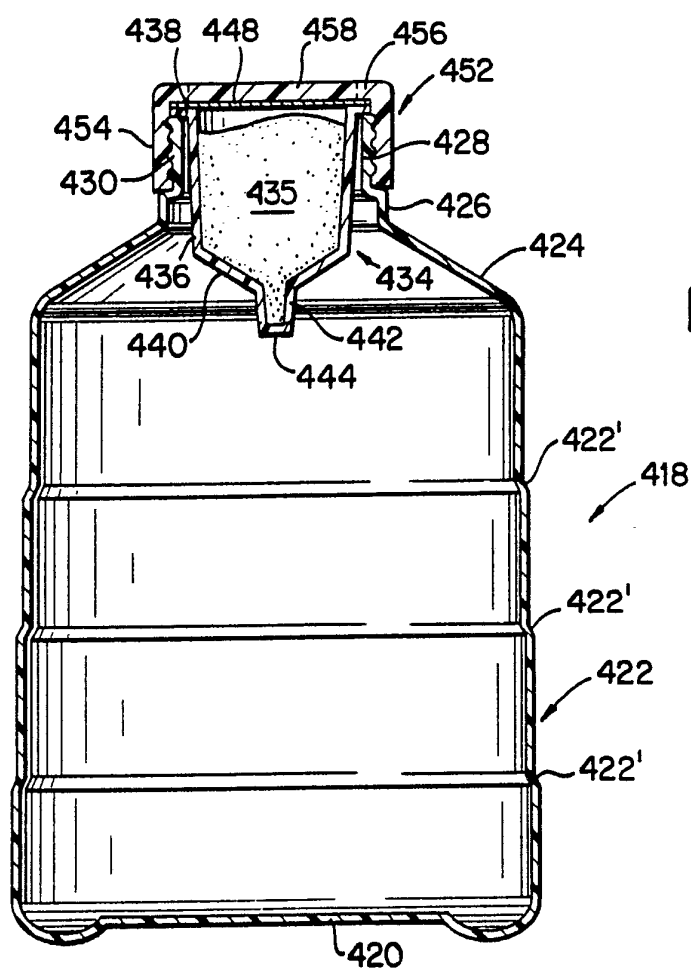


FIG. 25

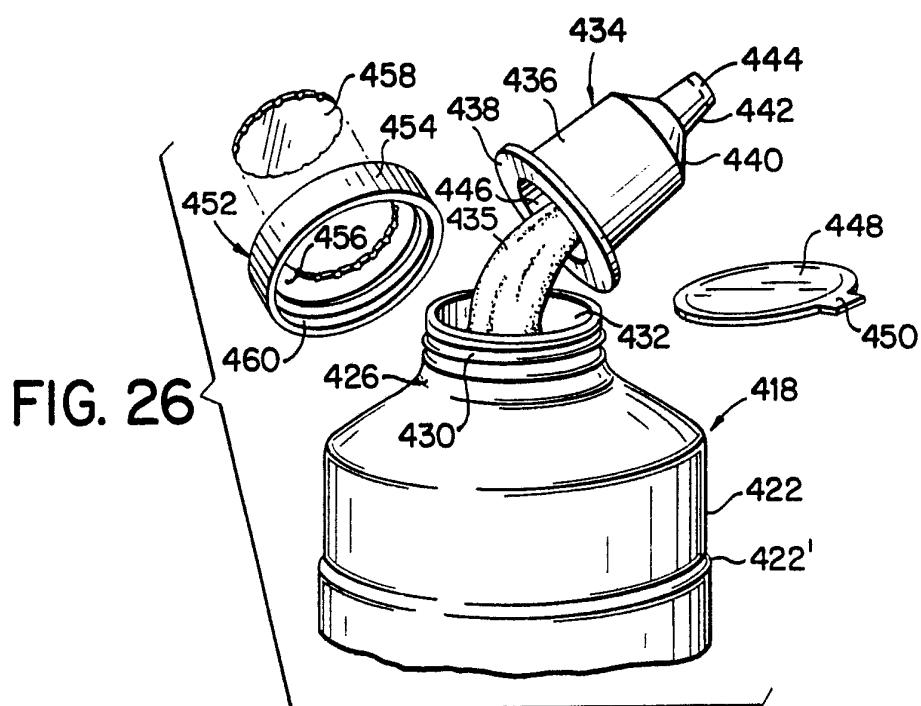
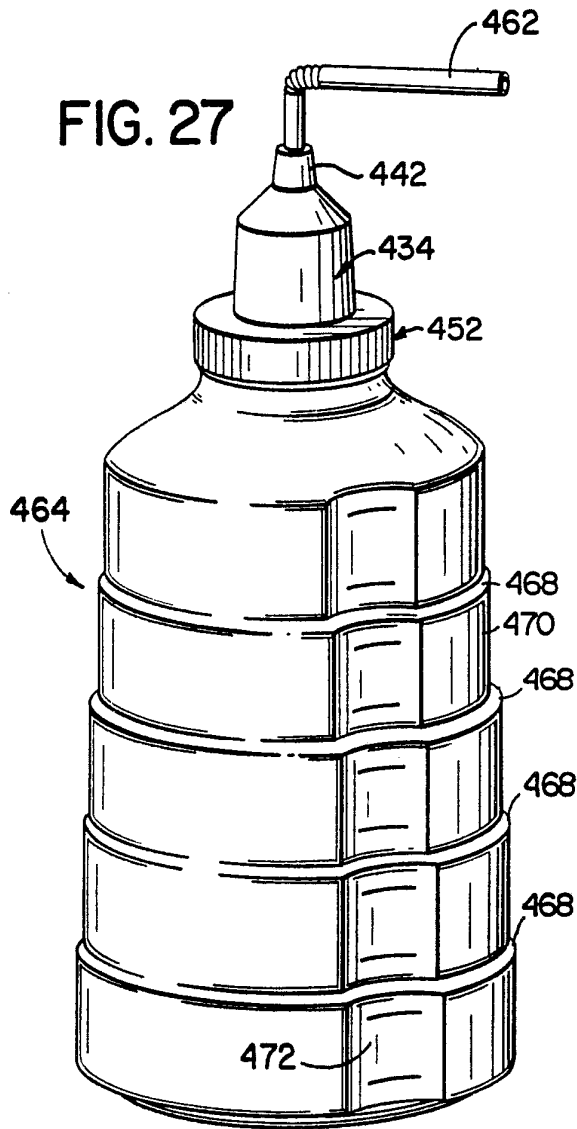
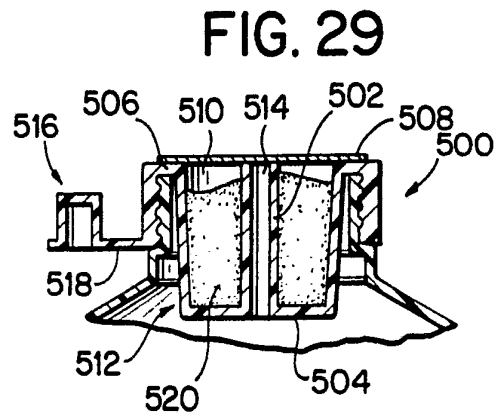
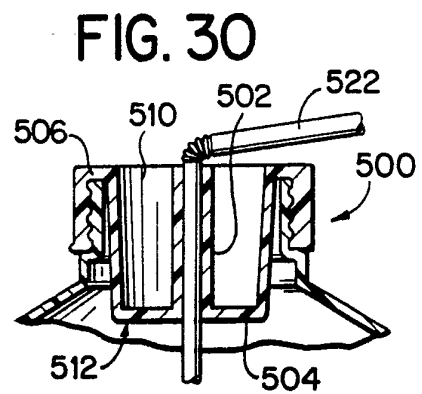
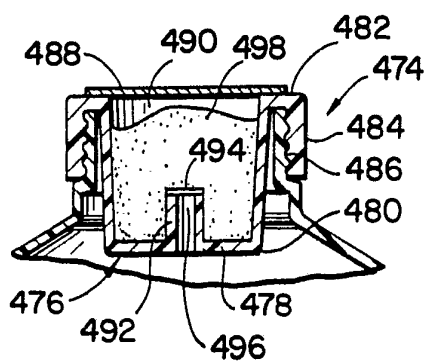
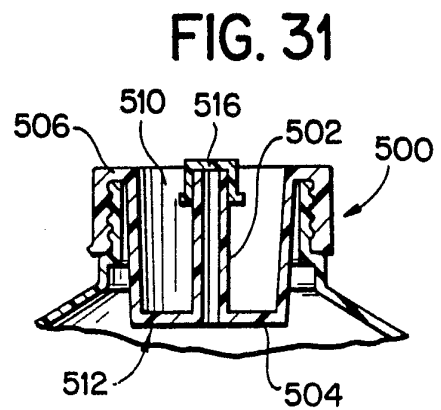


