

[54] **SEALED CONTAINER ASSEMBLY AND METHOD OF MAKING SAME**

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[51] Int. Cl. **B21d 51/00**

[58] Field of Search **113/80 DA, 1 F, 121 A, 113/121 AA, 121 C; 220/27, 29, 53**

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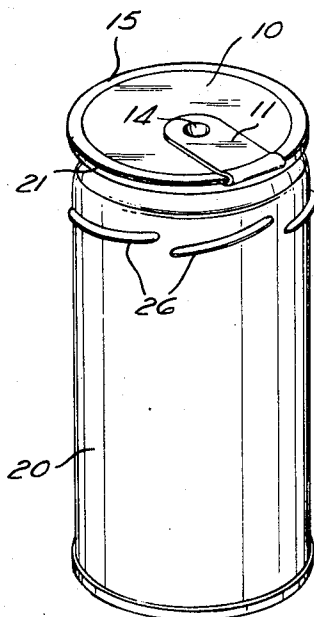
Attorney—Ely, Golrick and Flynn

[57]

ABSTRACT

Easily opened sealed container comprising a rigid container body preferably having an opening provided with a beaded edge, a rigid outer cover for the opening, the outer cover being readily releasably mechanically interlocked over the opening, an inner peelable sealing diaphragm equipped with an integral pull-tab engaged between said outer cover and said edge, and a plasticized resinous sealant adhering said diaphragm to said edge. The sealant, preferably of a solventless heat-activated type, is characterized by relatively weak shear strength. The diaphragm is preferably cut from sheet material with areas to be cut from sheet "packed" to provide a quadrilateral "scrap" area from which an integral tab is formed.

