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B-1853 Strombeek-Bever (BE)**EP 0 666 222 A1**(54) **Air tight containers, able to be reversibly and gradually pressurized, and assembly thereof.**

(57) The present invention relates to air tight containers, which can be pressurized above the relevant ambient pressure reversibly and gradually and maintain the pressure built up inside in an assembly. By providing said containers with an internal pressure above the relevant ambient pressure, the damage resistance and the stackability of the corresponding packaging assembly are substantially improved. This allows significant savings on material usage of said containers and consequently on the whole packaging assembly. The present invention relates also to possible ways to pressurize these air tight containers in an assembly, from mechanical deformation of the external walls of said containers to a pumping effect during capping of said containers.

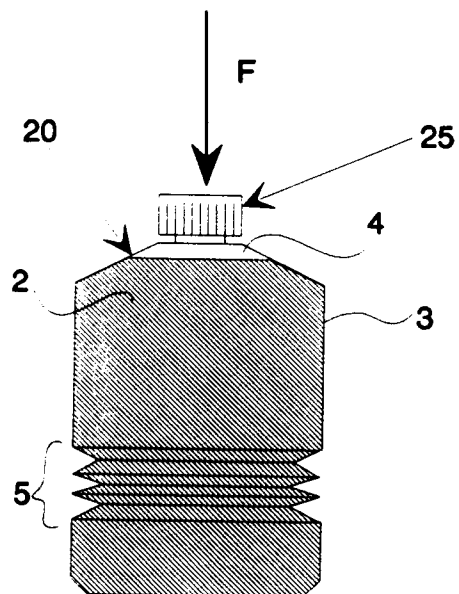


Fig 1 b)

Field of the invention

The present invention relates to air tight containers, which can be pressurized reversibly and gradually in an assembly and maintain the pressure built up inside them during stacking. The present invention relates also to possible ways to pressurize these air tight containers in an assembly, such as mechanical deformation of the external walls of said container, or pumping effect during capping. These air tight containers are deformable in a completely reversible and gradual manner and are suitable to contain any type of liquid (or granular) substance.

Background of the invention

In general, containers are preferably made of plastic, since plastic is a material with low manufacture cost and it can contain a great variety of substances without being jeopardized. In order to further reduce the cost in material required for the manufacture and the cost related to the disposal of said containers, the manufacturing industries tend to reduce as much as possible the weight of these containers. However, the amount of manufacturing material needed for said containers depends on other requirements.

One such important requirement, is stability in all usage situations. The principal usage situations can be encountered in the manufacturing, where the container is assembled and filled, during the storage and distribution steps (including transport and store handling), and finally during use of the product. Out of these situations, the storage and distribution conditions pose the highest requirements on containers or assemblies thereof. In particular sufficient stackability is critical in depot storage and truck transport.

Typically it is the packaging material of the containers, that has to support the weight of a stacked assembly. That is the reason, why most of the foods and household chemical industry uses containers made of a packaging material strong enough to resist common stackability conditions, such as High Density PolyEthylene (HDPE).

This problem can be bypassed, if the contained substance vaporizes a gas pressurizing the inside of the container; an example is carbonated liquids. This internal pressure helps to support the thin walls of a can, typically made from steel, aluminum or aluminum alloys, against compression and damage.

The UK Patent Application GB-A-2 124 597 teaches how to pressurize internally a lightweight can for still liquids, which do not release from themselves any vaporized gas. The principal disadvantage of these methods described in said prior art consists in the sudden and instant release of the pressure at the opening of the container, since in particular situations the internal pressure is sufficiently increased to spill out the contained substance. It would be then more desirable to have the possibility to unpressurize completely or partly the container before its opening, in order to reduce possible losses of the contained substances.

Another disadvantage of one of the methods described in the UK Patent mentioned above, resides in the fact that a special equipment is necessary in order to inject the gas, not interacting with the contained substance and which pressurizes the inside of the container prior to the sealing of said container. In this way it is more difficult to achieve a substantial reduction of the manufacturing costs.

From U.S. Patent 4 146 154 a dispenser for liquids is known to convey the contained liquid to a dispensing member by collapsing the corrugated side walls of the container through a force exercised from the top of said container. U.S. Patent 4 122 980 discloses the appropriate stopper to said dispensing device. This stopper prevents evaporation of the contents of the container or the entrance of foreign matter into the container during shipment and storage. The stopper has to be broken away along a line of weakness before the use.

It is more desirable to have a closure of a container strong enough to maintain a sufficient pressure built up in the inside of the container during the stacking of an assembly of said containers. These pressures are relatively high, considering that the weight, which compresses on the lowest part of the stacked assembly during shipping and/or storage, can be up to 150 kg. The value of the corresponding pressure built up inside the containers is about 0.3 bar above the relevant ambient pressure, but this pressure value is strongly dependent on several other parameters, which will be explained further on. The collapsible container disclosed above is not developed for the purposes of the present invention, since it serves only for as a dispensing container.

It is also more desirable to have the possibility to reuse these containers with the corresponding detachable air tight cap, allowing the manufacturer to refill several times said air tight containers, achieving in this way a consistent material saving together with the possibility to produce the air tight containers with lightweight material.

It is an object of the present invention to improve the stacking capability of lightweight containers. This purpose is achieved by building up an internal pressure in said air tight closed containers. In the present invention said internal pressure is built up in a reversible and gradual manner using the stacking constraints themselves. Once these constraints are removed, said pressure disappears again before the container is opened.

It is yet another independent object of the present invention to provide an assembly of said air tight containers, suitable for stacking and pressurize internally the containers.

Brief description of the figures

In the following "vertical" means a direction defined by the perpendicular axis in respect to the supporting basis of the container, when it is in its standing position. "Horizontal" defines the direction of said supporting basis.

Figure 1a) shows a preferred execution of the air tight container, in which the pressure is built up through a vertical mechanical deformation of the air tight container (Figure 1b)) closed by an air tight cap, as illustrated in more detail in Figure 2.