FIG. 26



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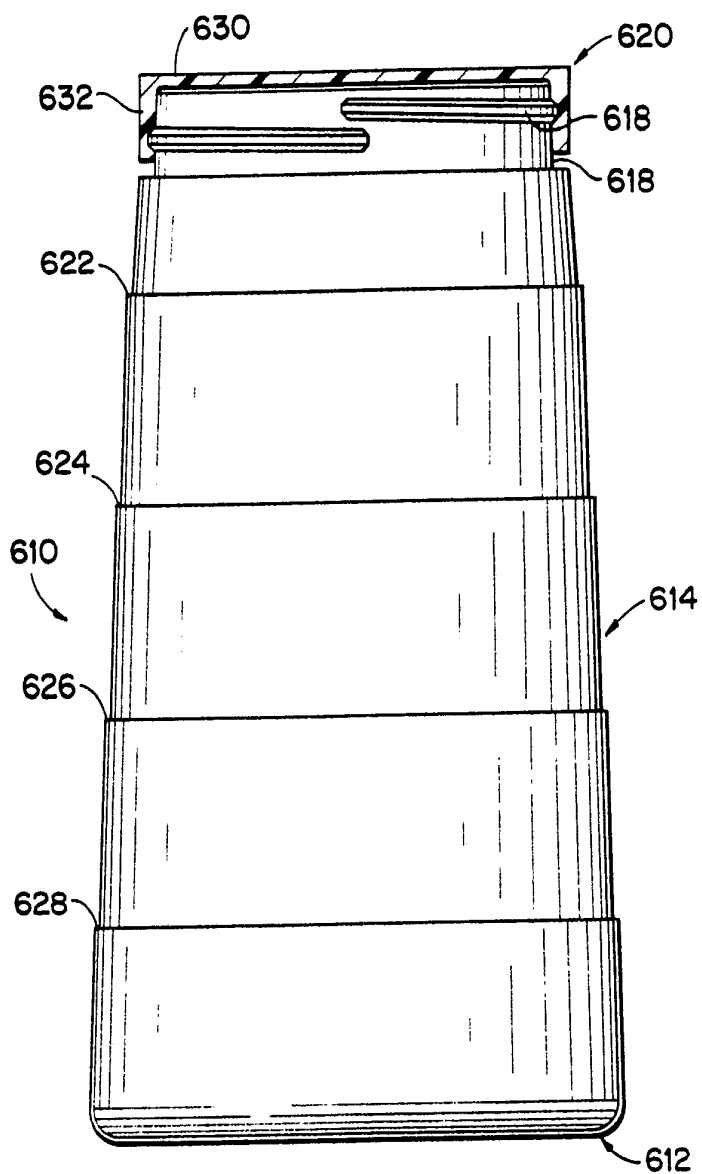


