June 9, 1953 M. J. QUILLINAN 2,641,292

CONTAINER

Filed Aug. 17, 1951

Fig. 2

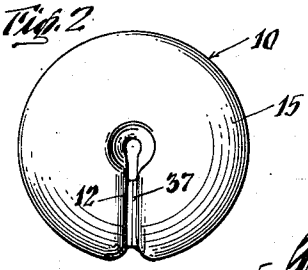


Fig. 4

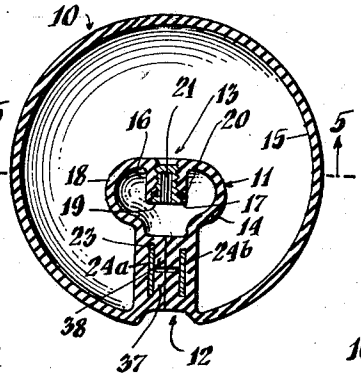


Fig. 5

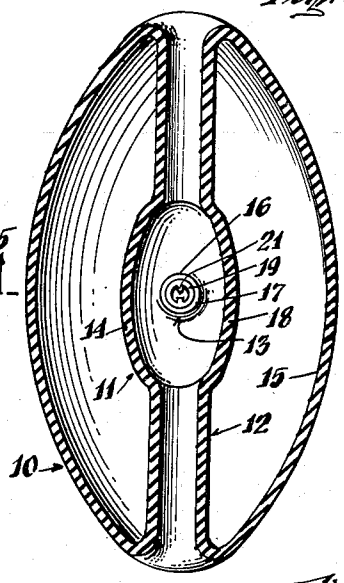


Fig. 1

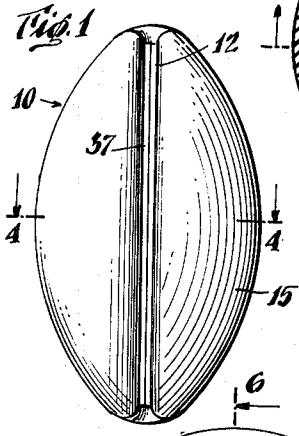


Fig. 7

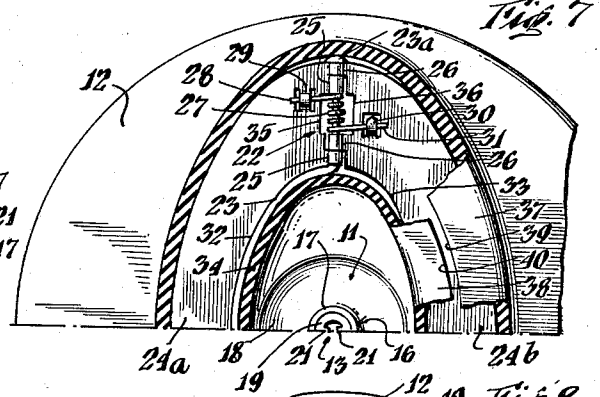


Fig. 3

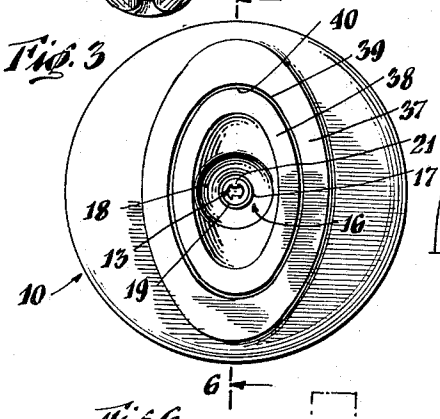


Fig. 8

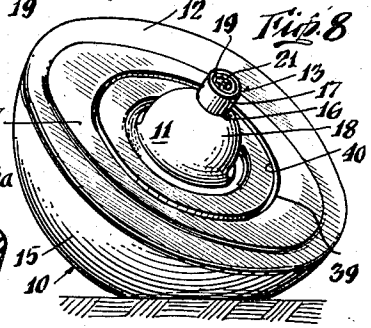
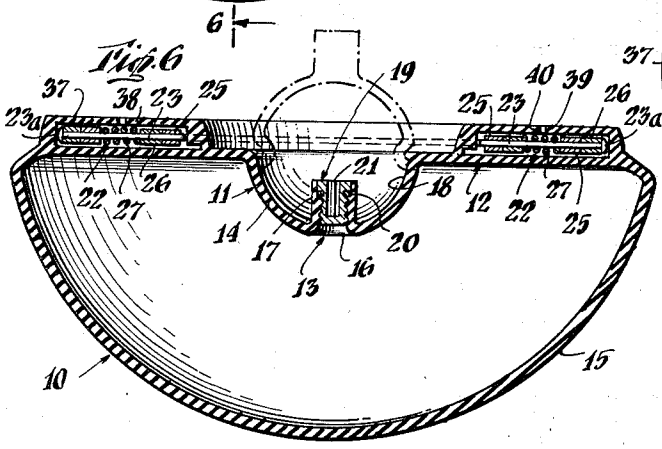


Fig. 6



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Patented June 9, 1953

2,641,292

UNITED STATES PATENT OFFICE

2,641,292

CONTAINER

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Application August 17, 1951, Serial No. 242,325

9 Claims. (Cl. 150—0.5)

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The present invention relates to new and improved containers generally and, in particular, to a rubber-like container such as may be used to carry petroleum products and chemicals, which container may be dropped from relatively high altitudes without a leakage occurring in either the container's body portion or the bung therefor.

As tactical warfare has progressed in techniques hitherto thought unwieldy, and men and machines are dropped behind enemy lines after being airborne, the advantages to be gained thereby and the initiative necessarily assumed substantially increase supply problems. Oftentimes, it becomes necessary to replenish material of war under the most extreme terrain conditions and highly concentrated enemy barrage. Then again, said material must, upon being released from a carrier aloft over enemy territory, further assure that it will do the job when it arrives in places where friendly troops are concentrated. Not the least among the aforementioned supply problems is the requirement of dropping large quantities of strategic liquid, for example fuel oil, in containers which must not leak after being subjected to great percussion. The bung for such containers is a vulnerable element in this regard and it too, regardless of what degree of erectness the container may reach the ground, must remain intact.