Figure 3 to 6 show possible modifications of the deformable wall, which allow a vertical mechanical deformation of the air tight container.

Figure 7 illustrates an embodiment of the present invention with the possibility of an horizontal deformation of the wall.

Figure 8 shows a possibility to modify the corrugated wall, in order to combine the horizontal with the vertical deformation of the container.

Figures 9a) and 10a) schematically illustate another modification of the corrugated wall, allowing a twisted deformation of the container, shown respectively in Figures 9b) and 10b).

Figures 11a) and 12a) show possible modifications of the air tight cap able to build up an internal pressure in the container during capping, schematically illustrated in Figures 11b) and 12b), through pump effect

Figure 13 shows a preferred execution of the packaging assembly with a plastic shrink film applicable to all described air tight containers and suitable for stacking in an assembly. Said assembly is illustrated in Figure 14.

Summary of the invention

According to the invention there is provided an assembly of several deformable air tight containers, which are able to be pressurized above the relevant ambient pressure in a reversible and gradual manner and to maintain said built-up pressure. Said pressure inside said air tight containers is built-up through the stacking constraints of said assembly.

Detailed description of the invention

The material of the air tight containers according to the present invention have not the necessary resistance to support the weight in normal stacking conditions during shipping and/or storing. These containers would start bulging and possibly even break when a top load is applied on them. Such containers are well known in the art and are typically made of plastic, but even other materials, such as paper, cardboard, laminate material, metal, aluminum or aluminum alloys, are possible.

An essential characteristic of the air tight containers for the present invention consists in a neck or aperture, closed by an air tight cap. The air tight cap can be made of any material. The way to apply the air tight cap on or in the lightweight container's neck or aperture are multiple and various, the appropriate way can be chosen by any person skilled in the art. The present invention poses no limit to any air tight closure system.

In some cases, for example for plastic bottles in trial size, the plastic containers are blow-molded and filled simultaneously with the desired material, so that the top of these containers can be sealed together immediately after the filling in the same blow-molding process. The present invention is applicable also for this type of containers, although the removable cap represents the preferred embodiment of the present invention.

The present invention solves the problem of giving an additional support to containers, which normally do not resist the necessary top load during stacking, with the only assumption that this container is closed in an air tight manner. The problem is solved by building up an internal pressure inside the air tight

containers in a reversible and gradual manner, using a pre-defined deformation pattern for the containers. As the container is deformed, its internal volume diminishes and the internal pressure builds up.

Reversible in this context means, that the pressure built up inside the air tight container disappears before the air tight container is opened, bypassing the problem of the sudden release of the vaporized gas from the container once it is opened. Gradual in this context means, that the pressure inside the air tight container is built up as a function, for example, of the weight of the stacking. The possible ways to build up reversibly the necessary pressure inside the air tight container can be classified in two independent, but combinable methods.

The first method consists in building up the pressure through a reversible and gradual mechanical deformation of the wall of the air tight container. The necessary feature of the wall to achieve the claimed reversibility and graduality is a corrugation of the wall of the container. The possible corrugation forms of the wall of the container are multiple and various, as will be described later on in the Examples. The way in which this pressure is used in said container can be further differentiated, depending from the specific features of said corrugation.

In particular, if the corrugation of the wall allows reversible and gradual deformation, which is not in a parallel direction of the force induced by the weight of the stacking, said weight of the stacking is supported only by the wall of the container. The deformation has to create the sufficient pressure, which strengthens the resistance of the walls, allowing the container to resist to the top load from the stacking. This means that the pressure built up in this manner does not support directly the weight. On the contrary, the pressure is the source of a direct supporting force, if the corrugation of the wall allows a reversible and gradual deformation in a parallel direction to the force induced by the weight of the stacking. The further deformation of the container through the applied weight in this latter case is hindered by the pressure itself, and not by the walls, which are strengthened only as a side effect.

The second method of pressurizing an air tight container is to reduce the head space during capping through a pumping effect. The air tight cap requested comprises a transition piece, which creates a volume that is pushed in the neck or aperture of the container compressing the air inside. Since the pressure is built up without an accompanying deformation of the wall of the container, the pressure helps only to strengthen said walls, as explained before.

Furthermore, the second method is only gradual in the sense that the necessary pressure inside the air tight container has to be predetermined by the amount of volume pushed inside the container in the relation to weight that has to be loaded upon, i.e. it does not adjust itself to changing conditions, like the first method automatically does. Furthermore, this second method has shown not to be as efficient to reach a sufficient high pressure inside the air tight container as the first method, because large volumes are needed to be pushed inside the container before the necessary pressure inside the air tight container is reached. Therefore this latter method can be used only in combination with the first method described above to obtain a sufficient reversible and gradual pressurization of an air tight container.

Said second method has the advantage of eliminating the large head space volume that exists when a screw on dosing cap is used. This benefit of reducing the head space volume is very useful to improve the pressurization through the mechanical deformation method, since, as it will be shown, less mechanical deformation of the air tight container will be needed to reach high pressures, as the head space volume will be reduced.

Experiments have been carried out to check the feasibility of these methods. In particular, the Table I illustrates the top load compression that can be achieved with different amounts of head space volumes as a function of the amount of the mechanical deformation, with the example of a 0.075 m high, 0.01 kg weighted and 0.07 l volumed container, which presents a pre-defined deformation pattern on the side wall, similar to the one shown in Figure 1a). These compressions are created with the help of a compression tester, equipped with a load cell/displacement registration to indicate the force displacement curve, summarized in Table I. Said compressions are in the parallel direction of said deformation pattern, this means, as explained before, that it is directly the built up pressure through the deformation, which supports said compression.

