United States Patent [19]

Souza

[11] **3,742,898**

[45] **July 3, 1973**

[54] **PRESSURE INDICATING BUNG WITH SELF-LOCKING INSERTION FEATURE**

[75] Inventor: **Augustine A. Souza,** San Jose, Calif.

[73] Assignee: **Robert N. Noyce,** Los Altos, Calif.

[22] Filed: **Aug. 10, 1972**

[21] Appl. No.: **279,314**

[52] **U.S. Cl.** **116/70,** 215/52, 217/78, 217/108, 220/24.5

[51] **Int. Cl.** **G01l 19/12**

[58] **Field of Search** 116/70, 65, 34; 222/214, 554, 563; 220/24.5; 217/78, 108; 215/52

[56] **References Cited**

UNITED STATES PATENTS

2,604,225	7/1952	Armstrong	220/24.5
2,742,175	4/1956	Parilla	220/24.5
3,239,090	3/1966	Bramming	215/52
3,313,264	4/1967	Keller	116/70
3,473,686	10/1969	Kusserow	217/108
3,574,312	4/1971	Miller	220/24.5
3,675,722	7/1972	Balmes, Sr.	116/70

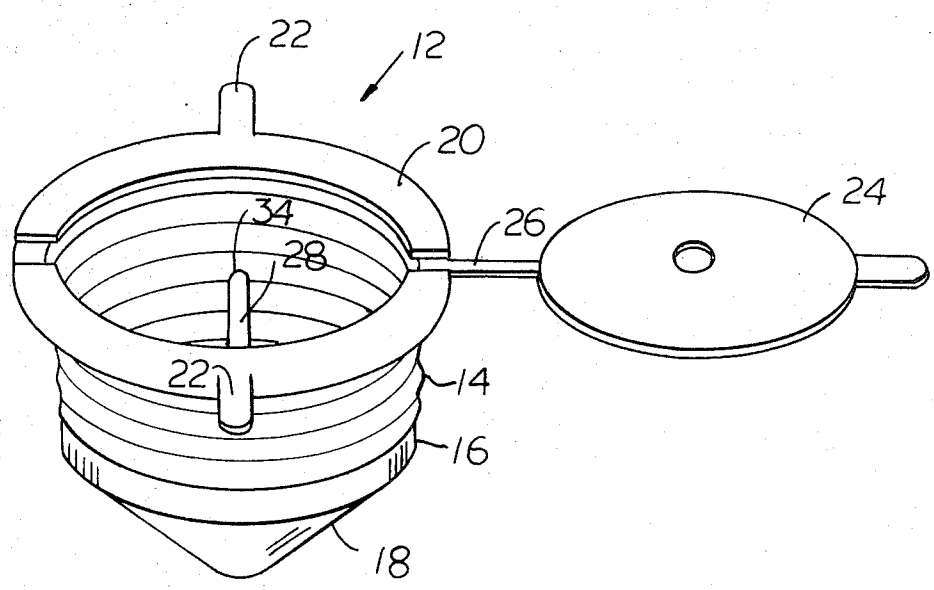
Primary Examiner—Louis J. Capozi

Attorney—Jerald E. Rosenblum and Thomas Schneck

[57] **ABSTRACT**

A bung in which the side walls are relaxed upon insertion into a bung hole, as in a beer barrel, but which subsequently become compressed when pressure in the barrel or similar vessel pushes against a bottom wall connected to the side wall, compressing the side wall with bellows action, thereby forcing corrugated side wall edges into contact with the bung wall. Pressure on the bottom wall forces the bottom wall upward so that an elongated member attached to the bottom wall raises as the bottom wall is raised, thereby indicating the extent of pressure on the bottom wall.

