

Feb. 27, 1973

E. M. REYNER ET AL

3,718,236

PRESSURIZED CONTAINER WITH NON-RIGID FOLLOWER

Filed Dec. 4, 1969

4 Sheets-Sheet 1

FIG 1

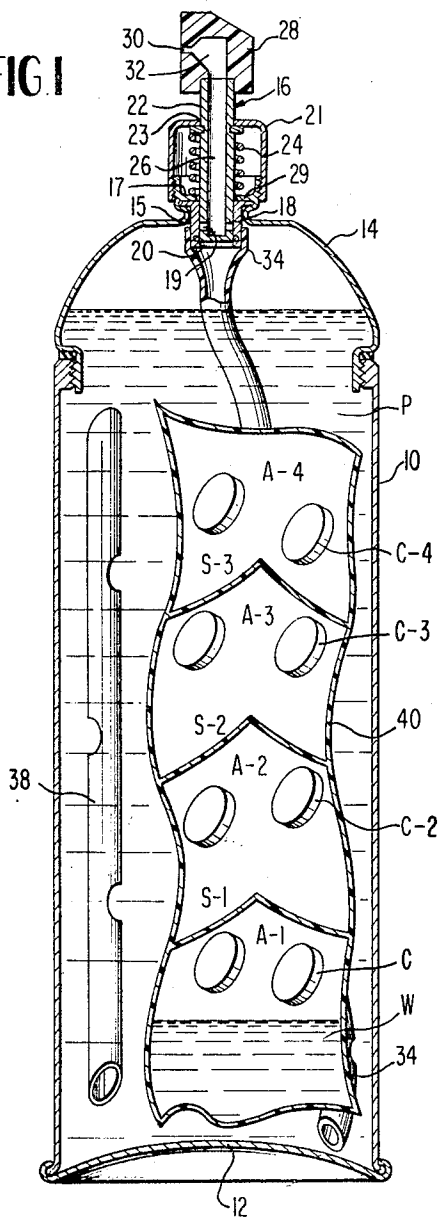
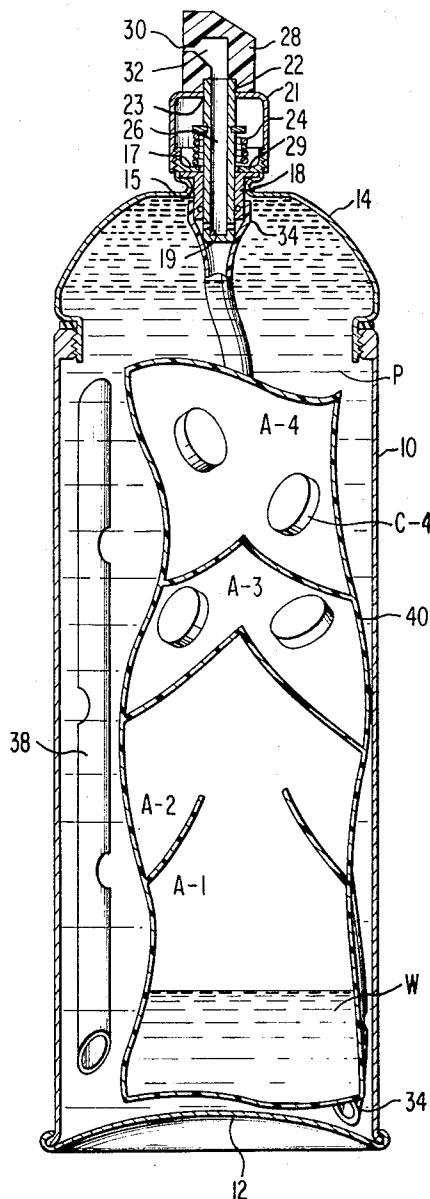


FIG 2



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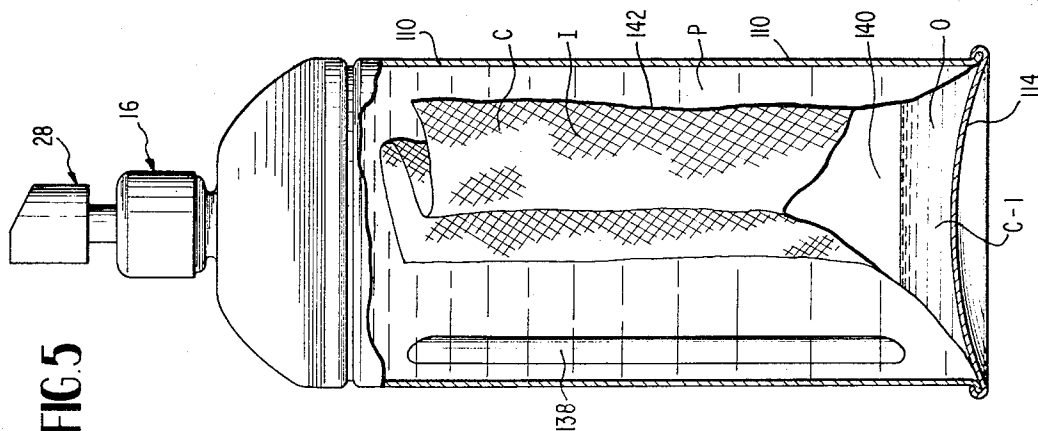