TABLE I

Deformation (cm)	Compression strength (N) at different head space volumes						
	uncapped	100%	48%	33%	19%	11%	3.70%
0.25	15	20	20	25	40	40	60
0.5	30	40	45	55	75	90	125
0.75	45	55	65	80	110	135	180
1	60	60	85	110	150	190	230
1.25			95	135	200	225	

The results of this experiment show that with a higher filling level of a liquid (the head space is smaller) the pressure inside the air tight container is built up with less deformation of the container (note that the liquid is an almost incompressible substance). With a large head space a larger deformation is needed to achieve the same pressure inside the air tight container. This experiment shows the possibility to reduce the forced mechanical deformation of the air tight container by reducing the volume of the gaseous head space. It is recommended to minimize this head space volume, as much as possible, in order to optimize the performance of the present invention.

If we compare now the compression strength achieved by a deformable bottle in respect to a regular one, which has no deformable pattern on the wall, we get the values of Table II. Any further increase of the compression strength led to an irreversible deformation of said bottles.

Table II

d (mm)	F(N)	
	Bottle A	Bottle B
0	0	0
3	231	162
6	381	387
9	434	609
12		802
Bottle A: regular 46g bottle Bottle B: Corrugated side wall, 43g (no irreversible damage)		

This Table also shows, that greater strength values are possible to achieve in respect to Table I. This is possible in two combinable ways. A greater amount of volume can be compressed, if the deformation pattern allows a greater deformation length, for example by having more than three grooves, which form the deformation pattern of the container. Another possibility is to increase the area of the cross section in a horizontal plane of the deformable part of the container, since less deformation is needed to compress the same amount of volume. The horizontal plane is defined to be a parallel plane to the base supporting a container in its standing position.

Another example to simulate the compression possibilities of a regular air tight container (not deformable) is summarized in Table III. A 750 ml cubical lightweight container (27 g) was put under pressure via a hole in the wall of the container. In this manner the pressure has only the strengthening effect on said wall. The compression strength needed to obtain always the same mechanical deformation of the container (4 mm of deformation are commonly allowed at most, before any risk of an irreversible deformation of the wall itself) has been measured for different internal pressure values.

TABLE III

Pressure [mBar]	Force [N] to achieve 4 mm deformation of the container
0	90
100	120
200	200
300	350

The conclusion is, that in pressurizing internally an air tight container, this container becomes more resistant to top load, consequently lightweight packaging material is more attractive even for stacked containers. The present invention, furthermore, uses the stacking constraints to create pressure inside the container, and this precisely resolves the issues associated with stacking.

Typically the substances that can be contained in the containers of the present invention are all substances that do not vapourize a gas at all or sufficiently enough to pressurize internally the container. In particular it can be used in food products, such as fruit juices, or even household products, such as liquid detergent, household cleaners and softeners. In principle, even granular substances, such as detergents, can be contained in the same containers, but the mechanical deformations needed to achieve the necessary internal pressure, as explained above with the help of Table I, have to be clearly greater, since a volume of a granular substance inherently contains a high air volume, or in other words a great head space volume.

The following descriptions of the air tight containers suitable to build up the necessary pressure inside the said containers and to hold this pressure during, for example, normal stacking conditions, has to be only seen as examples of all the other specific possibilities to transform the mechanical deformation of the container or the pump effect during capping into a sufficient internal pressure. Any person skilled in the art can vary and modify the present invention for any specific needs.

The assemblies, called pallet stacks, of the present invention are formed by stacking grouped air tight containers, commonly called shipping unit. A shipping unit of air tight containers, each of which represents the so-called consumer unit, is constituted by several of said containers and held tightly together by a bundling material, such as plastic shrink films, or by straps or simply in boxes made of corrugated board. All these tightening means are also very helpful to build-up the pressure of some embodiment of the present invention, as will be described in the following Examples. The plastic shrink film and the boxes have the further advantage, that they protect the container from dust and dirt, which accumulates during shipping and/or storage.

EXAMPLE I

Figure 1a) illustrates a container (20) closed by an air tight cap (25) with a corrugated side wall (5), a contained material (2) and a gaseous head space (4). The corrugated side wall (5) is mechanically deformable in a reversible and gradual manner in the vertical direction, that means that exerting a vertical force **F**, as schematically shown in Figure 1b), from the top of the container (20) downwards, the disposable volume for the contained material (2) and the gaseous head space (4) inside said container (20) is reduced through the effect of collapsing the side wall (5). The pressure built up in this manner is held by the air tight cap (25) and said pressure is the source of the force, which counteracts directly on force **F**. As a side effect, also the side wall (5) is strengthened by part of said pressure.

For purpose of illustration, the side wall (3) has three annular V-shaped grooves (6), (7) and (8) and formed therein to present a pre-formed corrugation pattern (5) having beveled annular surfaces (10) and (11), which converge with respective beveled annular surfaces (9) and (12) at respective annular boundaries (15) and (16) at the inner extremities of notches (6) and (7). Similarly, the beveled surfaces (12) and (13) converge with respective beveled annular surfaces (11) and (14) at respective annular boundaries (16) and (17) at the inner extremities of notches (7) and (8). In essence, therefore, surfaces (9), (10), (11), (12), (13) and (14), are conical and annular in configuration. Thus, when side wall (3) is in its equilibrium or expanded position of Figure 1a), surfaces (9)-(14) are relatively far apart; however, when a downward force is applied to the upper extremity of the container, as shown in Figure 1b), side wall (3) yields reversibly and gradually at boundaries (17) and (15) and surfaces (9)-(14) move toward each other in accordion fashion. When this

occurs, the interior of the container is decreased in volume. The dimension and the number of the annular grooves and the annular beveled surfaces comprising the pre-defined corrugated side wall (5) can be changed by any person skilled in the art for any specific needs of the container (20).