I have provided a container designed to satisfy the desiderata outlined above and, at the same time to provide a high degree of economy, both in handling and re-use. Most containers of the day, in addition to being bulky and highly cumbersome in handling and storing, are quite susceptible to abuse under handling conditions such that the life of the container is shortened. In view of the extreme conditions contemplated by airborne supply problems, such considerations as long life and economy are seldom achieved.

Briefly, the invention comprises a hemispherical diaphragm of rubber-like material which is substantially concentric with an internal and integral hemispherical bubble. This bubble is substantially less flexible and stronger than the diaphragm, being reversible and withdrawable from the latter for a purpose to be hereinafter disclosed. The bung for the container invention is provided at the polar portions of this hemispherical bubble and is preferably integrally formed on the bubble, both the bubble and bung being also made of a rubber-like composition. Spring means are provided on the circular face connecting the bubble with the

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diaphragm such that both the bubble and the diaphragm are foldable along their respective incident diameters and maintained in this position throughout the portage of the container, as will be hereinafter disclosed.

Referring to the drawings where similar reference numerals refer to similar parts:

Fig. 1 is a lengthwise view of the container showing where the circular face of the container joins to form an elliptical or egg-like barrel.

Fig. 2 is a top view of the container in Fig. 1 looking along the axis of fold thereof.

Fig. 3 is a plan view of the container in its unfolded condition, the circular face being closer to the viewer.

Fig. 4 is an enlarged sectional view of the inside of the container taken along line 4—4 in Fig. 1.

Fig. 5 is a sectional elevation view of the portion shown in Fig. 4 taken along line 5—5 in Fig. 4.

Fig. 6 is an enlarged sectional elevation of the unfolded container shown in Fig. 3 taken along line 6—6 in Fig. 3.

Fig. 7 is an enlarged fragmentary view of a portion of the unfolded container shown in Fig. 3 wherein the lips covering the hereinafter described spring means are broken away to show the spring means to better advantage.

Fig. 8 is a perspective view of the container illustrating what happens to it upon impact with the ground.

For sake of clarity in illustrating the elements of the container, any symbolic representation for a liquid has been omitted from the above drawings.