11 Claims, 6 Drawing Figures



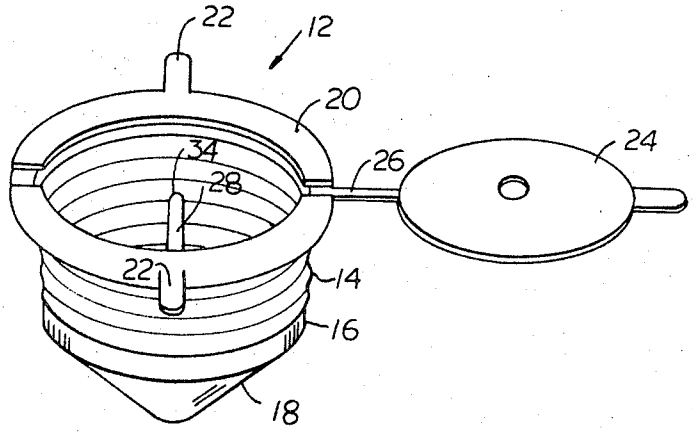


Fig. 1

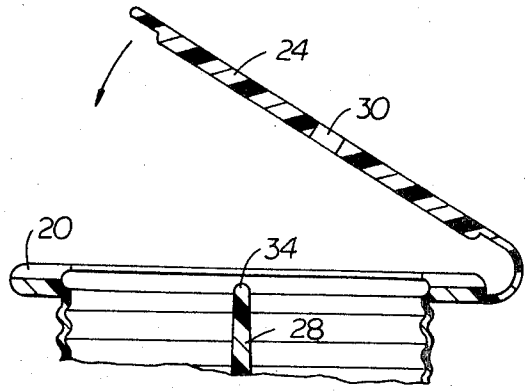


Fig. 2

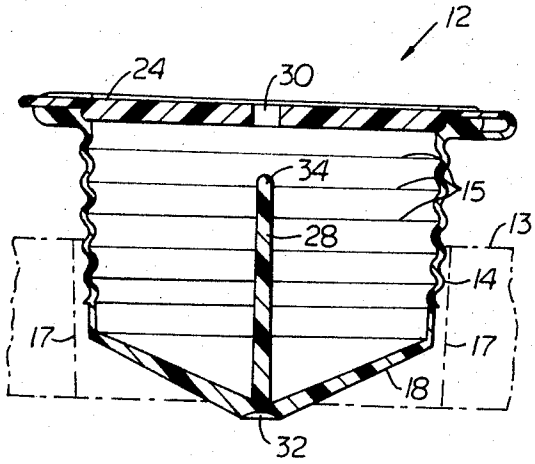


Fig. 3

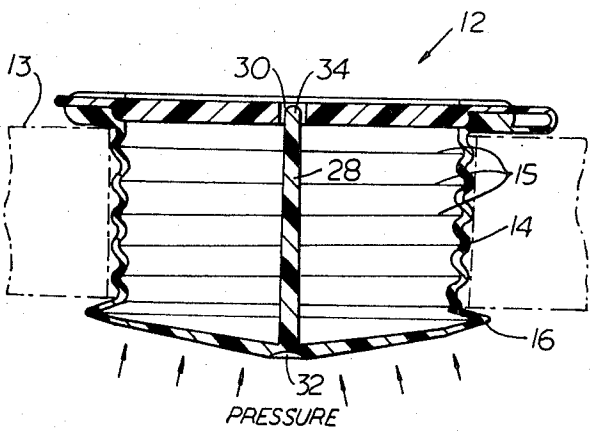


Fig. 4

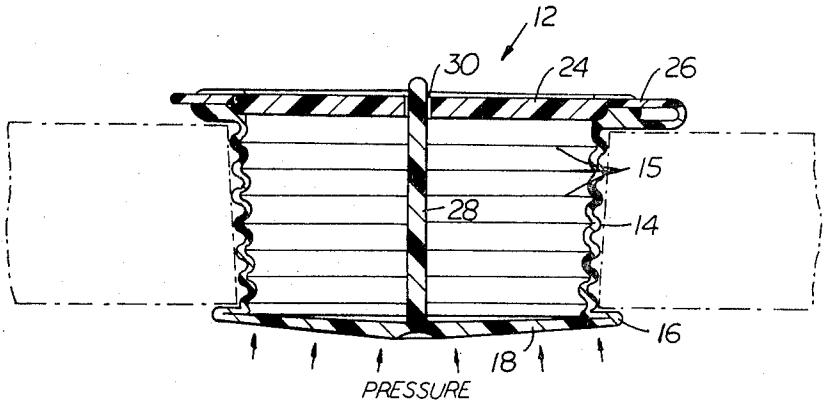


Fig. 5

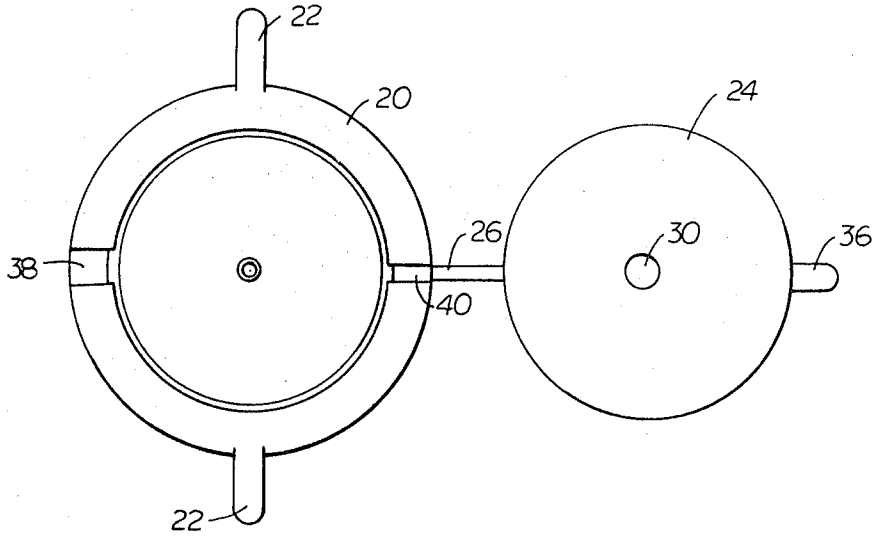


Fig. 6

PRESSURE INDICATING BUNG WITH SELF-LOCKING INSERTION FEATURE

BACKGROUND OF THE INVENTION

The invention pertains to closures for pressure vessels and more particularly to self-sealing closures for pressure vessels which also serve to indicate the extent of pressure within the vessel, as in a beer barrel.

Barrel bungs with corrugated side walls are known, both in cases wherein the corrugations are formed before insertion into a bung and in cases where corrugations are formed in situ by insertion of an expansible tool into the bung and rotation thereof for deforming the side walls outwardly to grip the bung surface. Further, various types of pressure-indicating closures are known wherein the extent of deformation of a closure member is indicative of the pressure thereon.

A problem with corrugated wall barrel bungs of the prior art is that in the case where the corrugations were formed before insertion into the bung hole, the bung was difficult to insert into the hole. On the other hand, in the case where the corrugation was formed in situ, the closure process was time consuming and commercially unfeasible except when done by machine.

An object of the present invention is to provide a bung with self-locking corrugated walls which become firmly locked in position upon pressurization of the vessel defining the bung hole. A further object is to provide a bung with a pressure indicator which becomes operative upon locking of the bung side walls in place.

Still another object is to provide a bung which implodes when pressure on the outside of the bung exceeds the strength of the bung material thereby keeping the bung from becoming a missile and possibly saving the pressure vessel from destruction.

SUMMARY OF THE INVENTION