The air tight cap (25) closing the container (20) is illustrated in Figure 2. The cap (25) is screwed in the predetermined threads (26) of the neck (27) of container (20). The cap (25) has a rift (30), which presses on the lip (28) of neck (27). A skirt (31) of the cap (25) goes inside said neck (27) and shows another rift (32). This rift (32) presses against the inner part (33) of said neck (27). The rifts (30) and (32) assure a superior air tightness of the cap (25), especially when a top load is applied (rift (30) is pressed on lip (28)) and an internal pressure is built up (rift (32) is pressed against the inner part (33) of neck (27)). The cap (25) is usable to any container that will be described further on. The described screwed on closure system of the cap (25) can be easily replaced by any person skilled in the art by any other state of the art closure systems. The only strict requirement is that the cap assures a complete air tightness.

An example of a heat sealed container is shown in Figure 6. The container (70) has the same corrugated side wall such as container (20), but a cap is not needed, since the neck (71) is heat sealed together in an area (72). The heat sealed area (72) has to be severed to open the container (70).

Several containers (20) can be now packed together to a shipping unit (200) as illustrated in Figure 13. All these containers are tightly pressed together by any state of the art wrap-around plastic film (202). The same function of said plastic film (202) is accomplished with other tightening facilities, as explained before. The shipping unit (200) is formed to a rectangular shape, suitable for stacking one shipping unit over another for depot and transport to form the complete assembly or pallet stack, shown schematically in Figure 14. The pressure inside the containers is built up during the stacking operations. Said pressure increases with the increasing number of stacked shipping units of the assembly on the lower shipping units. The built-up pressure disappears again once the top load is removed for the reversibility of the deformation.

The container (50) illustrated in Figure 4 is another possible embodiment of the present invention with a little variation in respect to container (20). It has also three annular, V-shaped grooves (52), (54) and (56), but separated from each other by straight annular surfaces (57) and (59). In this manner the container (50) presents three smaller collapsible parts in respect to the container (20) around the annular grooves (52), (54) and (56). Applying the usual vertical force from the top of the container, the grooves disappear gradually and reversibly uniting the surfaces (55), (57) and (59) and reducing therefore the volume of the container (50) with relative increase of the pressure inside said container. The dimensions and the number of the collapsible parts of this container (50) are variable for any person skilled in the art.

Since only a small volume is now reversibly compressible, less pressure is created in container (50). This embodiment represents a combination of weight carried by the strength of the wall itself and by the built up pressure, the latter improving considerably the stacking possibility. The assembly is formed in the same way as described before.

EXAMPLE II

Another embodiment of the present invention is shown in Figure 3a). The container (40) closed by the air tight cap (25) with a collapsible side wall (43), comprising the parts (44), (45) and (46), a contained material (41) and a gaseous head space (42). The collapsible side wall (43) is reversibly and gradually deformable in the vertical direction, that means that exerting a vertical force **F**, as schematically shown in Figure 3b), from the top of the container (40) downwards, the disposable volume for the contained material (41) and the gaseous head space (42) inside said container (40) is reduced through the effect of the collapsing the side wall (43). The pressure built up in this manner is held by the air tight cap (25), which has been described in Figure 2.

The collapsible side wall (43) has a sloped annular surface (46) between two annular edges (44) and (45). When a vertical force **F** is exerted, as shown in Figure 3b), the edge (44) is reversibly and gradually pushed downwards inside the contained material (41), inverting the slope of the surface (46). The result is the same as described in Example I, since the volume of the container is reduced in this manner building up the pressure inside the container (40). Once the surface (46) has inverted its slope, no further deformation of the container (40) is possible. The total amount of the pressure built up till the slope inversion is used principally now to strengthen the side wall (43) of container (40); the pressure has no direct influence on force **F** anymore.

As said in Example I, there are no limitations, in principle, for the dimensions and the number of the parts that determine the corrugation of the wall of the container (40) for any person skilled in the art. The assembly is formed in the same way as explained in Example I.

EXAMPLE III

All the Examples described till now have the collapsible parts of the container resided always on the side walls. In this example, referring to Figure 5, the collapsible part (61), which shows identical features as the collapsible side wall of Example I, is located on the neck of the container (60) with the standard air tight cap (25). The effect of reducing reversibly and gradually the volume of the container (60) by exerting an appropriate vertical force downwards is the same as explained in the preceding examples. The same assembly described above applies to this Example.

EXAMPLE IV

In Figure 7, the V-shaped grooves (82) and (84) of container (80) with the standard air tight cap (25) are vertical in order to get an horizontal deformation of the container (80). The force has clearly to be horizontal to deform reversibly and gradually this container acting from both sides (85) and (87). This can be achieved through a similar shipping unit illustrated in Figure 13 and described in Example I made of several containers (80). The wrap-around plastic film (202) presses the containers of the packaging assembly tightly together, and the side walls of the assembled containers (80) collapse through the grooves (82) and (84). This reversible and gradual deformation reduces the volume of all single container (80) of said unit with a consequent increase of the pressure inside the containers (80) of said unit. This built up pressure strengthens clearly the wall of container (80), as described in detail before. This shipping unit is stackable again to form a complete assembly in the same manner as above. Any other tightening means for the shipping unit, as described before, apply in the same way.

A simple modification of the container (80) is achieved through the container (90) of Figure 8. It presents the same features for a horizontal deformation such as container (80) (vertical V-shaped grooves (92) and (94)) in addition with a vertical collapsible part (96) displaced on the neck of the container (90). This vertical collapsible part (96) located now on the neck of container (90) has been previously described in Example III. In this case, the weight of the stacking is not only supported by the strengthening of the wall of container (90), but also by the direct force exerted by the pressure itself through the vertical collapsible part (96).

As usual, the dimension and the number of the grooves permitting the reversible and gradual mechanical deformation can be varied by any person skilled in the art to solve specific problems.

EXAMPLE V

The container (100) closed, for example, by the usual air tight cap (25) illustrated in Figure 9a) has a side wall made of V-shaped parts (102). This shape of the side wall is not continued neither on the base of the container (104) nor on the shoulder or the neck of the container (106). In order to reduce the volume, said container (100) has first to be partly twisted and held in this position, for example with the help of the constraints of the shipping unit, as described in Example I. This twisting can now be further increased, if a force **F**, which is created by the weight of a stacking, is exerted from the top of container (100), as illustrated in Figure 9b). The volume is reduced through this reversible and gradual twisting of the side wall and therefore a reversible and gradual pressure is built inside the said container (100).