FIG. 32

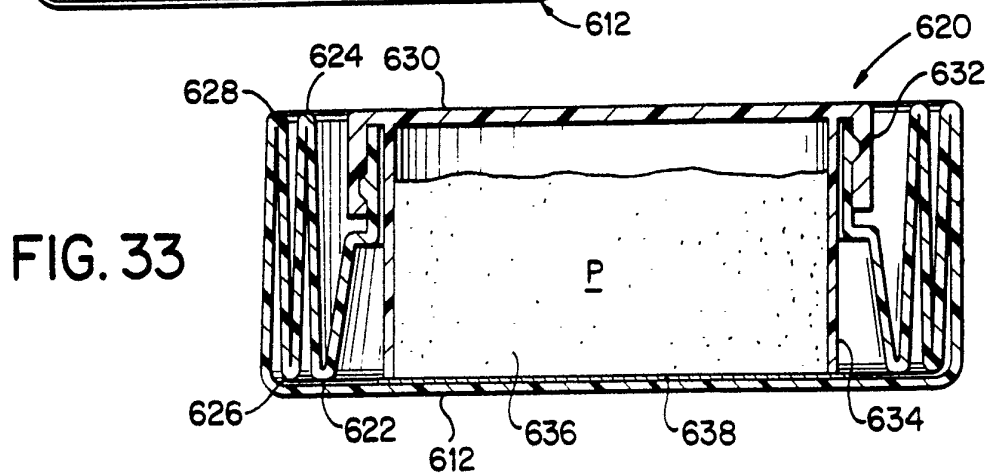


FIG. 33

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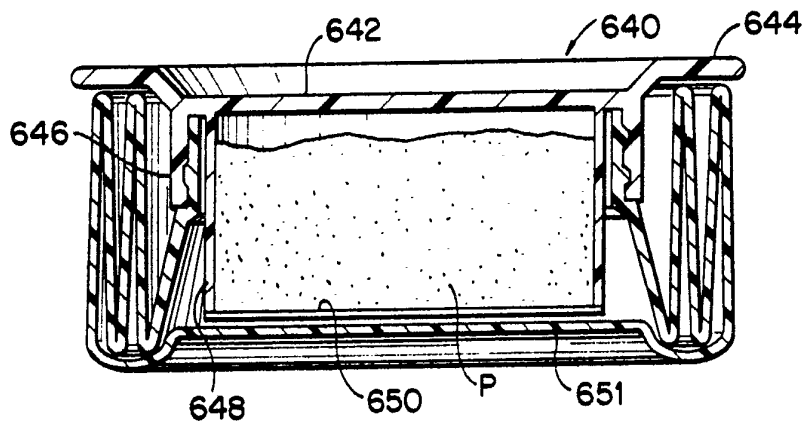