The above objects are achieved in a bung having an annular side wall with an externally corrugated wall surface with an expansible rim at the bottom of the side wall. Connected to the rim is a conical bottom wall with a central zone which is somewhat thinner than the surrounding area, allowing the conical wall to flatten when pressure outside the bung increases compared to the pressure inside. Excess pressure on the outside of the bottom wall will tend to flatten it, thereby enlarging the expansible rim and providing a self-locking closure of the bung in the bung hole while simultaneously forcing side wall corrugations into tight contact with the bung hole wall. The bottom wall is also provided with an elongated member mounted above the central zone of the bottom wall and extending upwardly. When the bottom wall flattens in response to pressure, thereby moving upward toward the plane of the expansible rim, the elongated member moves upward, thereby indicating pressure on the bottom wall.

An annular top flap is mounted transversely across the side wall which serves as a reference for the elongated member which may pass through the center of the flap. Thus, once pressure is applied to the bottom wall of the bung, the bung will both lock itself in the bung hole and will indicate pressure within the vessel which the bung is closing.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective of the apparatus.

FIG. 2 is a partial cut-away of the apparatus.

FIG. 3 is a side cut-away operational view of the apparatus shown seated in a barrel.

FIG. 4 is a second side cut-away operational view of the apparatus seated in a barrel under pressure.

FIG. 5 is another operational view of the apparatus seated in a barrel under further pressure.

FIG. 6 is a top view of the apparatus.

DESCRIPTION OF THE PREFERRED EMBODIMENT

FIG. 1 shows a perspective view of the pressure-indicating bung 12 of the present invention. Such a bung is intended to fit in the bung hole of barrels, kegs, bottles, and similar vessels. For a given type of barrel, for example the standard aluminum beer barrel or keg, uniform bung hole sizes have been adopted. Thus, the dimensions of the present bung are selected to fit in such standard size bung holes.