FIG. 5

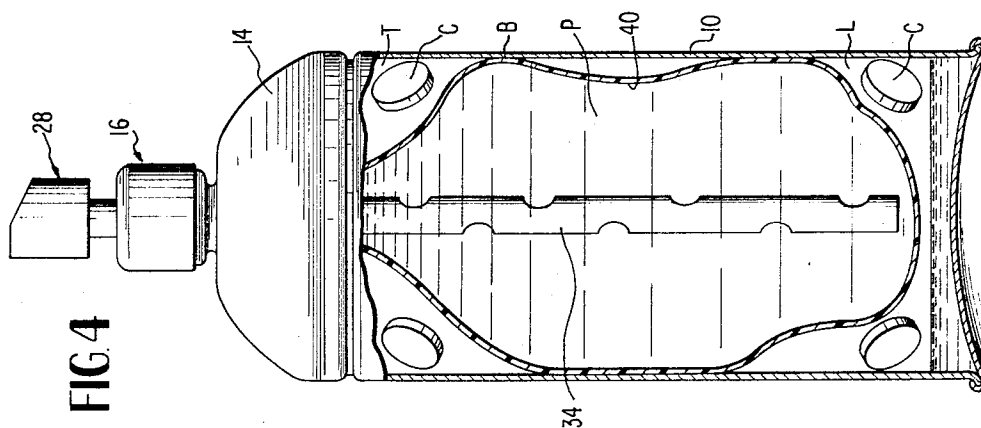


FIG. 4

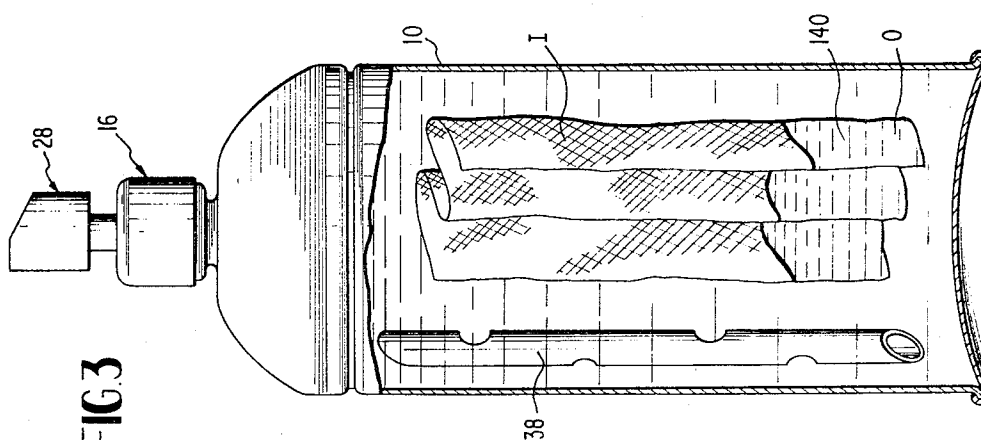


FIG. 3

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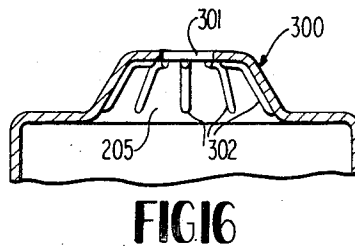
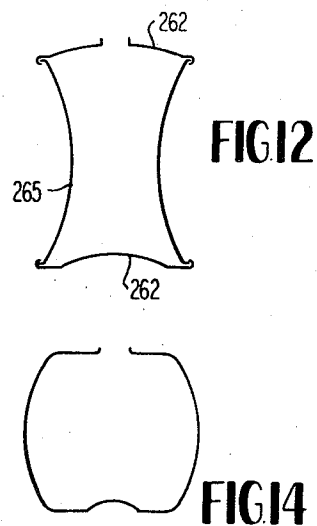
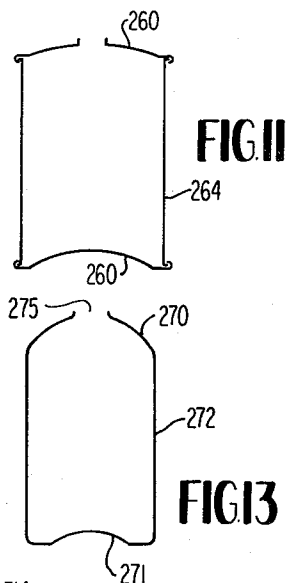
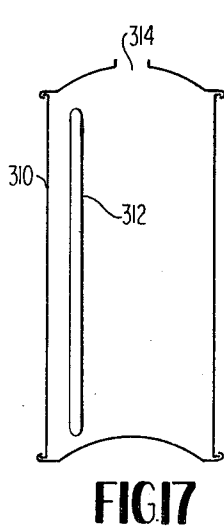
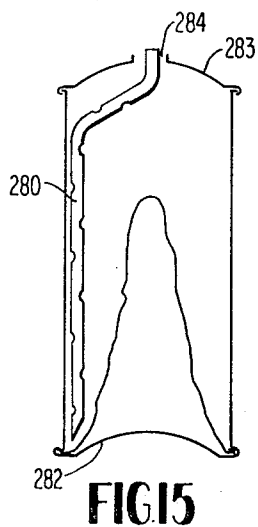
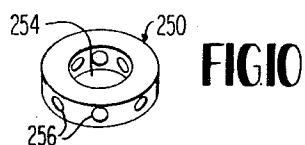
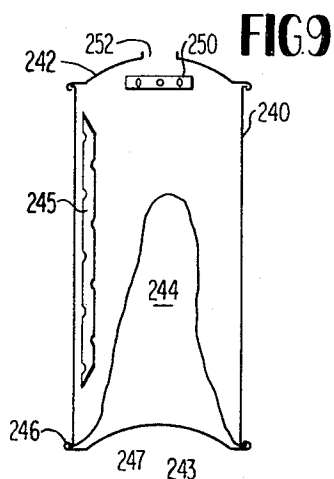
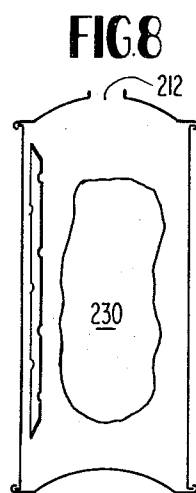
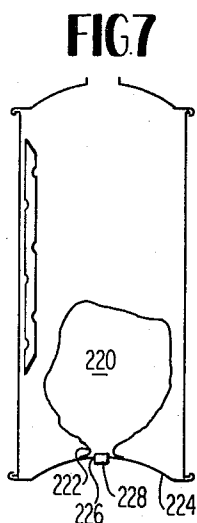
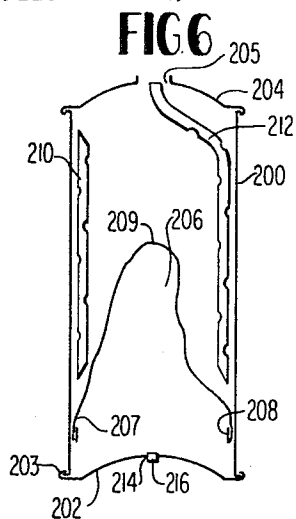
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FIG. 18

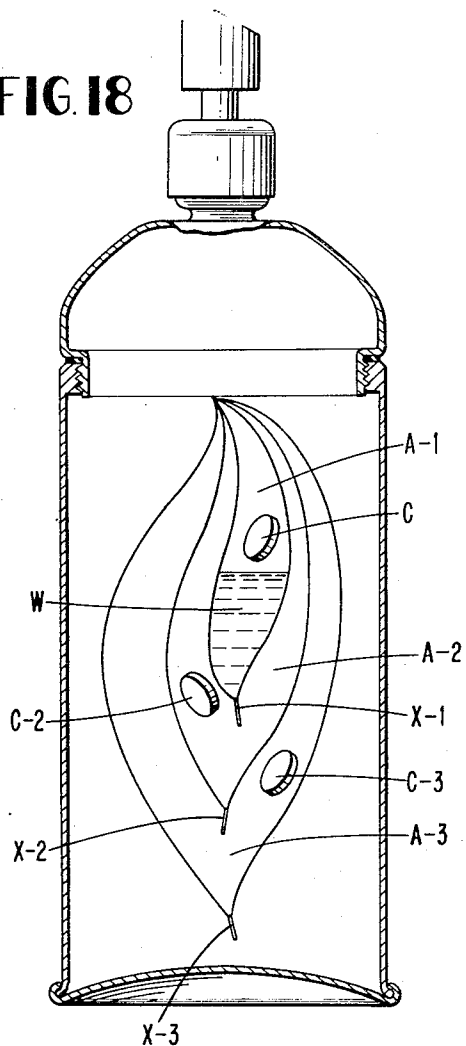
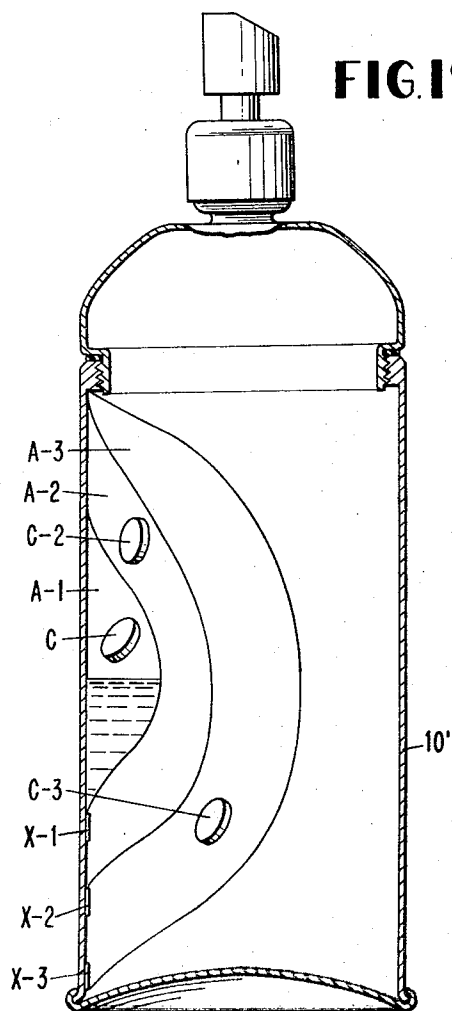