A possible modification of said container (100) is labeled as (110) in Figure 10a) closed by the air tight cap (25) for example. The V-shaped part (102) is continued on the shoulder or neck (112) of container (110). The reversible and gradual twisting effect schematically illustrated in Figure 10b) by applying a vertical force **F** from the top of said container (110) is the same as explained above.

Another simple modification is schematically shown in Figure 10c). The attachment area (108) of all the V-shaped parts (102) on the base (104) is shifted in respect to the attachment area (109) of the respective part (102) on the shoulder or the neck of the container (106). This particular feature allows an automatic reduction of the volume of the container, without any pre-twisting obligation from the constraints of said shipping unit.

The dimensions and the number of said V-shaped parts (102) forming the side wall of container (100) or (110) is completely variable to solve specific needs by any person skilled in the art. The assembling features are the same as above.

EXAMPLE VI

The building up of the pressure during the capping operation is schematically shown on Figure 11a) and Figure 11b), which represent a transverse section through the cap and the container's neck. The cap (125) is screwed on the neck (120) of a container. The cap (125) pushes inside the neck (120) a volume represented by the part (126) of cap (125). The part (126) has a slightly conical shaped wall (128). This conical shaped wall presses against the neck (120) of the container right from the beginning and during the whole capping operation. The conical shaped wall (128) of part (126) assures an air tightness from the beginning of the capping operation. The part (126) is in practice a volume, which is pushed inside the container, reducing reversibly the volume available to the contained substance, assured by the air tightness during the whole capping operation. As an optional feature, at the base of part (126) there is provided a removable plug (129). It is removable through the line of weakness (127).

The same principle applies for the dosing cap (130) shown in Figures 12a) and 12b) with dosing lines (132).

The pressure built up inside during the capping operation as described above is proportional to the total volume pushed inside from the cap (125). Therefore a great volume is needed to reach the pressures needed to strengthen sufficiently the walls of the containers for usual stack conditions. This method nevertheless helps to reduce the volume of the head space of containers closed with dosing caps. This method is completely combinable with all the examples mentioned before with reversible and gradual mechanical deformation of some part of the wall of the container, in the sense that said cap pre-pressurizes the containers, before the further pressurization through the described deformations.

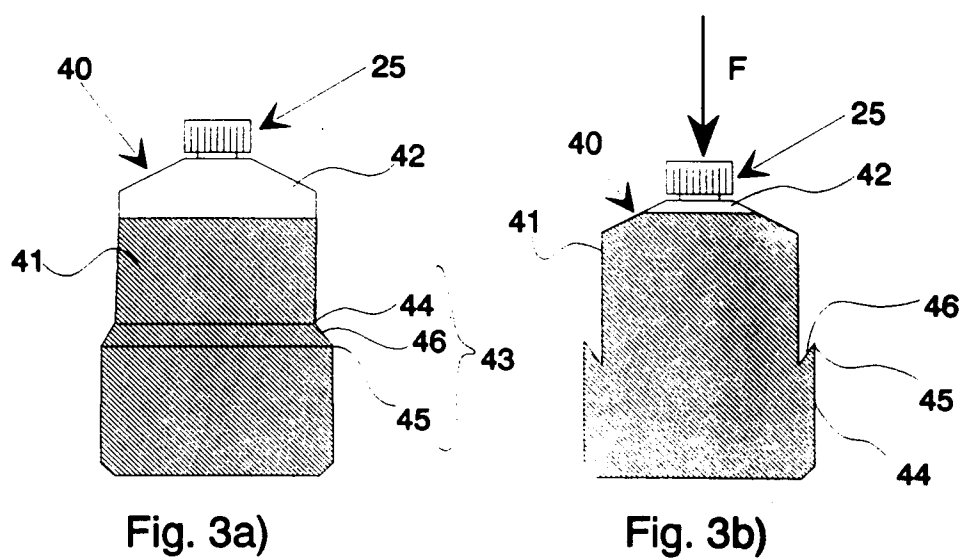
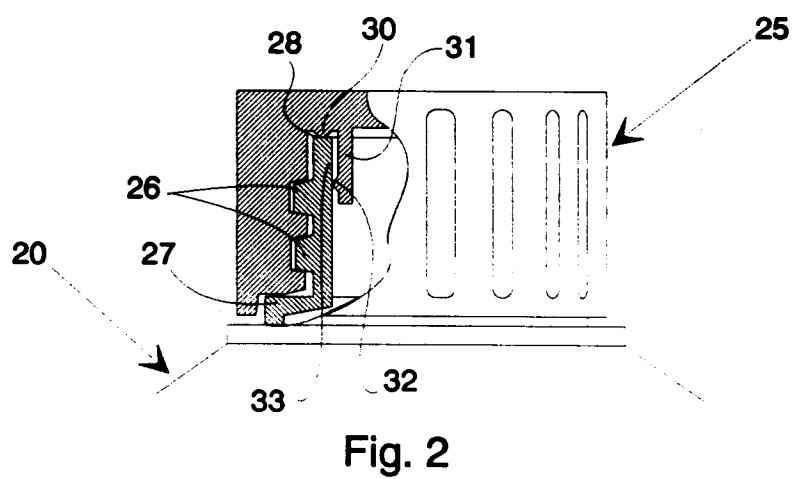
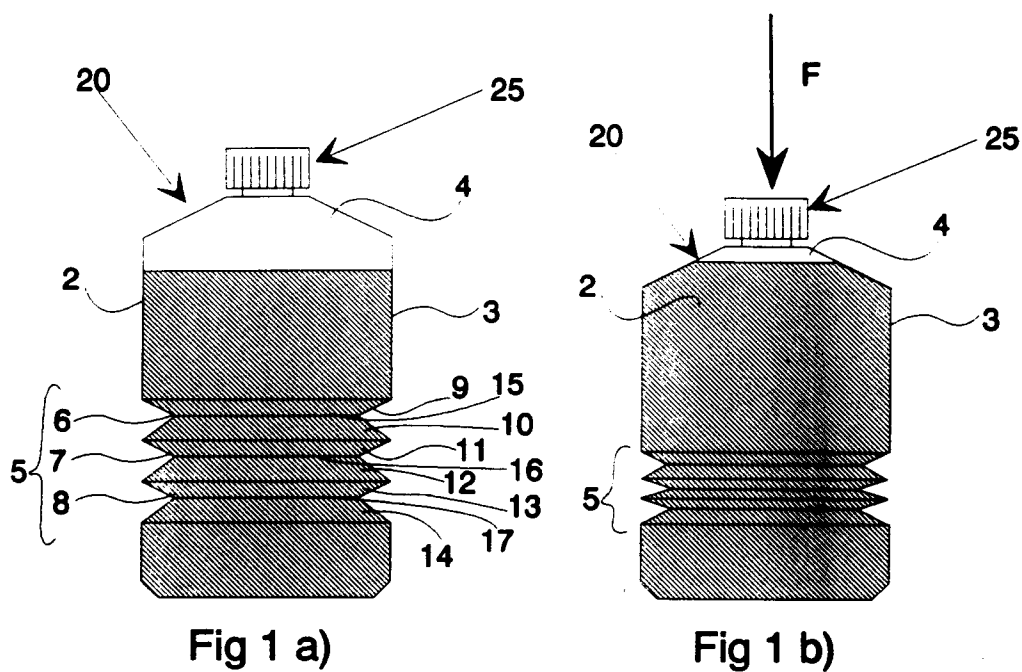
Claims