An annular side wall 14 has a flexibly corrugated wall surface, similar to a bellows. The corrugations are spaced generally parallel to each other and parallel to the plane of the bung hole, except that the corrugations may have a slight pitch when, for manufacturing purposes, it is convenient to form a screw thread wall structure. This enables the wall surface corrugations to grip the interior of the bung hole when the corrugations radially expand. A lower annular portion of the side wall comprises an expansible rim 16, which is connected to a bottom wall 18. The expansible rim is designed to reside below the bung hole so that radial expansion of the rim will prevent removal of the bung from the bung hole.

An annular upper portion of the side wall 14 is connected to a radially outwardly extending lip 20 and sealed thereto. Lip 20 includes tabs 22 for gripping the bung. An annular top flap 24 is connected to lip 20 by means of a flexible hinge 26 which has an outer diameter which is at least as great as the inner annular side wall diameter, so that the flap 24 can cover the interior of the bung 12. The annular flap 24 defines an aperture through the center of a diameter which is sufficient to allow the passage therethrough of an elongated pressure-indicating member 28 which is mounted to bottom wall 18 and which is described hereinafter.

FIG. 2 shows the manner of closure of the flap 24 over the lip wherein the direction of full closure is indicated by the arrow in the figure. The pressure-indicating member 28 fits through the aperture 30 in the figure when the flap 24 is fully closed into the lip 20.

FIG. 3 shows an operational view of the apparatus seated in a barrel 13 wherein the side wall 14 is corrugated with bellows or accordion type pleats 15 so that when no pressure exists on the bottom wall 18 of the bung 12 the side wall is fully distended and the bung 12 will easily fit into a bung hole defined by walls 17 without appreciable friction. With low pressure or no pressure on the bottom wall, corrugations 15 have a minimum diameter. FIG. 3 also shows that bottom wall 18 is generally conical in configuration with a central zone defining a dimple 32 which is thinner than the surrounding area. This allows the conical wall to flatten in response to pressure on the underside thereof.

While the terms "under", "bottom", "top", "upper", and "side" are used with reference to the drawings, it will be understood that these terms are relative and that

it is not necessary for the bung to assume any given direction for operation as described herein.

It will be noted that the elongated pressure-indicating member **28** is mounted with one end directly above the dimple **32** and that the length of indicator **28** when side walls **14** are fully distended is such that the tip **34** of indicator **28** is below the plane of flap **24.**

FIG. **4** shows bung **12** with a greater pressure applied to the underside of the bottom wall **18** than exists on the upper side. Pressure is indicated by the arrows in the figure. The above mentioned pressure causes the bottom wall to flatten, pivoting about the dimple **32.** The material of the bottom wall is a semi-stiff material such as plastic made of a thickness so that the sides of the conical bottom **18** will remain stiff yet will pivot at the dimple **32.** As the conical bottom wall **18** flattens, the bottom expansible rim **16** of the side wall **14** is urged outward. At the same time, the upward pressure on the bottom wall tends to compress the side wall, thereby outwardly urging the corrugations of the side wall **14.** The corrugations then contact the interior of the bung hole and tend to lock the bung into place. Since the expansible rim **16** extends radially even further than the corrugations of the side wall, the bung will remain firmly locked in place in those cases where the thickness of the bung hole is less than the length of the side wall **14.**

It will be noted that the tip **34** of the pressure-indicating member **28** is projecting slightly through the aperture **30,** thereby indicating the extent of pressure on the bottom wall. The tip **34** may be marked with graduated fiducial markings which are calibrated against a standard so that the extent of projection of the tip **34** through hole **30** quantitatively defines the pressure on the bottom wall.

FIG. **5** shows the bung **12** of the present invention with bottom wall **18** fully flattened due to pressure on the underside of the bottom wall in the direction of the arrows. The rim **16** has fully outwardly extended in response to the enlarged diameter due to flattening of the conical bottom wall **18.** This flattening causes the pressure-indicating member **28** to project still further through the aperture **30** of flap **24.** The increased pressure causes a further outward projection of the corrugations of the side wall **14,** toward a maximum diameter thereby increasing friction of the bung **12** against the bung hole due to the increased pressure on the bottom wall **18** which outwardly urges the corrugations **15.** If pressure in the key which defines the bung hole increases still further, the elastic limits of the bung material will be overcome and the walls will collapse due to the increased pressure, thereby releasing the excessive pressure without causing the bung to become a projectile. The bung material is usually a plastic, such as polyvinylchloride, and is designed to yeild at the side walls in response to the predetermined high pressure substantially before the pressure vessel yields. Yield at the side walls is controlled by the yield strength of the selected material and its shape. The yield strength may be verified empirically by testing. By insuring that the bung will yield at a substantially lesser pressure than the pressure vessel, pressure vessels can be saved from damage.