Provided on the container is a substantially hemispherical diaphragm 10 made of a rubber-like composition such that it is elastic and flexible. An internal hemispherical bubble 11 connects with diaphragm 10 by means of a circular face, generally shown at 12. The bubble and circular face are made of rubber-like composition and are each relatively greater in thickness than the material of the diaphragm. Moreover the bubble, though harder, has relatively more inclination to "pop" having a bowed rigidity less than the strength of diaphragm 10, which behavior will be elaborated upon herein. The bubble is adapted to be turned inside-out with a substantial manual pressure on the bung, generally shown at 13, or by reason of the percussive force on diaphragm 10, which percussive force is transmitted through the liquid in the container deposited between the unexposed faces

14 and 15 of the bubble 11 and diaphragm 10, respectively, to the bubble 11.

The bung 13 is preferably integrally provided at the polar portions 16 of the bubble 11. The bung 13 consists of a hard rubber bushing 17 vulcanized to or otherwise similarly attached to bubble 11. The bushing 17 has its axis directed to the center of bubble 11 and is provided on the exposed face 18 of the latter such that it is pointed away from the container's contents. A corrosion resistant plug 19 is threadable within bushing 17 and has a sealing gasket 20 seated on the plug 19 above its threaded portions. Wrench engaging lugs 21 facilitate removal and sealing of the plug in its respective bushing.

Provided on the circular face 12 of the container are the springing means, generally shown at 22, which means comprise an axle 23 having retaining buttons 23*a* at both ends thereof. This axle 23 is arranged to be substantially coincident with the folding axis of the container and is, in truth, what defines and controls the location of the axis of fold. Rotatable on the axle 23 are flat elliptical folding leaves 24*a* and 24*b*, each leaf having a set of hinges 25 and 26 surrounding a substantial portion of the axle at the ends thereof. Also surrounding axle 23 near the ends thereof and longitudinally fixed on said axle by the hinges 26 and 25 are strong coil springs 27. One end 28 of each spring 27 projects laterally outward from the helix thereof and is permanently fixed on one of the leaves, i. e., 24*a*, the socket 29 being stamped out of the leaf 24*a* to overlap spring end 28 and station it on the leaf. A clip 30 is similarly stamped out of the other leaf 24*b* to optionally retain the other free end 31 of spring 27 which also extends laterally outward into the hooked portion of clip 30 for a purpose to be hereinafter disclosed. The innermost edge of leaves 24*a* and 24*b* are also elliptically formed as at 32 and 33. The axle 23 is correspondingly curled into a half of an ellipse as it clears the hinged area of the body of the leaves 24*a* and 24*b* as at 34. This elliptical curl or bend 34 is along the major axis of the leaves' innermost edges 32, residing just inside one of these edges. Finally, the leaves 24*a* and 24*b* are cut away as at 35 and 36, respectively, to house the helical body portion of the coil spring 27 and permit freedom of rotation of the leaves about axle 23. Thus the axle 23 locks and retains the leaves 24*a* and 24*b* at hinges 25 and 26 between the buttons 23*a* and the curled portion 34.

A set of elliptical lips 37 and 38, integrally connected to circular face 12, and made of rubber-like composition similar to that of circular face 12, contains the spring and leaf combination hereinabove at the leaves' elliptical inner and outermost edges, respectively, while retaining the leaves against the circular face 12 flexibly. Elliptical meeting edges 39 and 40 provided on lips 37 and 38, respectively, complete the container.

In operation, before the container is filled its appearance is characterized by Figs. 3 and 6. The barrel or container is then in an unfolded state and free end 31 of spring 27 is disengaged out of cocked relation with clip 30. The springs 27 therefore remain unflexed and there is no folding pressure upon the leaves 24*a* and 24*b*.

The bung is manually pulled outward from its concealed position in the bubble 11 such that both it and bubble 11 occupy a position similar to that shown in Fig. 8. The plug 19 is removed by use of wrench engaging lugs 21 and the container is filled. Thereafter, the plug 19 is reinserted in sealing engagement with bushing 17 and bubble 11 is reversed by depressing it again into the position shown in Figs. 3 and 6. It should be noted that the rigidity of bubble 11 is an important facet of this invention. The material of the bubble is preferably made of a relatively hard rubber and of a substantially greater thickness than that of the diaphragm 10. The bowed rigidity of the bubble 11 relative to that of the diaphragm 10, due to the properties of the former, assures that the bubble will not "pop out" of position until the desired time.