FIG. 19



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PRESSURIZED CONTAINER WITH NON-RIGID FOLLOWER

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Int. Cl. B67d 5/42

U.S. Cl. 222—386.5

30 Claims

ABSTRACT OF THE DISCLOSURE

In a container for a flowable product which is dispensed through an outlet in the container controlled by a valve or closure, a plurality of expansible chambers or compartments serially arranged and separated from each other by disruptable partitions. One compartment has a pressure generating agent which, through the addition of a delaying agent, begins to generate pressure in the compartment after the container is assembled and charged with the product to be dispensed. The generated pressure causes the compartment to expand and force the product out of the container through the outlet of the container, when the valve of the container is opened. Expansion of the compartment also disrupts the associated partition to place the adjacent compartment in communication with the first compartment. Chemical reagent in the second compartment reacts with or is activated by the pressure generating substance in the first compartment to further generate gas causing continued expansion of the compartments for dispensing the product under pressure. This expansion of the compartment in turn disrupts a second partition to communicate a third compartment to activate a chemical reagent in the third compartment to further generate gas and pressure for dispensing the product in the same manner. Other features and embodiments of the invention will appear subsequently in the specification and drawings.

SUMMARY OF INVENTION AND OBJECTS

The present invention relates to improvements in pressurized containers for dispensing flowable products such as disclosed in U.S. Pat. No. 3,178,075.

A common problem with conventional pressurized containers in many cases, is that it is difficult to dispense the entire contents of the container because the pressure employed for dispensing the product is dissipated prematurely. This often frustrates the user of the container and moreover results in product waste.

The present invention seeks to overcome the above problem by insuring a sufficient and continuing supply of pressure which will allow the container to be adequately and satisfactorily emptied of its contents through pressurization without exceeding predetermined maximum and minimum pressure level limits.

A further object of the present invention is to provide such an improved pressurized container which may be economically manufactured and sold commercially at competitive prices. Included herein is such a container which may be employed in connection with various container designs and shapes and also various substances and products to be dispensed from the container.

A still further object is to provide improved bag enclosures that may be employed in a pressurized container to contain either the product to be dispensed or the pressure agent used for expelling the product from the container. Included herein is a provision of novel containers as well as attachment methods and devices for attaching such bag-like enclosures in the containers.

Yet another object is to provide a novel method and ap-

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paratus for charging a container with a propellant used to expel the product from the container upon opening of an outlet valve in the mouth of the container.

A still further object of the present invention is to provide a new method and structure for preventing a propellant containing bag from blocking off the product flow passage in the container leading to the outlet of the container. Included herein is the provision of a novel container outlet which insures that the bag, upon expansion, will not block off flow of the product through the container outlet.

Yet another object of the present invention is to provide improved container construction which not only facilitates charging the container with the product as well as the propellant, but which also insures that an internally included bag which contains the propellant will not block off passage of product through the outlet of the container.

Other objects and the precise nature of the present invention will become evident from the following description and accompanying drawings in which:

FIG. 1 is a vertical sectional view of a pressurized container including an internal bag-like enclosure constructed according to the present invention and showing the container in condition for initial operation;

FIG. 2 is a vertical sectional view of the pressurized container of FIG. 1 except illustrating the valve in open position and the bag-like enclosure partially inflated for dispensing the product;

FIG. 3 is a schematic vertical sectional view of a modified bag construction in the container;

FIG. 4 is a vertical sectional view of another modified bag container construction in the container;

FIG. 5 is a vertical sectional view of yet another modified bag construction in the container;

FIG. 6 is a vertical, sectional view of another embodiment of the invention disclosing a means for attaching a bag-like enclosure containing a propellant to the inner wall portion of a container;

FIG. 7 is a vertical, sectional view of another embodiment of the invention illustrating a different shape for a bag-like enclosure which contains the propellant for discharging the product and also another method of attaching the bag-like enclosure to the container;

FIG. 8 is a vertical, sectional view of a still further embodiment of the invention wherein the bag enclosure which contains the propellant, is free floating in the container and charged with an improved propellant;

FIG. 9 is a vertical sectional view of a still further embodiment of the invention incorporating an internal flow control element for insuring that the propellant-containing bag does not block off flow of the product at the mouth or outlet of the container;

FIG. 10 is a plan view of the internal flow control element included in the embodiment of FIG. 9;

FIGS. 11 through 14, inclusive, are vertical sectional views showing various container constructions and shapes which may be employed in carrying out the invention;

FIG. 15 is a vertical, sectional view of still another embodiment of the invention illustrating a dip tube which leads along the internal wall of the container to the mouth or outlet thereof and wherein the propellant containing bag is attached to the bottom of the container;

FIG. 16 is a cross-sectional view of an outlet attachment or fixture which may be employed in pressurized containers to insure that the propellant containing bag in the container does not seal off the outlet passage of the container;

FIG. 17 is a vertical, sectional view of another container illustrating an internal ridge along the container

for preventing blockage of the product flow paths to the mouth of the container; and

FIGS. 18 and 19 are partial longitudinal cross-sectional views illustrating further modifications of the dispenser shown in FIG. 1.

The illustrative embodiment of FIG. 1 comprises a cylindrical container 10 having a cap or top wall 14 and a bottom wall 12. Cap 14 has a threaded neck 15 with inwardly projecting flanges 17, 29 and a centrally disposed valve seat 18 having an axial bore 20. A cover 21 having a central opening 23 therethrough threadedly engages neck 15. Within bore 20, opening 23, and flanges 17 and 29 is a valve 16 resiliently mounted by means of a spring 24 which cooperates with flanges 17 and 29. Valve 16 has a stem 22 with opening 19 in the lower end thereof. Stem 22 projects upwardly through the bore 20 of the valve seat 18 and is secured to a knob or actuator 28. This knob has a lateral duct 30 and a central duct 32. Lateral duct 30 extends from the outside of the knob 28 to central duct 32 and continues to duct 26 which is in alignment with bore 20. Connected to valve seat 18 of cap 14 is a perforated dip tube 34 that extends into that part of the container which contains the flowable material P to be dispensed. Bore 26 is in communication with tube 34 by means of openings 19 when knob 28 is depressed. Dip tube 34 can be of variable dimensions, shape and also perforated

Pressure for dispensing contents P from the container is achieved through sealed expandable chambers shown as being formed by a pouch or bag-like enclosure 40 received in the container. Bag 40 is made expandable either because of its elastic nature or by unfolding it from a collapsed or deflated condition represented in FIG. 1. Also bag 40 is made of suitable size and shape such that when inflated, it will completely line the interior walls of the container.