1. An assembly of containers comprising several air tight containers made of a deformable material, which are able to be internally pressurized above the relevant ambient pressure in a reversible and gradual manner, and to maintain this built-up pressure, wherein said containers are assembled in said assembly so that the containers are pressurized.
2. An assembly of containers according to Claim 1 characterized in that said assembly comprises a bundling material wrapped around a group of air tight containers, the totality of said wrapped groups forming the whole assembly.
3. An assembly of containers according to any of the preceding Claims characterized in that the bundling material is a plastic film.
4. An assembly of containers according to Claim 1 or 2, wherein said assembly is formed by stacking said air tight containers.
5. An air tight container suitable for use in an assembly according to the preceding Claims characterized in that one or several parts forming the external wall of said container, as the side walls or the shoulder or the neck or a combination thereof, have a pre-defined pattern, which allows a reversible and gradual mechanical deformation of said container, the amount of said deformation depending on the total force exerted from outside on said container.
6. An air tight container according to Claim 4 characterized in that the pre-defined pattern of the walls allow a reversible and gradual mechanical deformation induced by a vertical force exerted downwards on said container, and said force derived from the weight of said assembly, said weight being up to 150 kg, preferably up to 90 kg.
7. An air tight container according to Claim 5 characterized in that the pre-defined pattern of the walls allows a reversible and gradual mechanical deformation induced by an horizontal force or a combination of an horizontal and a vertical force exerted on said container.
8. An air tight container according to Claim 6 characterized in that the weight stacked upon said container in said assembly is up to 150 kg, preferably up to 90 kg.

9. An air tight container according to Claim 4 to 7 characterized in that said container is closed by a detachable air tight cap or closed through an air tight seal after filling said container.
10. An air tight container according to Claim 8 characterized in that a detachable air tight cap presents a cone at the bottom of said air tight cap, which represents a volume that is pushed into said neck of the container, compressing an equivalent volume in said container during capping.

Amended claims in accordance with Rule 86(2) EPC.

1. An assembly of containers comprising several air tight containers made of a deformable material, which are able to be internally pressurized above the relevant ambient pressure in a reversible and gradual manner, and to maintain this built-up pressure, wherein said containers are assembled in said assembly so that the containers are pressurized.
2. An assembly of containers according to Claim 1 characterized in that said assembly comprises a bundling material wrapped around a group of air tight containers, the totality of said wrapped groups forming the whole assembly.
3. An assembly of containers according to any of the preceding Claims characterized in that the bundling material is a plastic film.
4. An assembly of containers according to Claim 1 or 2, wherein said assembly is formed by stacking said air tight containers.
5. An air tight container suitable for use in an assembly according to the preceding Claims characterized in that one or several parts forming the external wall of said container, as the side walls or the shoulder or the neck or a combination thereof, have a pre-defined pattern, which allows a reversible and gradual mechanical deformation of said container, the amount of said deformation depending on the total force exerted from outside on said container.
6. An air tight container according to Claim 5 characterized in that the pre-defined pattern of the walls allow a reversible and gradual mechanical deformation induced by a vertical force exerted downwards on said container, and said force derived from the weight of said assembly, said weight being up to 150 kg, preferably up to 90 kg.
7. An air tight container according to Claim 6 characterized in that the pre-defined pattern of the walls allows a reversible and gradual mechanical deformation induced by an horizontal force or a combination of an horizontal and a vertical force exerted on said container
8. An air tight container according to Claim 7 characterized in that the weight stacked upon said container in said assembly is up to 150 kg, preferably up to 90 kg.
9. An air tight container according to Claim 5 to 8 characterized in that said container is closed by a detachable air tight cap or closed through an air tight seal after filling said container.
10. An air tight container according to Claim 9 characterized in that a detachable air tight cap presents a cone at the bottom of said air tight cap, which represents a volume that is pushed into said neck of the container, compressing an equivalent volume in said container during capping.