Ready access to the free end 31 of each spring 27 is then attained by parting the resilient elliptical lips 37 and 38 at their respective meeting edges 39 and 40. The spring's free end 31 is then flexed by being inserted in the hooked portion 30. Both springs 27 having been cocked, they act upon leaves 24*a* and 24*b* causing them to come together by rotation about axle 23 and bring the respective halves of circular face 12 with them as shown in Figs. 1, 2, 4, and 5, the flexible diaphragm 10 meanwhile folding into substantially an egg-like container shape similar to that of an American or Rugby-type football.

The container is now ready for shipment.

It is obvious from the drawings that such a container may be handled with great dexterity, the egg shape providing an ideal rolling surface.

Moreover, ordinary handling stresses will not affect the container since the strength of coil springs 27 in the spring means combination of leaves 24, axle 23 and leaves' springs 27 is strong enough to prevent the container from unfolding except under the two desired conditions, namely, manually exerted pressure upon the halves of cylindrical face 12 or the percussion force effect of the liquid upon shock absorbing elements of the container, as will be hereinafter explained. It will also be noted that uniquely the container wall sides surround the bung 13 thereby further preventing the effects of untoward handling stresses induced in the container. Also, the bung 13 is better prepared to withstand the direct impact induced in the container when it is dropped from relatively great altitudes. The bung 13 herein is hidden from any direct contact with the ground no matter how the container lands. Upon the container itself impact force is also reduced to a minimum since there are no vulnerable barrel chimes which oftentimes are the weakest link in the barrel's sealing integrity.

In tactical warfare and other humanitarian aspirations the container may be hassocked in a parachute and dropped. However, this is not the only manner of descent of the container that may be practiced. The use of a parachute may be omitted and the container sent aloft as a free falling body. Upon reaching the ground the diaphragm receives the initial impact of the ground and transfers this impact into a percussive force which rapidly builds up the liquid pressure in the container. Such a percussive force suffices to burst the present day containers since there is no way of reducing the initial shock of this percussive force on the container. While rubber-like material may be practiced upon the ordinary container wall since it possesses some qualities of elasticity, a uniform performance of such containers is not readily achievable. The container may be expensively overdesigned but this still does not provide the required mobility after the container has landed. It might be suggested that smaller than usual quantities of the strategic liquid may be shipped but such a prac-

tice fails to supply the answer to the problem since oftentimes rapidity of ground operations demands the "fastest with the mostest."

It is just that which is achieved in this invention. A unique shock absorbing means has been provided which greatly reduces the effect of the percussive force resulting from initial impact. By use of these means on containers, the shock reaction is automatically alleviated and the time increments of the percussive force of the liquid is comparatively increased, thereby allowing the container to more readily absorb the shock of sudden impact. By causing a gradual pressure release in the container of the hydraulic liquid pressure suddenly built up, percussive force is spent in overcoming the automatic shock absorbing means rather than bursting the walls of the container. Moreover, the sudden increase of hydraulic pressure is less rapid than before and consequently the need for overdesigning the container per unit of liquid transported is alleviated thereby allowing economy to be practiced.

This automatic shock absorbing means consists of what has been referred to hereinabove as spring means and the bubble 11. It requires a substantially large force to operate against the flexed pressure of springs 27 upon leaves 24 to rotate the latter about axle 23. This is exactly what occurs when the initial percussion takes place. The suddenly built up container pressure resulting from the hydraulic force of the non-compressible liquid causes the liquid to seek a release. Such a "bursting action" on the walls of the container, viz., the diaphragm 10, the cylindrical face 12 and bubble 11, causes the container to unfold along axle 23 against the spring means. In addition, such a bursting force is further spent as the container unfolds in attempting to work against the bowed rigidity of the flexible bubble 11 and reverse the same. It will be noted therefore that this occurs because it requires less force to cause the bubble to "pop out" than it does to burst the container wall.

The use of a flexible rubber-like material for the components of the container also alleviates the bursting action.

In its final unfolded condition the container appears as in Fig. 8 with the bubble 11 outwardly extended and obstructing the container leaves 24 from refolding. The spring means are therefore accessible and free end 31 of each spring 27 may again be disengaged from the clip 30, the meeting edges 39 and 40 of lips 37 and 38, respectively, being separated to reveal the flexed spring.