FIG. 34

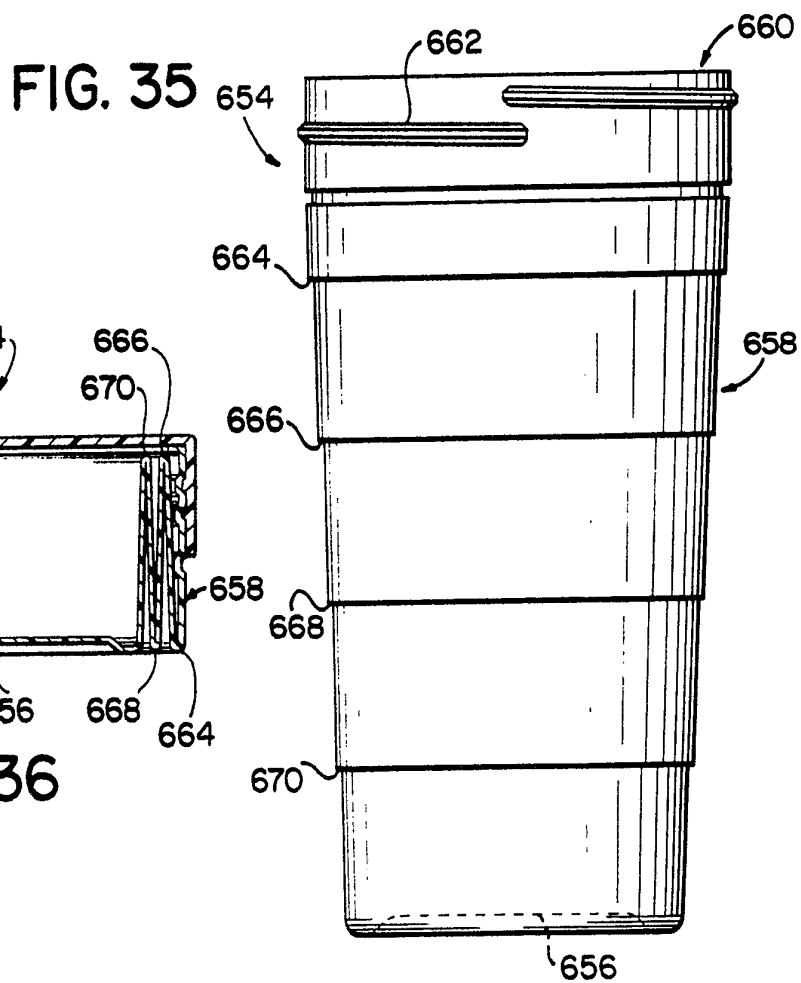


FIG. 35

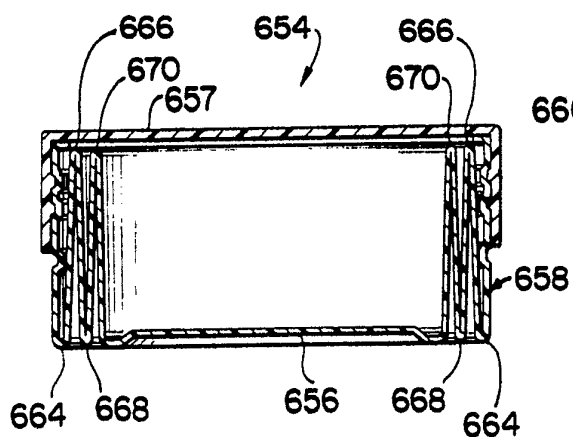


FIG. 36

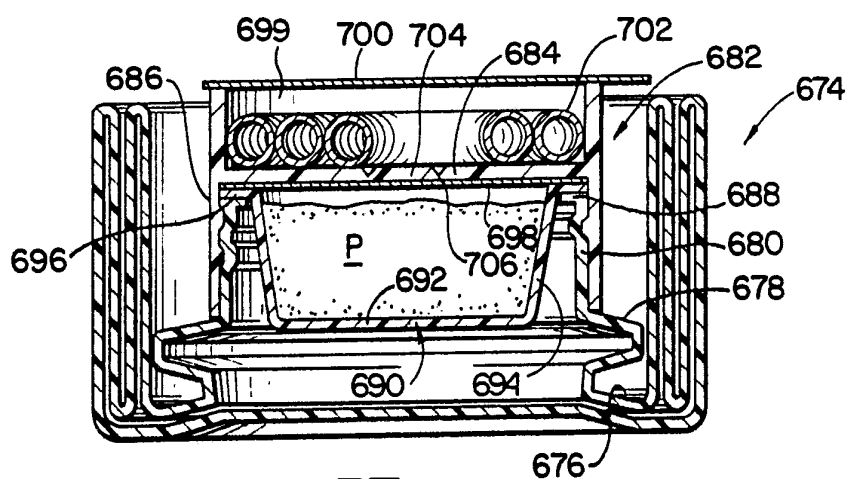


FIG. 37