FIG. **6** shows a top view of the constructional detail of the flap **24** and the lip **20** on which it closes. Note that the flap **24** includes a closure **36** which fits into a corresponding groove **38** and projects slightly thereover for locking purposes if desired. A second groove **40** is provided on the opposite side of the lip **20** to receive a portion of the hinge **26** when it is folded over so that the flap **24** can rest in a generally flat position with respect to the plane of the lip **20.** Thus, the plane of lip **20** becomes a reference surface for sighting the extent of the projection of the pressure-indicating member **28** through the aperture **30** defined in the annular flap.

The entire apparatus lends itself to construction by injection molding techniques. Because of the construction as described above, the entire apparatus may be molded in one piece. Thus, the apparatus is simple, economical, and easy to use.

When the apparatus is inserted into a bung hole of a pressure vessel which is at atmospheric pressure, the bung easily travels into its resting place with the lip **20** resting against the perimeter of the bung hole. As soon as pressure begins to build, for example upon filling the vessel, the increased pressure forces the conical bottom wall **18** upward, thereby compressing side wall **14,** forcing bung corrugations into firm contact with the bung hole walls and expanding the expansible rim, and providing self-locking closure of the bung in the bung hole. It will be noted that two separate forces lock the bung into place: first, radial expansion of side wall corrugations and second, an even further radial expansion of the expansible rim. At the same time upward movement of the wall gives a pressure indication which, if calibrated, can indicate the degree of filling when pressure is directly related to such filling. When the vessel is emptied and returned to atmospheric pressure, the bung may be easily removed upon distention of the side walls, thereby allowing inspection of the vessel.

What is claimed is:

1. A pressure-indicating bung for a pressure vessel comprising an annular side wall having an externally corrugated, bellows type annular side wall surface, an expansible rim at the bottom of said side wall, a conical bottom wall connected to said expansible rim in sealed relationship therewith, said bottom wall having a central zone thinner than the surrounding area whereby said conical wall will flatten in response to pressure thereon thereby radially expanding said expansible rim and said corrugated wall surface, and an elongated member mounted at one end above said central zone of said bottom wall and upwardly extending therefrom for indicating pressure in response to movement of said bottom wall.

2. The apparatus of claim **1** further defined by a radially outwardly extending lip connected to the top of said side wall.

3. The apparatus of claim **2** further defined by an annular top flap having a diameter at least as great as said annular side wall and hinged to said lip at one point for mounting over said lip.

4. The apparatus of claim **2** further defined by tabs attached to said lip for gripping said bung.

5. The apparatus of claim **1** wherein the central thin zone of the bottom wall comprises a dimple at the apex of said conical bottom wall.

6. The apparatus of claim **1** further defined wherein said corrugated side wall surface is a bellows whereby the diameters of said corrugations are minimized with low pressure on said bottom wall and maximized with high pressure whereby said bung locks itself in place upon application of pressure upon said bottom wall.

7. The apparatus of claim 1 further defined wherein said corrugated side wall surface comprises screw threads.

8. The apparatus of claim 2 further defined wherein said elongated member extends from said bottom wall to slightly below said annular flap when pressure on both side of said bottom wall is equal.

9. The apparatus of claim 8 wherein said elongated member is graduated for indicating amounts of pressure.

10. The apparatus of claim 1 wherein said bung is made of a material which has a yield strength substantially less than said pressure vessel.

* * * * *

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,742,898 Dated July 3, 1973

Inventor(s) Augustine A. Souza

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Col. 3, line 49	Change "key" to "keg".
Col. 6, Claim 11	Claim 11 has been left out in its entirety.

Signed and sealed this 27th day of November 1973.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

RENE D. TEGTMEYER
Acting Commissioner of Patents

FORM PO-1050 (10-69)

USCOMM-DC 60376-P69
* U.S. GOVERNMENT PRINTING OFFICE : 1969 O—366-334.