Positioned along the side of the container are one or more siphons or conductor tubes 38 which may be of varying dimensions and shapes and also perforated. Tubes 38 prevent the product P from being sealed off due to the receptacle or bag 40 expanding as will be explained hereinafter. The function of the siphons may be accomplished by means of one or more elongated ridges or grooves formed in the internal surface of the container wall to extend between the bottom and top walls of the container to allow the contents to move freely within the container, and insure the flow of the product P to the container outlet, namely valve 16, even though bag 40 is inflated.

In the embodiment of FIG. 1, assuming that a commercial 16 oz. size aerosol type container is used, and that 15% of its capacity is allowed for head-space, and taking into consideration the solubility of the generated gas in the contents of the bag 40, said bag 40 has three partitions, S-1, S-2, and S-3 forming chambers A-1, A-2, A-3 and A-4. In one form of the invention chamber A-1 at the bottom contains: (a) W fl. oz. of water designated in the drawings as W; (b) C gms. of anhydrous citric acid; and (c) a certain amount of gms. of sodium bicarbonate mixed in the water W. By means of a delaying process, these substances are prevented from reacting chemically to generate gas until the container is fully assembled and sealed. Chamber A-2 contains C-2 gms. of sodium bicarbonate, chamber A-3 contains C-3 gms. of sodium bicarbonate, and chamber A-4 contains C-4 gms. of sodium bicarbonate. The product P for example may be salad oil to be discharged at room temperature (about 25° C.).

After the container is fully assembled and sealed, and after the predetermined time for delaying the chemical reaction has elapsed, the chemical reaction in chamber A-1 will start and the generated carbon dioxide gas inflates the bag and forces the product P to be discharged out of the container when the valve 16 is in an open position. When a predetermined amount of product P

has been discharged, there will be sufficient room for chamber A-1 to expand and reach its scheduled expansion of say about 26% of the container capacity. Further when more of product P is discharged and more room becomes available for continued expansion of bag 40, partition S-1 will open or separate, and gas from chamber A-1 will flow into chamber A-2. The chemical reagent in chamber A-2 will become available and reacts with part of the original content of chamber A-1 and produce more gas. The merger of chambers A-1 and A-2 will allow bag 40 to reach its scheduled expansion of say about 46% of the container capacity, when enough of product P is discharged. In FIG. 2 the bag 40 is shown as having been partly expanded and with partition S-1 opened or separated to communicate chamber A-1 with chamber A-2.

In the same manner chamber A-3 which contains C-3 gms. of sodium bicarbonate will merge with chambers A-1 and A-2, partition S-2 will open and this fresh quantity of sodium bicarbonate will react with the excess of citric acid solution from chamber A-1 and produce more gas. Bag 40 will expand further to reach its scheduled expansion of say about 80% of the capacity of the container.

Meanwhile the product P is being discharged progressively out of the container and it follows that chamber A-4 which contains C-4 gms. of sodium bicarbonate will eventually merge with chambers A-1, A-2 and A-3 when partition S-3 is forced open, and this fresh quantity of sodium bicarbonate will react with what is left of the citric acid in the solution and produce more gas. Accordingly, bag 40 will expand to completely occupy the available space inside the container 10 after its contents have been fully discharged.

Partitions S-1, S-2 and S-3 are disrupted one at a time while the bag is progressively expanding, but the sealed sides of the bag remain intact because they are made to support a greater amount of pressure than the partitions. The partitions may be made in various ways to disrupt or open at various predetermined pressures in accordance with a desired objective. Various separable adhesives, heat sealed plastics, or other means may be used in forming the partitions for this purpose. The quantities of chemicals in the container mentioned above will insure a continuous maximum and minimum pressure against the product P (say about 70 to 40 p.s.i.g. in this particular case). The data will vary however, as the temperature varies. The solubility of carbon dioxide gas in water changes according to temperature and pressure and the quantity of solvent present.

The modification of FIG. 3 shows dispenser 10 with a valve 16, a knob 28, and a siphon 38 similar to that shown in FIG. 1. The internal surface at upper portion I of bag 140 is lined with an inert binding agent and within this upper portion of the bag is a mixture of chemical reagents. The other or lower portion O of bag 40 contains the liquid medium. These chemical reagents in the presence of the reaction medium are capable of reacting together and liberating gas. By means of a delaying process, the chemical reagents are prevented from reacting until the package is fully assembled and sealed. In a fully assembled package, gas is generated inside the bag and exerts pressure which facilitates the discharge of the product when the valve is in an open position. The space in the container vacated by the discharged product becomes available to be occupied by the inflating bag. In the inflation process of the bag, its adhering inside surfaces are pushed apart from each other and a fresh quantity of chemical reagent means become exposed and react to produce more gas, with the result that there will always be continued pressure sufficient to facilitate the expulsion of the entire product from the container in a desirable pattern. This in effect is another form of and functions as a multi-chambered bag. It is partitioned by the adherence together of its inner surfaces by means of

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an inert adhesive, heat seal or other suitable means. As in the FIG. 1 embodiment, the size and flexibility of the bag in the FIG. 2 embodiment is such that the bag will completely line the interior wall of the container after the container contents have been completely discharged.

The illustrative embodiment of FIG. 4 shows product P inside bag 40, which discharges its contents into the intake part of valve 16. Valve 16 is connected with the open end of bag 40 in such a manner that it functions as its closure and the product P flows away from the valve when the package is in a resting position. Dip tube 34, which is suitably shaped, dimensioned, and perforated, is connected to the valve seat 18 and extends away from the latter to the opposite end of bag 40. In FIG. 1 embodiment, bore 20 is in communication with dip tube 34 by means of openings 19 when knob 28 is depressed. When full, bag 40 extends in close relation along the internal surface of container 10 with an intermediate peripheral portion of the bag in sealing engagement at B with an intermediate peripheral surface of the container. Thus two separate chambers T and L are formed between bag 40 and the container sidewalls on the opposite sides of the peripheral seal B between the bag and the container. Peripheral seal B may be formed by a suitable adhesive or any other means which is disruptable upon a predetermined pressure. Chamber L in one embodiment may contain specific quantities of water, citric acid, and sodium bicarbonate, which by means of a delaying process are prevented from reacting until the package is fully assembled and sealed. Chamber T may contain a specific quantity of sodium bicarbonate in a suitable form. These substances in chambers T and L are initially sealed off from each other by means of seal B.

After the container is assembled and sealed and at the conclusion of the delaying process, the chemicals in chamber L will react and produce carbon dioxide gas, which presses against bag 40 for dispensing the product P out of the container in a desirable pattern when the valve is opened. Due to the discharge of the product, bag 40, being under pressure collapses inwardly to eventually break or disrupt seal B whereupon chambers T and L communicate and their chemicals react to generate more gas in the container externally of the bag 40 for dispensing. Accordingly, due to the generation of gas in situ, which is maintained inside the container, and the predetermined amounts of the chemical reagents used, there will always be sufficient pressure against the bag to discharge the product out of the container in a desired pattern.

The pressure sensitive inert adhesive B may be replaced by an equivalent sealing means which is rupturable or separable upon a predetermined pressure.