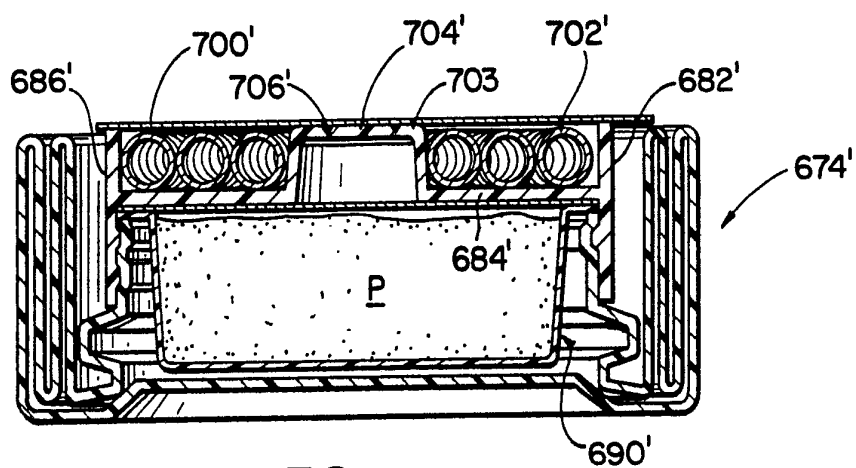


FIG. 38

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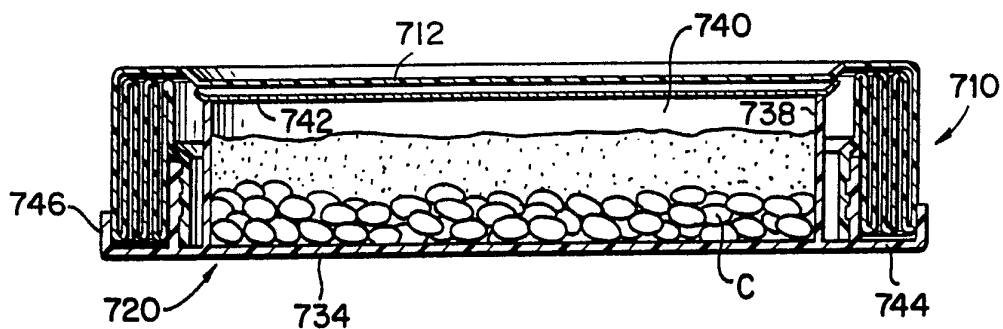
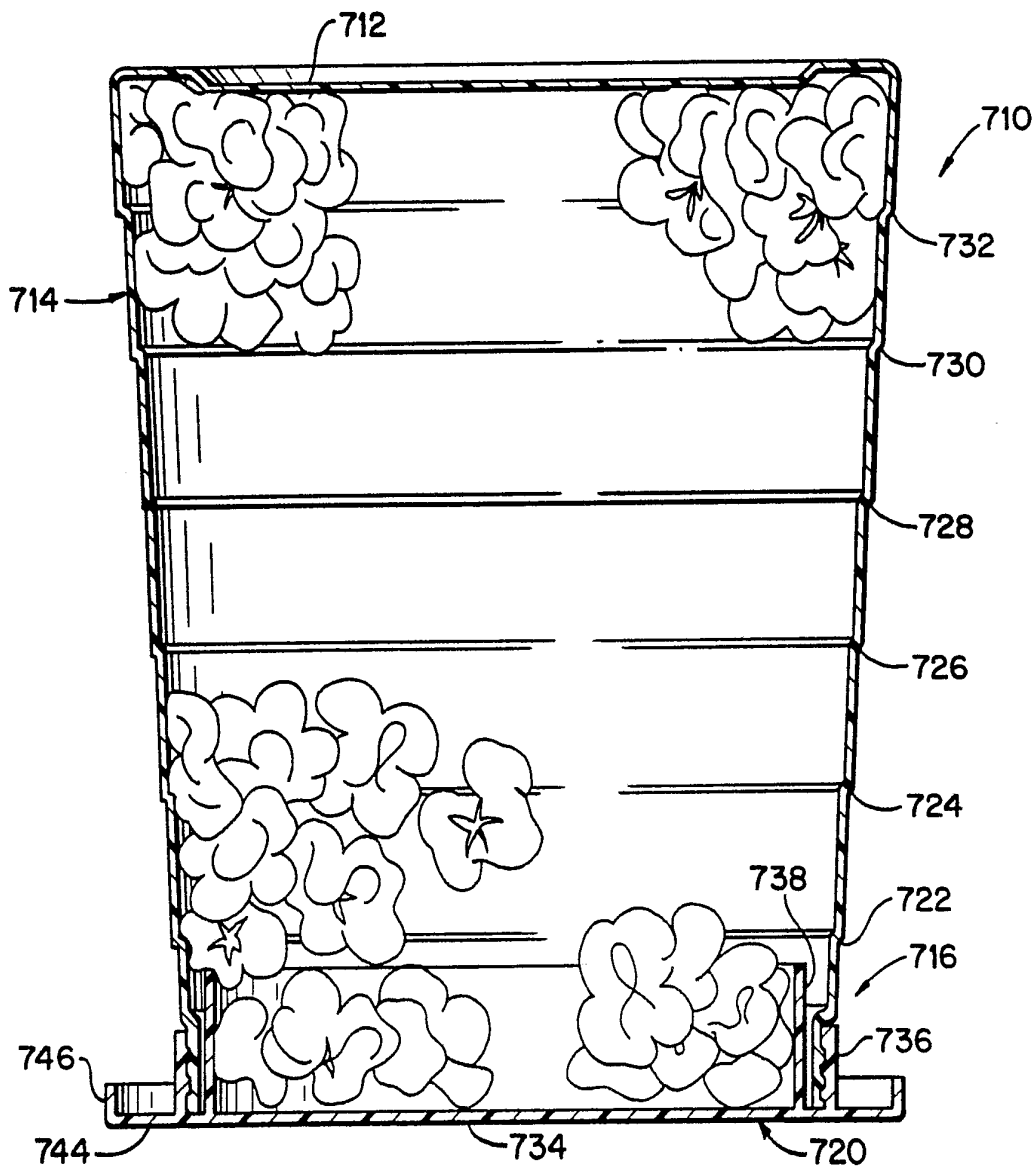