The user of the container thereafter withdraws plug 19 and may operate the container much like a bellows to give a rapid, pressure flow to the liquid, the optionally depressible ends 31 of springs 27 being disengaged and the container being therefore foldable in the opposite direction.

Since the container is deflatable it may be reshipped with comparatively less expense than ordinary containers.

The container disclosed herein is susceptible of a variety of modifications without departing from the spirit of the preferred embodiment. Thus the automobile tire art is proliferate with a prodigious fecundity of wall constructions and the reinforcements thereof which may be equally practiced on this container to reinforce the same and at the same time provide the flexibility required herein.

Having fully described the invention, what I claim is:

1. In a container, a flexible diaphragm acting in combination with spring means, a face connecting with the peripheral portions of said diaphragm, said face foldable along at least one axis of the container, said spring means provided on said face and acting to revolve opposed portions thereof about said axis and upon said diaphragm through said face to fold the diaphragm resiliently about said axis, parts of said face being urged into communication with each other thereby.

2. In a container, a flexible diaphragm acting in combination with spring means, a face connecting with the peripheral portions of said diaphragm, said face foldable along at least one axis of the container, a bubble acting in combination with said diaphragm, said bubble reversible within and centrally located on said face, said spring means acting upon said face to resiliently fold said face, said diaphragm, and said bubble about said axis, parts of said face being urged into communication with each other thereby.

3. In a flexible diaphragm type container, an elastic diaphragm acting in combination with spring means and a reversible bubble, a face connecting with the peripheral portions of said diaphragm, said face foldable along at least one axis of the container, said face connecting with the peripheral portions of said bubble, said bubble manually depressible within said face and responsive to fluid forces transmitted from said diaphragm through said container's contents to said bubble, said spring means acting upon said face to fold opposed portions thereof about said axis and upon said diaphragm through said face to fold said diaphragm resiliently about said axis, parts of said face being urged into communication with each other thereby.

4. In a container, a flexible diaphragm, a bubble and spring means acting in combination, a face connecting with the peripheral portions of said diaphragm and said bubble on the respective outer and inner rims thereof, said face foldable along at least one axis of the container, said bubble resiliently reversible within and without said container, said spring means acting upon said face to revolve opposite portions thereof about said axis and upon said diaphragm and said bubble through said face to fold said diaphragm and said bubble resiliently about said axis, parts of said face being urged into communication with each other thereby.

5. In a container, an elastic container flexible diaphragm acting in combination with spring means, a face connecting with the peripheral portions of said diaphragm, said face foldable in at least one direction about the axis of the container, said spring means acting upon said face to fold moities thereof about said axis, a bung provided upon said face, parts of said face being urged into communication with each other thereby.

6. In a container, a flexible diaphragm, a bubble and spring means acting in combination, a face connecting with the peripheral portions of said diaphragm and said bubble on the respective outer and inner rims thereof, said face foldable in at least one direction about the axis of the container, said spring means acting upon said face to fold moities thereof about said axis, a bung provided upon said face, parts of said face being urged into communication with each other thereby.

7. In a container, a flexible diaphragm, a bubble and spring means acting in combination, a face

connecting with the peripheral portions of said diaphragm and said bubble on the respective outer and inner rims thereof, said face foldable along at least one axis of the container and in at least one direction thereabout, said bubble resiliently reversible within said container being centrally located with respect to said face, said spring means acting upon said face to revolve opposed portions thereof about said axis, said spring means acting through said face to fold said diaphragm and said bubble about said axis yieldably, a bung being provided upon said bubble, parts of said face being urged into communication with each other thereby.

8. In a container, a flexible diaphragm acting in combination with spring means, a face connecting with the peripheral portions of said diaphragm, said spring means acting upon said face to fold said diaphragm along at least one axis in the plane of the face, moities of said face being urged into communication with each other thereby.

9. In a container adapted to collapse and to absorb shock and handling stresses, a foldable face having a reversible bubble therein adapted to be depressed within said face and resiliently reversed without said face by the pressure of the container's contents, a foldable diaphragm at the outer periphery of said face, spring means on said face acting to fold said diaphragm in the direction of said face, a bung provided on said bubble adapted to be hidden within the periphery of said face when said bubble is depressed and said diaphragm is folded, whereby said container absorbs shock through the intermediation of said bubble and said spring means.

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