As a modification (not shown) of the embodiment, shown in FIG. 4, the upper wall of the bag 40 may be omitted and the upper end of the bag 40 can be directly connected to cap 14 or to the internal upper end of the container body instead of to the valve assembly as shown in FIG. 4. Although not shown it will be understood that any other suitable valve or closure arrangement may be used in connection with the embodiment of FIG. 4 as well as the other embodiments disclosed herein.

The illustrative embodiment of FIG. 5 shows a novel outlet which may be employed in connection with any of the embodiments described here. A groove 138 of suitable dimensions and shape is formed in the internal surface of the container, replaces siphon 38 shown in the embodiment of FIG. 1 and performs its functions. The container 110 is first filled with the product P such as mayonnaise, except for a head space, and a space to crimp on a bottom 114 which has attached thereto a flexible bag 140 of suitable material, size and shape to be placed inside the container. The product P, in this particular case, flows away from valve 16 when the container is in a resting position. An outer zone O of bag 140 is charged with factor C-1 under a suitable pressure (as for example 50 p.s.i.g.).

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Bag 140 extends as a tube 142 closed at its free end and is suitably attached and fixed at its lower open end between the edges of the container body 110, and those of the container bottom 114. Another suitable method of attachment employed when bag 140 extends as a tube 142 closed at its free end, is to attach the lower opened portions of the bag to the lower internal sidewall of the container body 110. Other suitable means of attachment of the bag to the container are also possible.

Similar to the embodiment of FIG. 3, bag 140 may be disposed in the form of a number of contacting angular folds as shown in FIG. 5, or as an alternative (not shown) the bag may be rolled in coils. Material C which is placed in zone "T" within the fold of the bag together with factor C-1 which is placed in zone "O" may comprise anhydrous citric acid, anhydrous sodium bicarbonate, an inert adhesive, water, and compressed gas. When material C in the zone I is compounded to include for instance an adhesive and the sodium bicarbonate, factor C-1 in the zone O will be composed of the balance of the material mentioned above, namely, citric acid, water and compressed gas. On the other hand if C is compounded with the adhesive, anhydrous sodium bicarbonate and anhydrous citric acid, factor C-1 may be composed of only water and compressed gas. By the same token if material C in zone I is compounded with an inert adhesive, anhydrous sodium bicarbonate, and anhydrous citric acid and water in the outer zone O, factor C-1 may merely be compressed gas which may be introduced into zone O of the bag 140 by any suitable means. By means of a delaying process, the chemical reagents are prevented from reacting until the package is assembled and sealed.

In its initial state represented in FIG. 5, bag 140 is collapsed or folded with its internal surfaces in zone I in bonding engagement. After pressure is generated in zone O and by opening valve 16, a portion of the product is discharged, the space evacuated by the dispensed portion of the product allows bag 140 to expand or inflate starting at zone O and continuing into zone I with the result that a fresh quantity of the chemical reagents will be exposed and react to produce more gas which maintains the pressure in the container at desirable maximum and minimum levels. This generation of gas will provide continued pressure against the product P for discharging it out of the container when the valve is opened. After the entire contents have been discharged from the container, the bag will completely line the interior surface of the container as in the embodiment of FIGS. 1 and 3.

The apparatus in FIG. 5 is additionally useful in that it can be assembled under pressure while introducing factor C-1 into the bag 140 and then closing it by means of seaming the can bottom 114 on the container side walls. In this manner the pressure serves to temporarily maintain the bag collapsed in case it contains some trapped atmospheric air, and also as a temporary closure until the permanent closure 114 is fixed on the container. Introducing factor C-1 into bag 140 can be conveniently done by other means such as forcing it into the bag through a valve or opening (not shown) in the side of the container which can be mechanically plugged afterwards.

Bag 140 may also be constructed with single or multiple chambers. Also and although not shown, valve 16 may be mounted in the container side toward which the product P flows when the container is in a resting position. Bag 140 may terminate suitably in a tube 142 and with its open end attached and fixed between the edges of the container body 110 and those of the container side other than the side in which the valve 16 is mounted. In another modification (not shown), the open end of the bag 140 may be fixed around a valve inlet or around an opening that can be mechanically plugged.

Among the delaying processes which may be employed to delay for a predetermined period of time the chemical reaction such as that of sodium bicarbonate and the citric

acid and an aqueous medium or any other combinations from reacting are:

(1) Coating the surfaces of the chemical reagent with an inert material such as gelatin, shellac or any other substance which is slowly soluble or rupturable in the liquid medium. This process will delay the chemical reaction as long as the chemical reagent means are not in direct contact with each other.

As an alternative, the chemical reagent may be enclosed inside a sealed glass capsule which will break upon increasing or decreasing the internal pressure in the container. When the capsule is broken, the chemical reagent will be liberated and react with its surroundings and produce gas. Another alternative is to enclose the chemical reagent inside a small vial, the neck of which is closed by a suitable open valve attached to a dip tube and plugged with a viscous material such as petrolatum, which flows away upon increasing or decreasing the internal pressure in the container. Upon opening the container outlet, the pressure imbalance in the small vial and the container urges the chemical means to communicate and react with each other and produce gas. A further alternative is to enclose the chemical reagent means inside a small vial plugged with a hard brittle (fragile) material, which breaks upon increasing or decreasing the internal pressure in the container, which condition allows the chemical means to communicate and react with each other and produce gas. In yet another alternative, the delaying means can be a plug which closes the vial. The vial contains the chemical reagent. The plug is removable by means of a magnetic or an electromagnetic force after the container is assembled and sealed.

(2) Adding one or more of the chemical reagent means in a chemically or physically modified form, such as adding the water or the liquid medium in a frozen state. The reaction will be activated at a suitable temperature upon the liquification of the frozen medium.

(3) Dividing chamber A-1 in FIG. 1 into two separate sections by means of a partition similar to S-1. One section, say the bottom section, is to contain chemical means C, namely, water, citric acid and a certain amount of gas or atmospheric air. The upper section of chamber A-1 is to contain chemical means say C-1, namely, sodium bicarbonate in any suitable form such as powder, tablets or solution and its atmospheric air content is purged before it is sealed. The container is further processed and completely assembled and sealed. It is a common practice to leave in the filled containers a head space of some 10 to 15% of their capacity. This space is normally left product-free and solely occupied by atmospheric air or any other gas. When this atmospheric air or gas is purged or sucked out through the valve 16, a considerable drop in the internal pressure of the container will result. The air contained in the lower section of the bag (A-1) will expand and force open the partition separating it from the upper section of chamber A-1. This will bring the sodium bicarbonate which is lodged in the upper section of chamber A-1 together with the citric acid solution lodged in the lower section of chamber A-1, and their reaction will generate gas. The locations of these chemical reagents may suitably be interchanged. Other alternatives are also possible. By initially excluding from the package, the means necessary to bring about the chemical reaction, and introducing it into the package after it is assembled and sealed, gas may thus be generated to force the product out of the container when the valve is opened.

(4) Introducing into the assembled package, some missing factor which can start the chemical reaction which will eventually generate gas. This is explained above in connection with the FIG. 5 embodiment. The factor that starts the chemical reaction introduced into the container is one or an aggregate of the following: chemical reagents, compressed gas or mere compression. In other words this factor can be of a physical or a chemical nature or both.

(5) Assembling a part or the whole package under pressure. Other means for delaying the chemical reaction may be suitably devised to carry out the invention.

From the foregoing description it will be apparent that there has been devised an inexpensive yet efficient pressurized container in which gas is produced in situ and used as a propellant to effect an efficient expulsion of the product from the container.