FIG. 39

FIG. 40



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FIG. 41

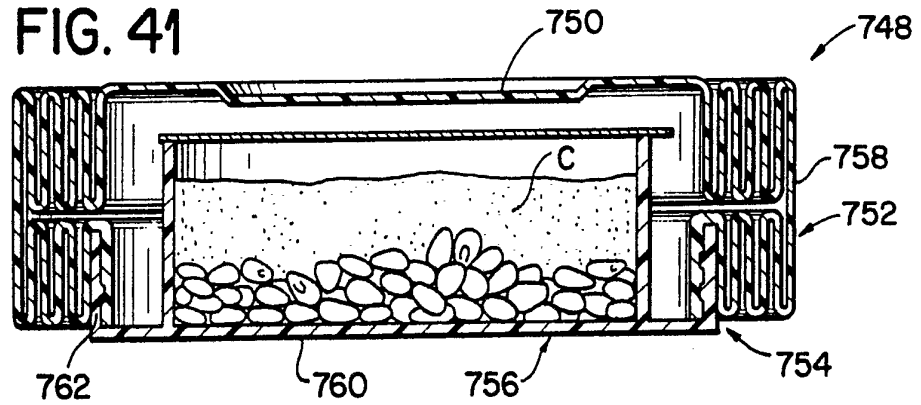


FIG. 42

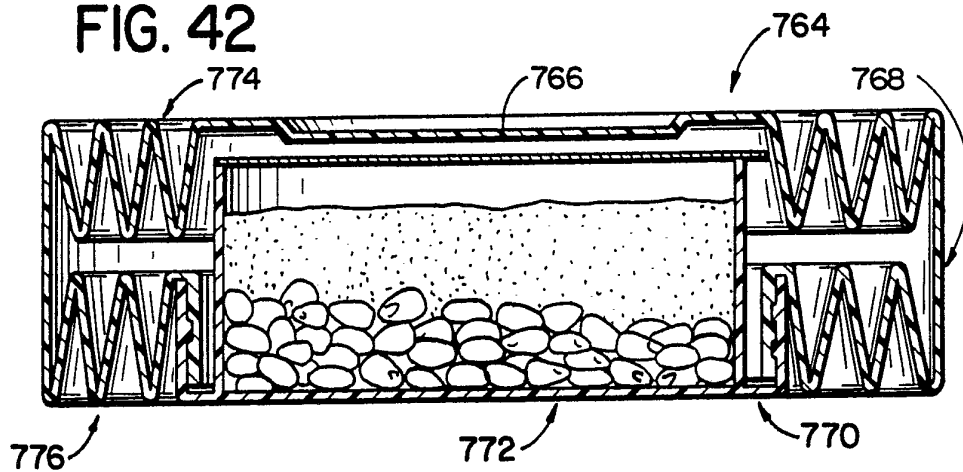
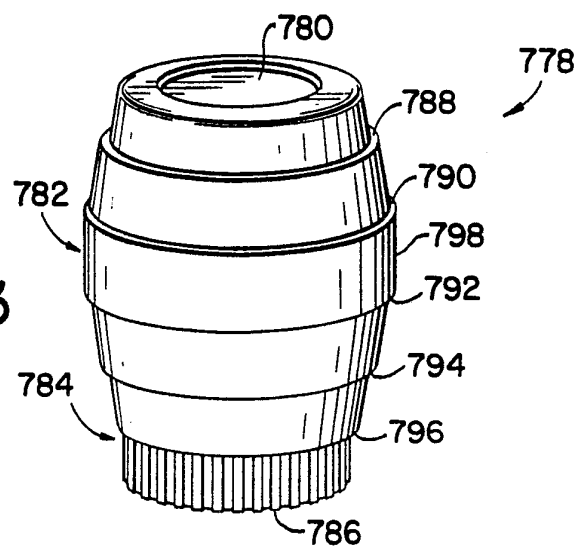


FIG. 43



SUBSTITUTE SHEET

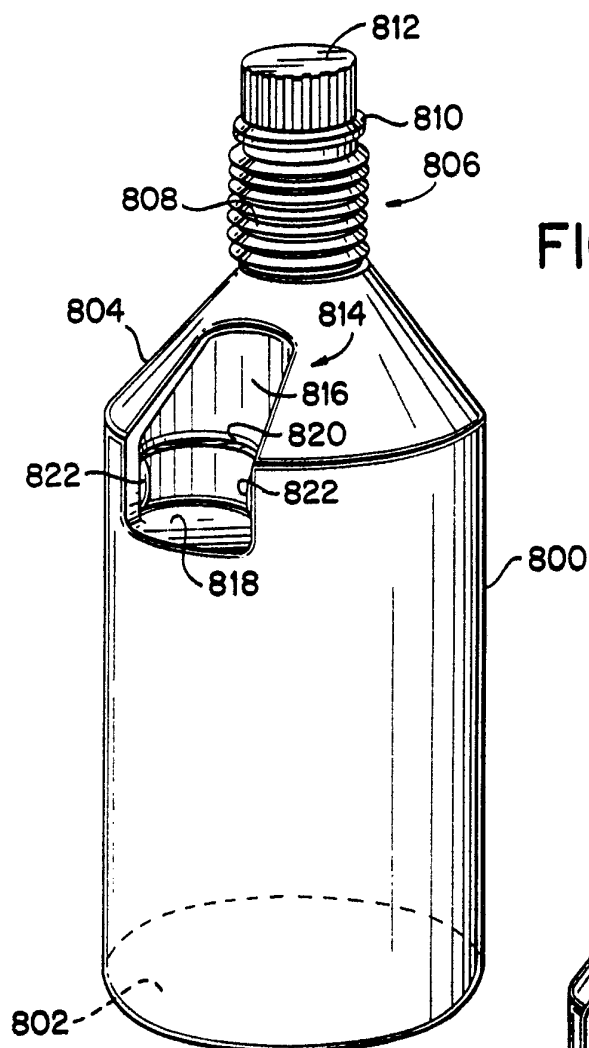
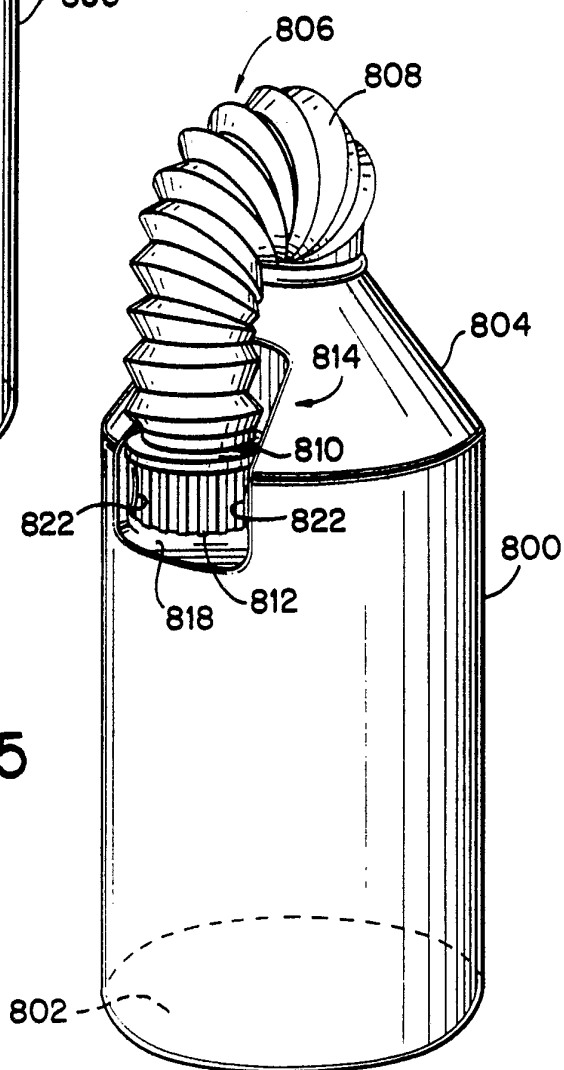