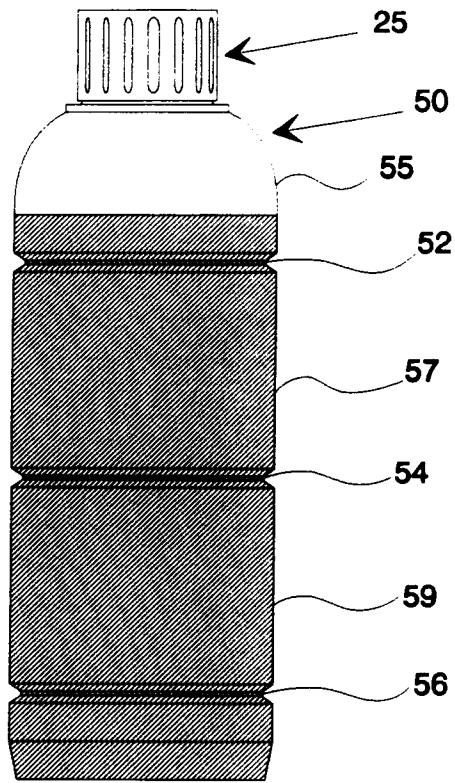


Fig. 4

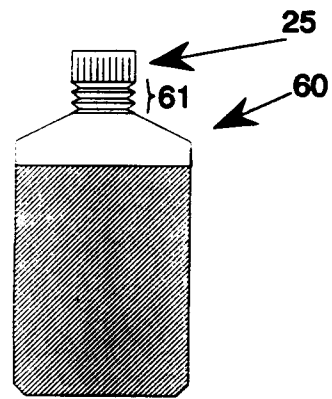


Fig. 5

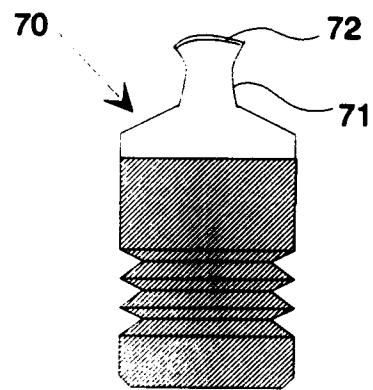


Fig. 6

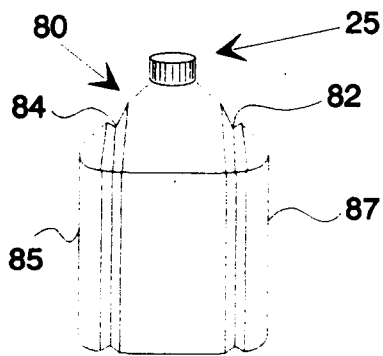


Fig. 7

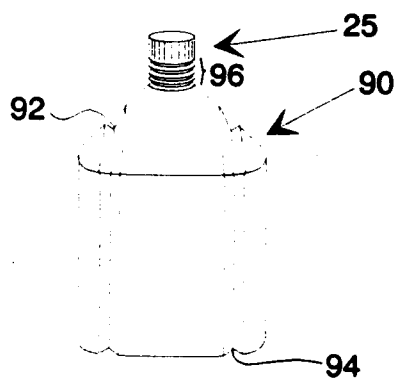
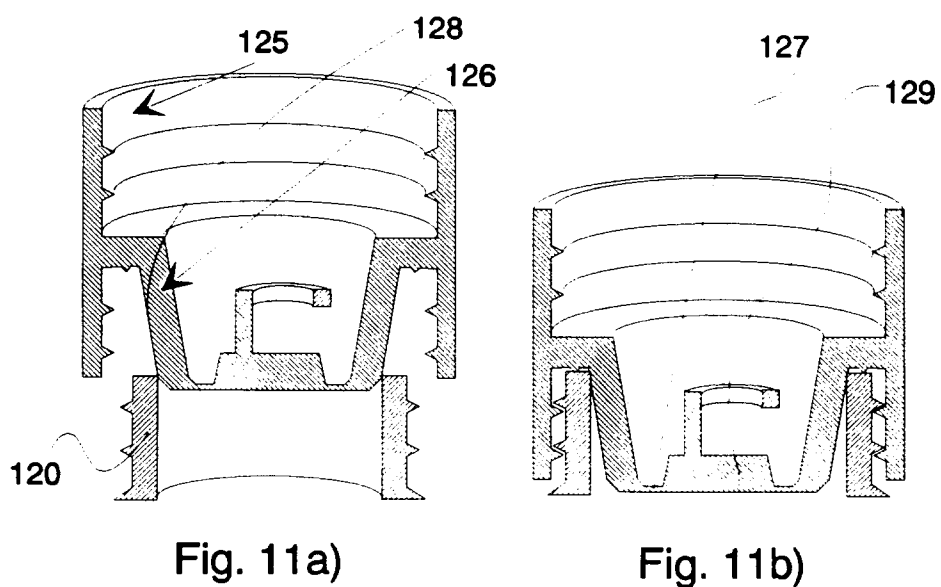
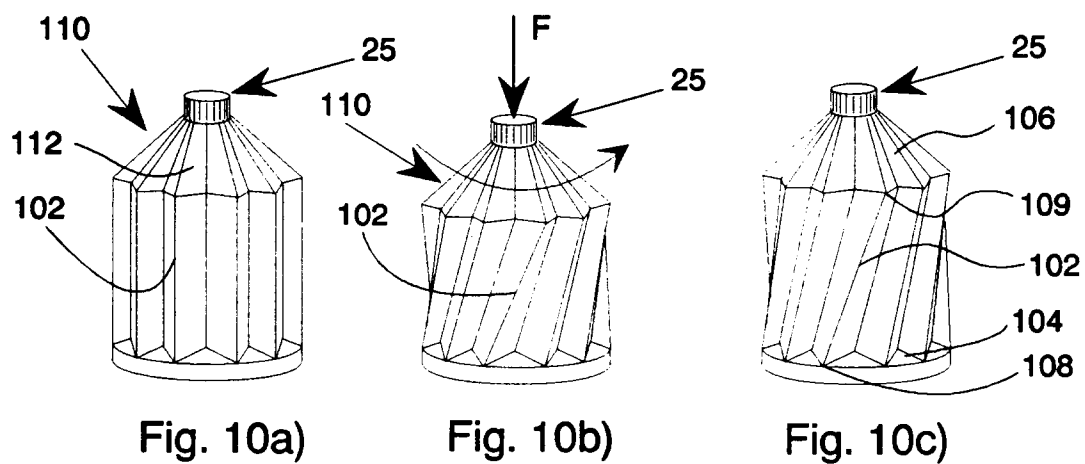
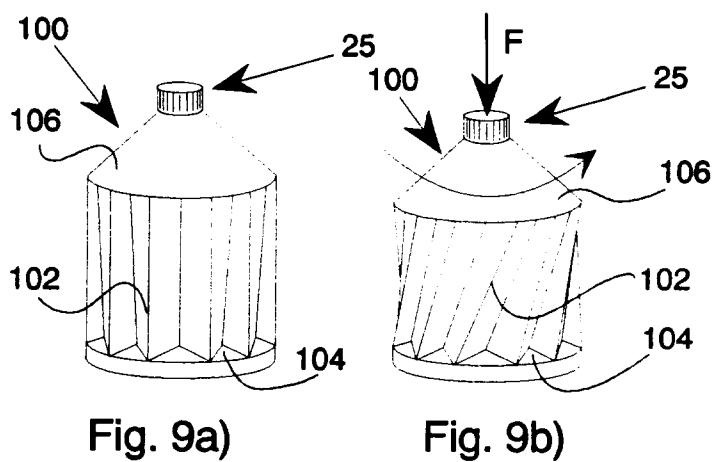