Moreover, it is evident that the container need not be excessively, as in conventional containers, pressurized to make certain that there will be adequate pressure available for expulsion of the entire product. With the present invention, there is a continuous gas pressure developed due to the fact that as the product is discharged, more carbon dioxide is liberated from the interaction of the acid and bicarbonate which maintains the pressure within predetermined desirable maximum and minimum pressure levels.

Various modifications will be apparent to those skilled in the art. For example, other solids or liquids and other chemicals may be employed if desired. Chemical reagents which react and generate gas other than carbon dioxide, or generate a mixture of gases may also be used in the container to produce pressure. The chemical means used, represented by C or c and C-1 may also include other materials which serve some other useful purposes, such as catalytic agents, surface active agents, anti-freeze, or others. The gas is to be retained inside the container throughout its useful life. In addition, it will be evident to those skilled in the art that other valve and actuator means may be employed to release the product from the container such as shown for example in U.S. Pat. No. 2,671,578.

The bag of the present invention may also be designed to include suitable extensions to facilitate filling it or connecting it. The bag is made of any convenient impervious or non-impervious flexible or stretchable material among which are plastic-like polyethylene and rubber, metallic foils, specially treated fabrics or laminated multifold materials. Multiple bags may conveniently be used in a container in order to fulfill specific aims. In all forms of variations of these apparatuses formations involving the bag, the modifications are those: that the bag is constructed of a single or multiple chamber (compartments), and when fully inflated and unobstructed, it displaces the product and occupies almost all the available space in the container. It will be evident to those skilled in the art that the outer container may be of suitable flexible or non-flexible materials such as glass, plastic, metal, cardboard, insulating materials and others or a combination of materials. The container may also be of various shapes and sizes.

It will also be evident to those skilled in the art that the generation of gas or pressure may be accomplished by means other than the chemical reactions described above.

Referring now to FIGS. 18 and 19, there is shown two different modifications of the dispenser shown in FIG. 1 which modifications employ flexible bag-like enclosures located one within the other to define three pressure generating chambers A-1, A-2 and A-3. These chambers may be charged with the same pressure generating substances, such as C, C-1 and C-2 and W, described above. Upon the sequential generation of a sufficient pressure differential across the walls of these enclosures, the latter will sequentially open along seals X-1, X-2 and X-3. In the FIG. 18 modification, the bag-like enclosures may be considered to be free floating whereas in the FIG. 19 modification, one wall of each of the chambers is formed by the side wall 10' of the container itself.

Referring now to FIG. 6, there is illustrated another embodiment of the present invention including a cylindrical container sidewall 200, a bottom wall 202 whose peripheral edges 203 are crimped over into sealing engagement with the lower portions of the cylindrical sidewall, and a top wall 204 similarly connected to the sidewall 200. An outlet 205 is provided in the top wall to re-

ceive a suitable valve (not shown). In the container is a flexible bag-like enclosure 206 having an open end 207 which is secured to the sidewall by means of a clip 208 or any other suitable device. The closed end 209 of the bag is on the side of the clip leading towards outlet 205 of the container.

To facilitate the flow to and communication of the product with outlet 205 of the container, a siphon 210 or dip tube 212 attached to the intake of the valve is provided along the internal side wall of the container, the upper ends of which lead into outlet 205 of the container. Both siphon 210 and dip tube 212 are open at opposite ends and also are perforated along their lengths, as shown in the drawings. The container is loaded and the product is placed in the space between the outlet 205 and the bag 206. A suitable valve (not shown) is fixed on outlet 205. A suitable propellant means is introduced in the space between the container bottom 202 and the bag 206 through aperture 214 in bottom wall 202, which aperture is thereafter plugged with a suitable closure 216. Said pressure means presses against the product and discharges it thereof when the valve is in an open position.

FIG. 7 shows another embodiment of the invention similar to FIG. 6. However, in the present embodiment, the bag 220 has a narrow open neck portion 222 which is attached to the bottom wall 224 of the container rather than to the side wall as in the FIG. 6 embodiment. Bag 220 is charged through a passage 226 in the bottom wall which directly communicates with the neck 222 of the bag and which is suitably plugged by a closure 228 after the bag is charged with the propellant means.

Referring now to FIG. 8, there is illustrated another embodiment of the invention incorporating a free floating bag 230 for containing the propellant means. The cylindrical sidewall, top and bottom walls of the container may be the same as those described in the FIGS. 6 and 7 embodiments. However, in the present embodiment, bag 230 is not attached to any portion of the container but rather is free to move in all directions. In accordance with another novel aspect of the present invention, bag 230 is filled with a propellant having a boiling point of under 0° Fahrenheit. Bag 230 is charged with this propellant prior to inserting the bag in the container. After the bag is chilled below 0° F. and inserted into the container, the top and bottom walls of the container are sealed on, and when the valve (not shown) in the outlet 212 is open under normal temperature and pressure, the propellant will exert enough pressure on the product to cause it to be discharged in a desirable manner through the outlet of the container.

In FIGS. 9 and 10, another embodiment of the invention is illustrated including a container having a cylindrical sidewall 240, top and bottom walls 242 and 243 sealed into engagement with the opposite ends of the cylindrical sidewall to define the external container. A propellant means contained in bag 244 is secured in the container with its mouth portion clamped between the sealed portions 246 of the bottom wall and the sidewall of the container. Bag 244 may be charged in any suitable manner with propellant means; for example, one such manner being described in connection with the FIG. 6 embodiment or with a suitable compressed gas of single or multiple ingredients. In addition, a dip tube or siphon 245 may be employed in this embodiment as with the other embodiments described above.

In accordance with another novel aspect of the present invention, a flow control element 250 is provided in the container between the propellant bag 244 and the outlet 252 of the container to insure that the propellant bag does not block off flow of product P at the outlet of the container upon expansion of the bag. Flow control element 250 has a generally annular shape defining a central passage 254 and with radial flow passages 256 leading from the external surface of element 250 into central space 254. Additionally, and although not shown, flow control

element 250 may have suitable radial ridges formed at circumferentially spaced locations on the top and bottom surface portions thereof to further facilitate flow of the product. In certain embodiments, the flow control element may be free floating within the container; while in other embodiments, it may be positively secured to the container. It will be seen that not only does flow control element 250 prevent blockage of outlet 252 by the bag while facilitating the flow of product through the container, but also the flow control element prevents the bag from engaging any sharp edges which might appear on internal surface portions of the container.

FIGS. 11, 12, 13 and 14 illustrate various container shapes and constructions which may be employed in carrying out the various aspects of the present invention. The containers shown in FIGS. 11 and 12 are formed with top and bottom walls or panels 260, 262 which may be concave or convex and seamed to the opposite ends of sidewalls 264, 265. In FIG. 11 embodiment, sidewall 264 has a cylindrical shape whereas in FIG. 12 embodiment, sidewall 265 has a concave longitudinal-section, as illustrated.

In the embodiment shown in FIG. 13, top portions 270 and bottom portions 271 of the container are integral with sidewalls 272 of the container and moreover the top wall portion 270 merges into the outlet 275 of the container. The bottom portions of the sidewall 272 are crimped and bent inwardly so as to in effect form the bottom wall 271. In another embodiment (not shown) the bottom 271 may be bulging to the outside in a convex form. In FIG. 14 embodiment, the container has a generally barrel shaped configuration as illustrated.