FIG. 45



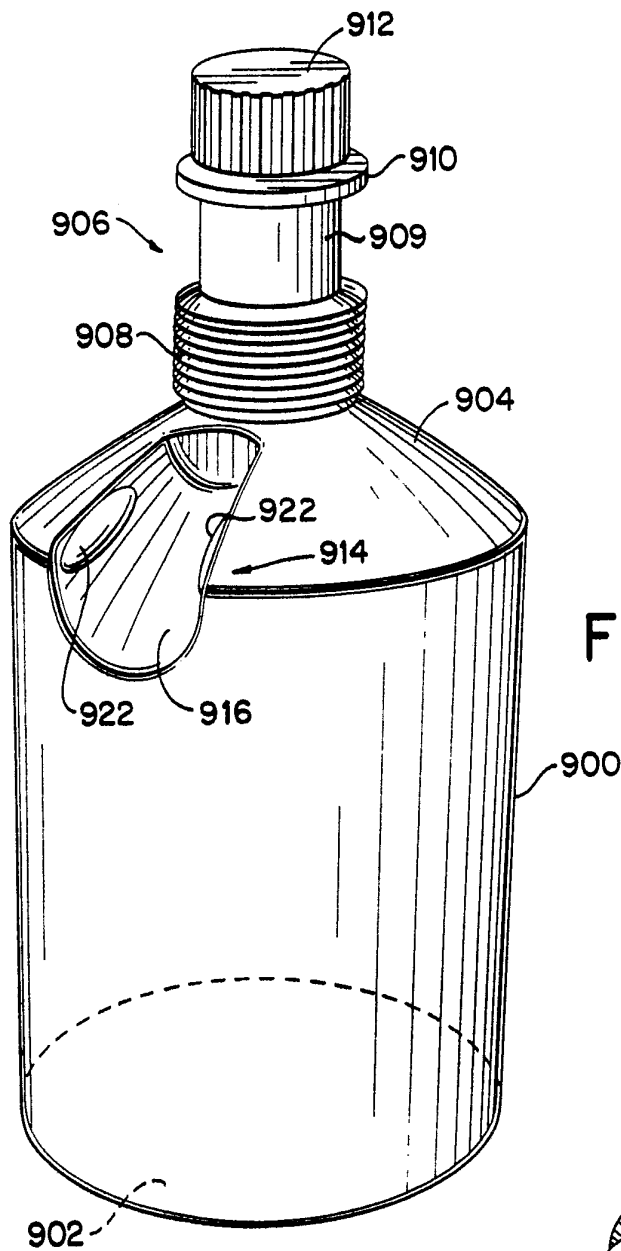
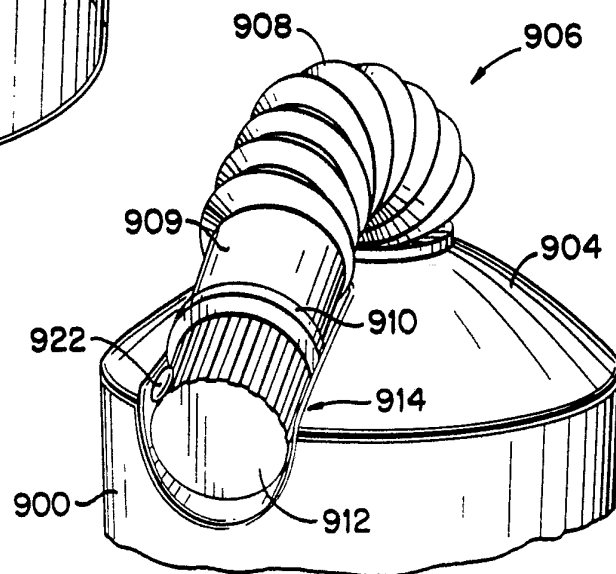


FIG. 47



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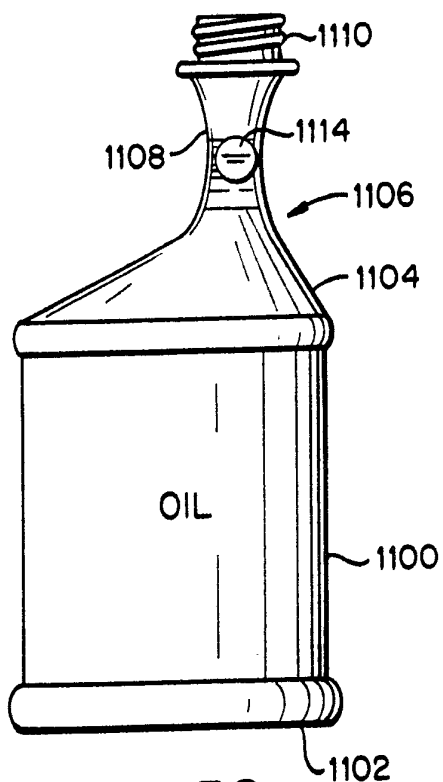