Fig. 8



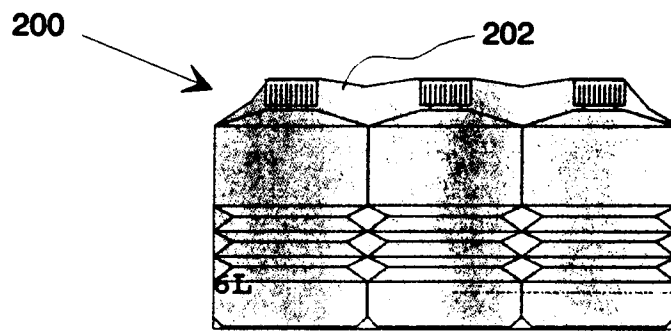
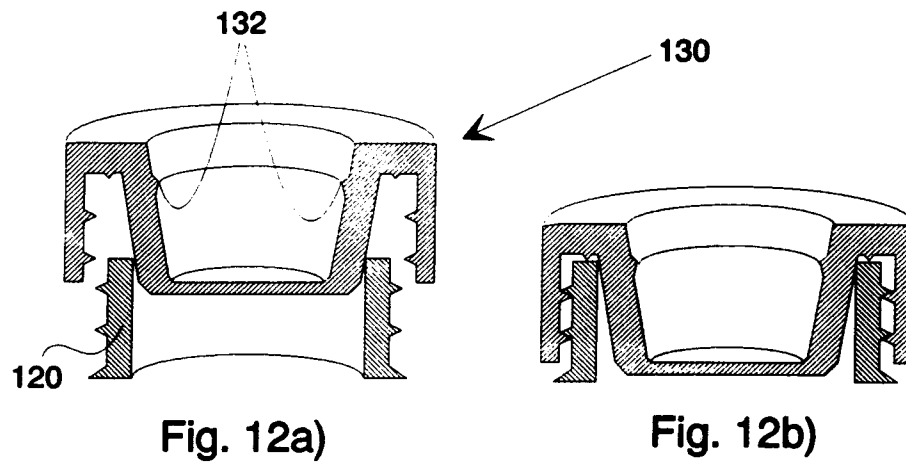


Fig. 13

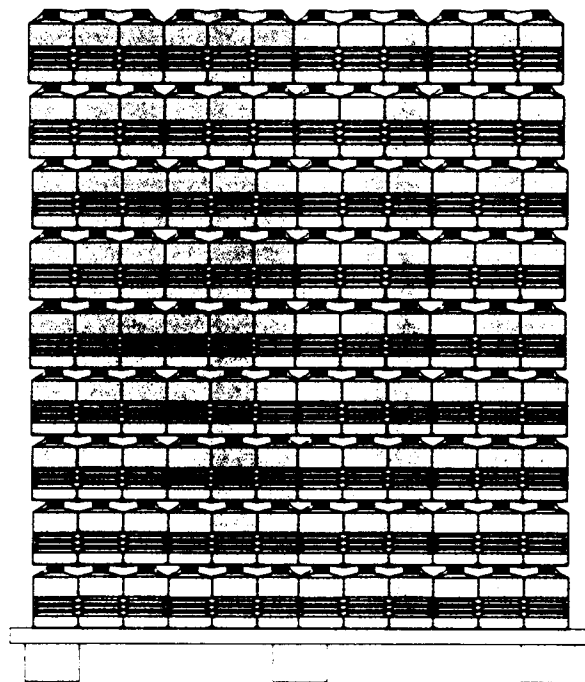


Fig. 14



European Patent
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EUROPEAN SEARCH REPORT

Application Number
EP 94 87 0023

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X	GB-A-1 560 631 (AMERICAN POTATO COMPANY)	1,2,4,5,7	B65D71/00 B65D1/02 B65D81/20 B65D41/04 B65D21/02
Y	* the whole document *	3,6,8,9	
Y	US-A-4 793 490 (EVERT) * the whole document *	3	
A		1,2,4	
Y	FR-A-2 607 109 (CASTANET) * abstract; figures *	6,8,9	
A	US-A-4 560 566 (ROTH) * abstract *	10	
			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			B65D B65B
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 17 June 1994	Examiner Bridault, A
CATEGORY OF CITED DOCUMENTS			
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application I : document cited for other reasons & : member of the same patent family, corresponding document	