The embodiment disclosed in FIG. 15 may have a container and bag-like arrangement similar to that shown in FIG. 9, for example, as well as any other disclosed herein. However, in accordance with another aspect of the present invention, the dip tube 280 extends from the bottom wall 282 of the container to the top wall 283 and moreover is inserted to the outlet 284 of the container.

Referring now to FIG. 16, there is illustrated a novel outlet 300 which may be employed in connection with any of the embodiments described above. This outlet 300 may be formed as a separate fixture or attachment which may be attached to the container side wall, or may be formed as an integral part of the top of the container by forming ridges across its interior surface extending from the periphery towards the center of the container top. Outlet 300 may include a rigid body having an outlet passage 301 through which the product flows from the container and an internal chamber formed by a hollow portion of the body below the outlet. In the internal wall surfaces of the body are formed a plurality of ridges 302 which lead to the outlet of the container for providing passages in which the product may flow to the outlet of the container. When the outlet attachment is secured in a container and for example an associated propellant bag expands into engagement with the inner surface 205 of the outlet, ridges 300 will still provide open flow passages allowing the product to be discharged from outlet aperture 301. Although the specific embodiment disclosed in FIG. 16 employs ridges, it will be apparent that in other modifications, passages may be formed by drilling through the outlet body or by any other suitable arrangement which will provide the desired open flow passages to the outlet.

In the FIG. 17 embodiment, the sidewalls 310 of the container are formed with one or more longitudinally extending ridges 312 which provide flow passages through which the product may reach the outlet 314 of the container from any point along the interior surface of a container. In this way, when the associated propellant bag (not shown) expands upon release of the outlet valve (not shown) ridges 312 will still provide open flow passages even though the bag is expanded against other portions of the interior surface of the sidewall 310 of the container.

While certain illustrative embodiments of the invention have been described with particularity, it will be understood that various other modifications will be readily apparent to those skilled in the art without departing from the scope and spirit of the invention. Accordingly, it is not intended that the scope of the claims appended hereto be limited to the description set forth herein but rather that the claims be construed as encompassing all equivalents of the present invention which are apparent to those skilled in the art to which the invention pertains.

What is claimed is:

1. In a container or the like having a product to be dispensed therefrom and an outlet and closure means through which the product is dispensed; means for forcing the product through the outlet means for dispensing comprising in combination, means in the container defining first and second chambers in the container, means in said first chamber for generating pressure in said first chamber, means in said second chamber for generating pressure in said second chamber when said chambers are in communication with each other, said means defining said first and second chambers including a positive disruptable seal means separating said first and second chambers and being disruptable upon generation of pressure in said first chamber for creating a sufficient pressure differential between the interior and exterior of the first chamber to place both of said chambers in communication with each other to cause a further and sequential generation of pressure in said second chamber.

2. The combination defined in claim 1 wherein said means for generating pressure in said first and second chambers includes chemical substances and wherein the pressure generated is derived from gas generated by the reaction of the chemical substances.

3. The combination defined in claim 1 further including a delaying means for delaying the generation of pressure in said one chamber until after the container is assembled and sealed.

4. In a container or the like having a flowable product to be dispensed and an outlet and closure means through which the product is dispensed; means for forcing the product through the outlet means for dispensing comprising in combination, means defining first and second chambers, means for generating pressure in said first and second chambers, and means for sequentially causing the generation of pressures in said chambers, said one chamber is formed by a flexible bag located inside the second chamber, said second chamber being formed by a larger flexible bag.

5. The combination defined in claim 4 wherein the bags are arranged such that the larger chamber shares a part of its walls with the smaller chamber.

6. In a container having a flowable product to be dispensed and an outlet and closure means through which the product is dispensed; means for forcing the product through the outlet for dispensing comprising in combination, a sealed bag located in the container, rupturable partition means in the bag dividing the bag into a number of compartments, first chemical means in one of said compartments for generating gas for increasing the pressure in said one compartment to inflate said one compartment for forcing a portion of the contents out of the container through the outlet when open, second chemical means located in the other compartment for reacting with a portion of the chemical means in said first compartment to further generate gas and pressure when these adjacent compartments are placed into communication with each other, said partition means being rupturable under sufficient pressure in said first compartment to place the said compartments in communication with each other to further generate gas pressure in the second compartment for dispensing the contents.

7. The combination described in claim 6 wherein said partition means includes at least two spaced partitions dividing the bag into at least three overlying compart-

ments, one of the compartments having chemical means for generating gas to increase the pressure in the said compartment to move radially outwardly the walls of the bag defining the said one compartment upon opening the closure means and dispensing of a portion of the product, said partition means being such as to rupture and consequently place adjacent compartments into communication with each other when the portion of the bag defining the compartments are moved radially outwardly, other adjacent compartments containing second chemical means for generating gas upon contact with the chemical means in the said one compartment such that when the said remaining compartments are brought into successive communication with the said one compartment a gas will continue to be generated in a successive manner corresponding to the communication with the remaining compartments and the pressure replenished in said bag for the continued application of pressure against the product for dispensing, said partition means being of weaker bonding than the bag and therefore rupture under a lower pressure than that required to rupture the bag.

8. The combination defined in claim 6 wherein the pressure of the product in the container around the bag and the pressure generated by the chemical substances in said first compartment are such that upon opening of the closure means of the container and discharging the product therethrough, the wall portion of the bag defining the first compartment will expand outwardly with such a force as to rupture the partition means to thereby place the first and second compartments into communication with each other and allow the chemicals therein to react and generate gas, said partition means being weaker therefore rupturable under a lower pressure than the bag.

9. The combination defined in claim 8 wherein the second compartment has opposite internal wall portions in sealing interengagement and being separable upon sufficient exertion of pressure in said first compartment to expose a portion at a time of the said second chemical means to a portion of the first chemical means to further generate gas pressure for dispensing the contents.

10. In a container having a flowable product to be dispensed and an outlet and closure means through which the product is dispensed; means for forcing the product through the outlet for dispensing comprising in combination, a sealed bag located in the container and containing the flowable product to be dispensed, outlet means in the bag communicable with the outlet and closure means of the container for dispensing contents, disruptable sealing means urging an intermediate outer wall portion of the bag into engagement with the surrounding wall of the container to define first and second chambers in the container outside of the bag on opposite sides of said sealing means, respectively, gas generating means in one of said chambers for generating a gas to increase the pressure in the container for depressing the bag to dispense the product from the bag when the closure means of the container is open, and means in the other chamber reactable with the gas generating means in said first chamber to further generate gas and replenish the pressure in the container, said first and second chambers being placed in communication to further generate gas when the pressure in the container is sufficient to disrupt said sealing means.

11. The combination defined in claim 10 wherein said sealing means includes an inert adhesive contacting the outer peripheral wall portion of the bag and the corresponding inner wall portion of the container.

12. In a container having a flowable product to be dispensed through an outlet opening in the container controlled by a cap or closure, the method of continuously generating gas pressure for purposes of dispensing the product from the container, including the steps of producing a chemical reaction in one sealed compartment and a corresponding increase in pressure in the container for dispensing a portion of the product and also

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for rupturing a closure of a second compartment in the container to communicate both compartments for causing a chemical reaction in said second compartment between the chemical substances in both of said compartments to further generate gas in the container for dispensing the product, the closure seal of a second compartment being of weaker bonding than seals defining the bag and therefore rupture under a lower pressure than that required to rupture the bag.