5 Claims, 7 Drawing Figures



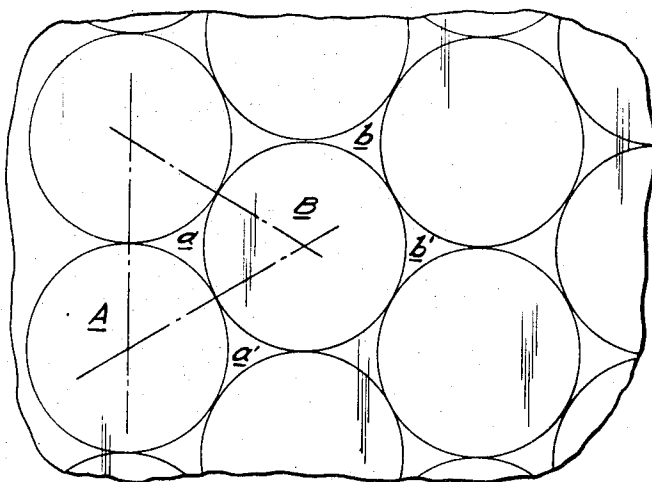


Fig. 1

PRIOR ART

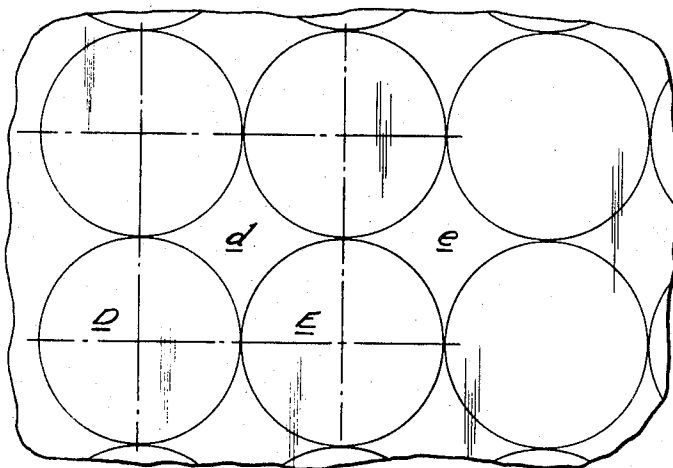


Fig. 2

PRIOR ART
ARRANGEMENT OF
CLOSURE AREAS

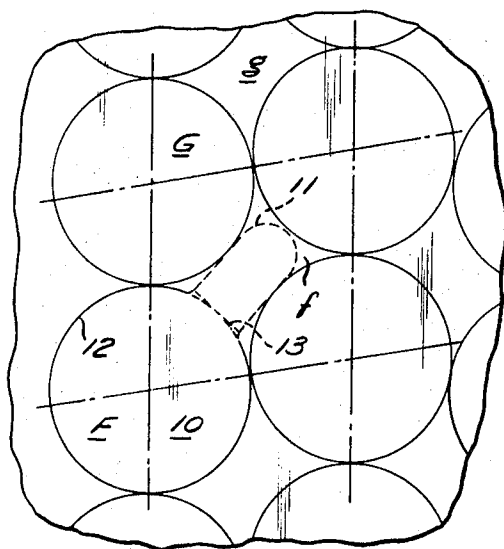


Fig. 3

Fig. 4

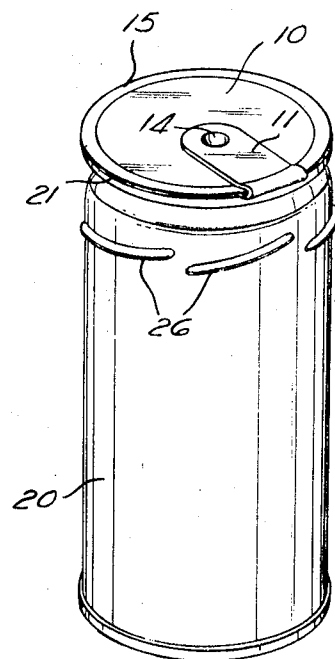
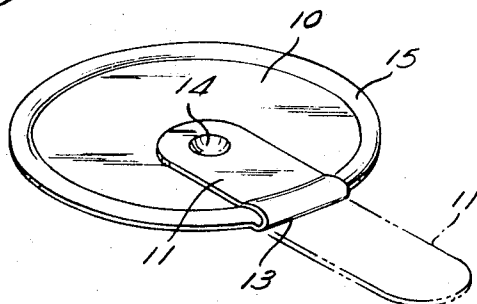


Fig. 5

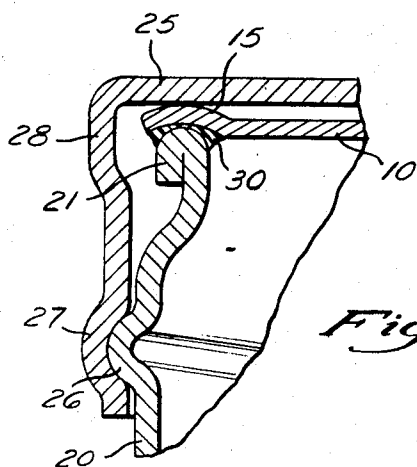


Fig. 6

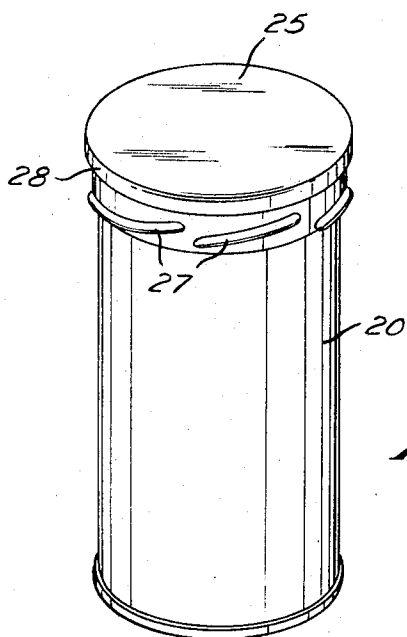


Fig. 7

SEALED CONTAINER ASSEMBLY AND METHOD OF MAKING SAME

This application is a divisional application with respect to our copending application Ser. No. 719,301, filed Apr. 8, 1968, now U.S. Pat. No. 3,501,045.

This invention relates to container assemblies which may be securely sealed for shipment and storage and yet which are safely, easily, and quickly opened manually without the need for opening tools or equipment. This invention also involves the method for making such sealed container assemblies.

It is an object of this invention to provide a manually operated container which requires a minimal torque or like force to provide access to the contents, which may be liquids or solids packaged at pressures ranging from substantial vacuum through atmospheric pressure to substantial super-atmospheric pressure. It is an advantage of this invention that, while the container is closed by a thin diaphragm, usually of foils of stronger materials, such as steel, or a light-gauge sheet of aluminum or other metals having less tensile strength, the manual opening does not involve the puncturing or ripping of the diaphragm, thereby avoiding the danger of cutting the hands or lips, for example, of the user. Further, containers made according to this invention are re-closable, another advantage not achievable heretofore by containers employing manually operable sealing diaphragms.