FIG. 50

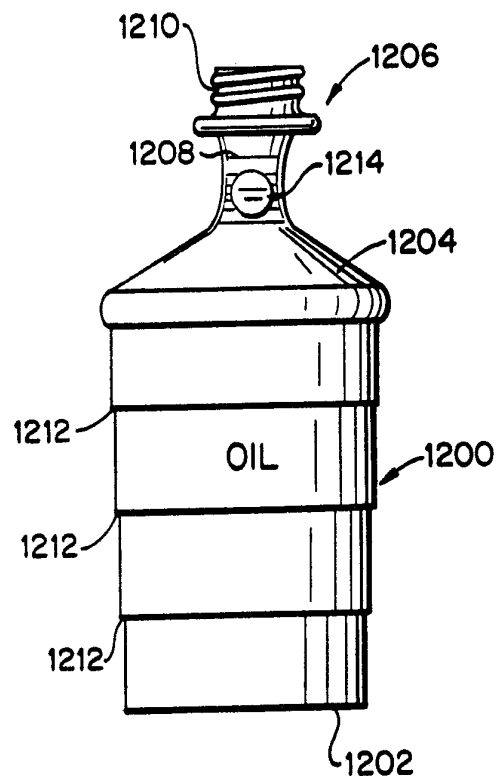


FIG. 53

FIG. 51

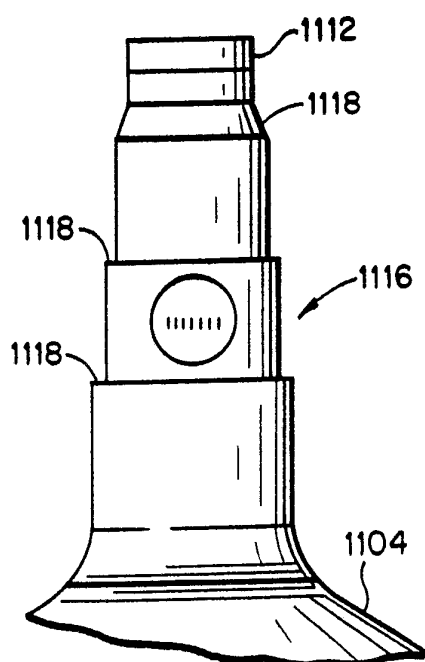
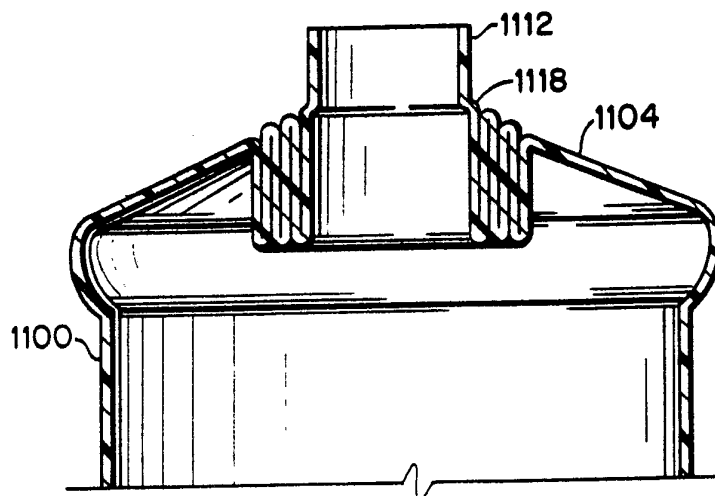


FIG. 52



INTERNATIONAL SEARCH REPORT

International Application No. PCT/US91/06222

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 IPC(5): B65D 1/02, 21/08, 25/54; B28B 11/10 U.S. CL: 206/499,508,509;215/1c,Dig.8;220/410,666;222/530;425/398;426/111,120		
II. FIELDS SEARCHED		
Minimum Documentation Searched ⁷		
Classification System	Classification Symbols	
U.S.	206/219-222,499,503,508,509,568;215/1A,1C,6,11.6, 251,Dig.8;220/8,403,410,462,470,666,675;222/105,107,530; 425/398;426/111,112,115,120,124	
Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched *		
III. DOCUMENTS CONSIDERED TO BE RELEVANT *		
Category *	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³
X Y	US, A, 4,492,313 TOUZANI 08 JANUARY 1985 See Col. 2, lines 21-26	1,5,6/1,13,20 2-4,6/2,7,14
Y	US, A, 4,602,728 HA 29 JULY 1986 See Col. 3, lines 33-55	11
X Y	US, A, 4,875,576 TORGRIMSON ET.AL. 24 OCTOBER 1989	13,15/13,16/15/13 14,15/14,16/15/14
A	US, A, 3,220,544 LOVELL 30 NOVEMBER 1965	
A	US, A, 3,326,421 PEACE 20 JUNE 1967	
A	US, A, 3,819,789 PARKER 25 JUNE 1974	
A	US, A, 4,079,111 UHLIG 14 MARCH 1978	
A	US, A, 4,219,137 HUTCHENS 26 AUGUST 1980	
A	US, A, 4,436,203 REYNER 13 MARCH 1984	
A	US, A, 4,456,134 COOPER 26 JUNE 1984	
A	US, A, 4,576,565 CHLYSTUN 18 MARCH 1986	
A	US, A, 4,634,003 UEOA ET. AL. 06 JANUARY 1987	
A	US, A, 4,667,818 EVANS 26 MAY 1987	
A	US, A, 4,773,458 TOUZANI 27 SEPTEMBER 1988	
A	US, A, 4,867,993 NORDSKOG 19 SEPTEMBER 1989	
A	US, A, 4,873,100 DIRKSING 10 OCTOBER 1989	
<p>* Special categories of cited documents: ¹⁰</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"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)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> <p>"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</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"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.</p> <p>"&" document member of the same patent family</p>		
IV. CERTIFICATION		
Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report	
16 December 1991	08 JAN 1992	
International Searching Authority	Signature of Authorized Officer	
ISA/US	Stephen Grabe	