13. The combinations defined in claim 12 further including the step of delaying the pressure and gas generating reaction in said one compartment for a predetermined period of time long enough to completely assemble and seal the container.

14. The method defined in claim 13 wherein the means of the delaying of the chemical reaction is accomplished by excluding from the package means necessary to bring about the gas generating reaction of the chemical means and introducing it into the package after it is assembled and sealed.

15. The method defined in claim 13 wherein the means of liberating the chemical reaction is initially inserted in the container during assembly and is removed later by introducing pressure into the container after it is assembled and sealed.

16. The method defined in claim 13 further including the step of employing chemical reagent means for producing the chemical reaction which liberates gas for generating pressure for the discharging of the product, and wherein the step of delaying the chemical reaction includes employing a chemical reagent which has an inert coating that after a suitable predetermined time dissociates from the chemical substances present in the surroundings to produce the said gas after the container is assembled and sealed.

17. The method defined in claim 13 further including the step of employing a chemical reagent for producing the chemical reaction with other substances for liberating gas and providing pressure for expelling the product from the container, and wherein the step of delaying the chemical reaction includes sealing the chemical reagent within a suitable thin glass ampule, and producing a pressure disturbance inside the container which is enough to rupture said glass ampule and thereby expose the chemical reagent for producing the chemical reaction.

18. The method defined in claim 13 further including the step of employing a chemical reagent for producing a chemical reaction with other chemical means for liberating gas and thereby providing pressure for expelling the product, and wherein the method of delaying the chemical reaction includes the step of housing the chemical reagent in a small container having an outlet including a plug closing said small container, and causing removal of the plug in the small container after the container is assembled thereby exposing the chemical reagent for producing the chemical reaction.

19. The method defined in claim 13 including the step of employing chemical reagent means and a liquid medium for producing the chemical reaction for liberating gas providing pressure for expelling the product, and wherein the method of delaying the chemical reaction includes the temporary changing of the physical state of the liquid medium, after the container is assembled and sealed, said medium changes to a liquid physical state and allows the chemical reaction to proceed.

20. The method defined in claim 13 including the step of employing chemical reagent means and a liquid medium for producing the chemical reaction for liberating gas providing pressure for expelling the product, and wherein the method of delaying the chemical reaction includes the temporary changing of the chemical state of said liquid medium after the container is assembled and sealed to allow the chemical reaction to proceed.

21. The method defined in claim 13 wherein the chemical reaction in one sealed compartment is delayed by par-

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tioning said one sealed compartment into at least two subcompartments, placing chemical reagent means in each of said subcompartments and with one of the said compartments being suitably inflated under at least one atmospheric pressure and purging the air out of the other subcompartment, relieving the pressure in the container externally of said one compartment to produce at least a partial vacuum externally of said one compartment whereby the pressure in said subcompartment will rupture the subpartition therebetween and allow the chemical reagents to react with each other to produce the chemical reaction for liberating a gas and producing the pressure for expelling the product.

22. In a container or the like having a flowable product to be dispensed and an outlet and closure means through which the product is dispensed; means for forcing the product through the outlet means for dispensing comprising in combination, means defining first and second chambers, means for generating pressure in said first and second chambers, and means for sequentially causing the generation of pressures in said chambers, said means for generating pressure in one compartment includes water, citric acid, sodium bicarbonate and wherein the means for generating pressure in the other compartment includes sodium bicarbonate for reacting with the excess of citric acid present in the said one compartment, and there is further included in the said one compartment a delaying agent preventing the chemical reagents in the said one compartment from reacting to generate the gas and pressure until a predetermined time has elapsed after the container has been completely assembled and sealed.

23. In a container or the like having a flowable product to be dispensed and an outlet and closure means through which the product is dispensed; means for forcing the product through the outlet means for dispensing comprising in combination, means defining first and second chambers, means for generating pressure in said first and second chambers, and means for sequentially causing the generation of pressures in said chambers, said means defining said first and second chambers includes a bag-like enclosure and a partition in said enclosure separating it into the said chambers, and wherein the product to be dispensed is located in the container about the enclosure.

24. In a container or the like having a flowable product to be dispensed and an outlet and closure means through which the product is dispensed; means for forcing the product through the outlet means for dispensing comprising in combination, means defining first and second chambers, means for generating pressure in said first and second chambers, and means for sequentially causing the generation of pressures in said chambers, said means defining the first and second chambers includes a bag-like enclosure and means placing part of the peripheral surface of the bag-like enclosure in sealing engagement with the inside wall surface of the container intermediate opposite ends of the container to define said chambers externally of the bag-like enclosure on opposite sides of said sealing means, the product to be dispensed being located within the bag-like enclosure and wherein there is further provided an outlet means in the bag communicable with the outlet and closure means of the container for dispensing contents, a perforated dip tube extending from the outlet means of the container inside the bag, respectively, gas generating means in one of said chambers for generating a gas to increase the pressure in the container for depressing the bag to dispense the product from the bag, when the closure means of the container is open, and means in the other chamber reactable with the gas generating means in said first chamber to further generate gas and replenish the pressure in the container, said first and second chambers being placed in communication to further generate gas when the pressure on the bag-like enclosure is sufficient to disrupt said sealing engagement.

25. A portable pressurized container defining a chamber for receiving a product to be dispensed from the con-

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tainer, an outlet in a wall portion thereof for dispensing the product from the container, closure means in the outlet for opening and closing the outlet, a flexible expandable bag-like enclosure located in the container and having a propellant therein for expanding the bag to force the product out of the container through the space between the container wall and the bag-like enclosure and then through the outlet of the container, flow control means ensuring passage of the product in the space between the container wall and bag-like enclosure and out through the outlet for dispensing regardless of the position of the container and expansion of the bag against wall portions thereof including means defining an elongated passage extending along the internal wall portion of the container between opposite end portions thereof and externally of the bag-like enclosure, said elongated passage communicating with said space between the container wall and the bag-like enclosure at several points along the container between said opposite end portions thereof, and a flow control element located in the container between the bag-like enclosure and the outlet adjacent to but externally of the outlet and having means forming a plurality of radial passages for carrying the product to the outlet for dispensing, said flow control element also serving as a barrier preventing expansion of the bag-like enclosure into the outlet as well as against portions of the container walls adjacent the outlet to thereby maintain constant communication between the space between the bag-like enclosure and the container wall and the outlet of the container.

26. The container defined in claim 25 wherein the outlet is in the top wall of the container, said container having a bottom wall opposite the top wall and side walls extending therebetween, said bag-like enclosure having an upper closed end facing said top wall and having an open lower end facing the bottom wall with portions of the open lower end fixed to the container, inlet means in the bottom wall for introducing pressure into the bag-like enclosure, and enclosure means in said inlet means in the bottom wall

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for closing said inlet means in the bottom wall after pressure is introduced into the bag-like enclosure.

27. The container defined in claim 25 wherein said flow control element includes radially extending ridges forming flow passages for the product.

28. The container defined in claim 25 wherein said flow control element has an annular shape defining a central aperture in the center thereof and wherein the said flow passages communicate with the central aperture in the flow control element.

29. The container defined in claim 25 wherein said flow control element is an integral part of the container top and includes ridge forming cavities extending across the interior surface of the container top from the periphery towards the center of the container top where the container outlet is located.

30. The combination defined in claim 16 including the step wherein said first chamber is the coating around the chemical reagent.

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