Essentially, as indicated above, this invention involves the use of an inner sealing diaphragm and a relatively rigid and strong mechanically secured cap which protects the diaphragm during shipping and storage. Concededly this basic construction has been employed for years in packing liquids which were highly volatile or have highly volatile components, such as, for example, various petroleum spirits or other organic solvents packaged in metal cans. In such cases, the inner metallic seal functions both to prevent leakage and evaporation of the contents, but also to protect the resilient sealant in the usual screw cap from attack by the contents. In such container assemblies, the inner seal is usually forced mechanically into the container opening — requiring a sharp-edged or pointed tool to rupture and remove it — and the seal is effected by high pressure exerted by the outer screw cap; in order to exert such pressure, the cap is so tightly turned that the user usually needs pliers or a wrench to open it initially.

A variant of the above-described screw-top sealant cans has been used for anaerobic or hermetic packaging at atmospheric pressure of medicines, for example, in glass bottles having screw-cap closures. As a barrier to gases and vapors in the interim between packaging and opening for use, a thin foil disc, with or without a laminated reinforcing ply of paper and/or film is adhered over the mouth of the bottle beneath the screw cap. Functionally, the vulnerable point of such a seal is the gas and vapor transmission potential of the adhesive between the foil and rim of the bottle mouth; consequently, powerful adhesives are used so that the diaphragm must be ruptured to open the bottle after the cap has been removed. And possibly because the pressure of the cap or the disc may compact the adhesive and reduce its vapor transmission or because a mechanical as well as adhesive seal of the foil barrier is desired, the screw top is usually tightened down so that a gripping tool, if not essential, is very helpful in first

opening the screw cap and is faster than other expedients, such as tapping, heating the cap, etc.

Another prior art can closure upon which this present invention improves is the key-opened can, familiarly used for packing processed fish, most commonly sardines. Most such cans crimp the top to the body adjacent the tab initially wound, or the key, requiring an actual tearing of the metal and leaving an undesirable sharp edge as well as a portion partly closing the can opening. Certain styles of key-opened cans avoided such torn edges by relying solely on the soldering of the can top to the body so that the winding of the top on the key ruptured the soldering and allowed all of the top to be wound on the key; this eliminated a dangerous torn edge, but required a special tool, i.e., the key, which notoriously frequently failed, and, of course, the container was not re-closable.

As indicated at the outset, containers, particularly cans, closed according to this invention, require no tools for opening and are re-closable to the extent of preventing spilling and protecting the contents remaining in the container after opening, though not necessarily re-closable to the extent of restoring the original seal.

Other objects and advantages of this invention will be apparent from the drawings, in which:

FIG. 1 is a fragmentary plan view showing one method of "packing" the top closure for cylindrical cans to be stamped out of sheet material.

FIG. 2 is a fragmentary plan similar to FIG. 1, showing another arrangement.

FIG. 3 is a fragmentary plan showing a frequently preferred variant of the arrangement shown in FIG. 2.

FIG. 4 is a perspective view showing a top with integral tab stamped and folded for affixation to a cylindrical can.

FIG. 5 is a perspective view of a cylindrical can sealed with a top as shown in FIG. 4.

FIG. 6 is a detailed cross-section of a top section of cylindrical can having an assembled closure made according to this invention.

FIG. 7 is a perspective view similar to FIG. 5, but showing the assembled closed container.

Referring to the drawings illustrating a preferred embodiment of this invention, namely, a cylindrical metal can closed with a steel foil diaphragm, FIG. 1 illustrates the usual arrangement of circular portions intended to be stamped out of sheet material employed for closures. This arrangement is based on the assumption that, provided the sheet is of sufficient width or length, "packing" so that the lines from the center of any one blank to those of two adjacent tangent blanks will define a 60° angle, will provide the minimum waste or "scrap" area between the blanks. The assumption is true for such a "honeycomb" arrangement if the blanks are to be precisely circular. It is not true if some of the so-called "scrap" is to be used for an integral opening tab, as in this invention, and the reason is evident from FIG. 1. In such a "honeycomb" arrangement, and ignoring marginal losses, there are two areas of scrap for each blank; thus, in FIG. 1, there are two essentially triangular scrap areas *a* and *a'* for the blank A, two scrap areas *b* and *b'* for the blank B, etc.

A more economical arrangement to provide material for integral lifting tabs from such scrap areas is illustrated in FIG. 2, in which four rather than three blanks are tangent to each other about each non-marginal

scrap area. As indicated in FIG. 2, the lines between centers may define squares, leaving essentially quadrilateral scrap areas, but with one scrap area per blank, thus allowing material for one larger tab. Rather than having the essentially square waste area *d* for the blank D, the area *e* for the blank E, etc., as shown in FIG. 2, it is usually preferable to arrange the blanks in tangent rows with each row tangent to but offset from an adjacent row so that the resultant quadrilateral waste area per blank is rectangular, rather than square, as illustrated in FIG. 3 by the waste area *f* for the blank F, *g* for the blank G, etc. This allows the tab 11 for the top, shown in dotted line in the waste area *f*, to have greater length for gripping and an adequate width for strength which avoid excessive interference with the circular edge 12 by the straight fold, shown by the dotted line 13, when the tab 11 is folded back on the inner can top 10.

As shown in plan in FIG. 4, the inner can top 10 is provided with the integral reverse folded tab 11, stamped from a blank, such as the blank F shown in FIG. 3. As indicated, in stamping out the blank, the edges of the tab 11 may be provided with a slight bead around its edge to reduce the danger of cutting and with a dimple 14, which will raise the edge of the tab from the blank and allow it to be readily lifted for opening. Also, the edge of the top 10 may be formed with a slight annular groove 15 to accommodate the bead of the can body. This groove is usually formed after or during the operation which folds back the tab 11 so that its straight fold 13 will not interfere with the seating of the top 10 on the can body.

As indicated in cross-section in FIG. 5, the top 10 is sealed to the beaded edge 21 of the cylindrical can by means of an adhesive organic sealant 30, to be described in further detail below. The tensile strength of the sealant is adjustable and variable so that, together with the variability of the sealing area provided by the bead 21 and the groove 15, the tensile strength of the seal 30 will, in the absence of external forces, withstand the internal pressures, sub-atmospheric or super-atmospheric, which the can body 20 is otherwise capable of withstanding.

To protect the internal top 10 and its seal 30 from external forces which can be expected to arise from normal handling during shipping and storage, the can 20 is provided with a seemingly conventional lid 25 mechanically interlocked on the can by mating portions 26 and 27 formed in body 20 and flange of the lid 25, the portions 26 and 27 providing a wedging engagement by being in the form, for example, of interrupted threads to provide a bayonet type of lock. If need be, the usual circumferential bead 28 in the upper corner of the lid 25 is slightly enlarged to provide ample clearance for the folded edge 13 and thereby avoiding disturbing the top 10 by engagement between the slight projections left by the fold 13 and the interior of the lid 25 when it is twisted to interlock it upon the can body 20.

In order to permit easy opening of the can, the lid 25 is tightened by engagement of the portions 26 and 27 only to the point of bringing the inner surface of the lid into contact with the outer surface of the sealing groove 15. The lid 25 thus provides mechanical protection for the inner top 10 and also backs up the seal 30 if the packaged contents are suddenly shifted due to the external force of dropping. Since the seal 30 is suffi-

cient to withstand the fixed loads imposed by contents, no substantial pressure need be applied by the lid upon the groove 15 beyond that which is sufficient to create sufficient friction with and between the members 26 and 27 to resist the minimal torque which could be caused by shifting the container during handling and shipping. Being assembled on the container lightly and with minimal torque, the relatively rigid lid 25 may, thus, be readily dis-assembled by manual application of minimal torque.

With the lid 25 removed, opening of the container for access to the contents is easily accomplished by lifting the tab 11 and pulling it back to rupture the seal provided by the sealant 30. The sealant 30, while characterized by ample tensile strength (and adhesion to the adjacent surfaces of the bead 21 and the groove 15) is of a type characterized by relatively weak shear strength. Thus, while the sealant 30 is amply strong to resist the tensile loads imposed by internal pressure (or absence of pressure) under which the contents are packaged, it takes but a light transverse pull on the tab 11 to rupture the sealant in the vicinity of the fold 13. The concentration of a shear load at one point by the initial pull on the tab 11 and the subsequent concentration of shear force at two points where the top 10 is being pulled away from the bead 21 enables the top 10 therefore to be simply and easily peeled off the opening of the can body 20.

In this connection, it has been appreciated that generally the relative strengths of the sealant, per se, in tensile and shear, is also indicative of an even greater relative disparity in surface adhesion under tensile and shear load. Thus, sealants which are amply strong to withstand the tensile loads distributed over the entire sealed area can be formulated and selected to peel away from the surface of the bead or the groove in preference to rupturing the sealant itself under the shear load imposed by pulling on the tab 11. When the sealant is selected so as to peel from a surface under shear rather than rupture, it takes but a minute difference in preferential adhesion to the groove 15 rather than to the bead 21 to cause the sealant 30 to peel away with the lip 10, leaving the bead clean. Often the more greater area in the groove contacted by the sealant is sufficient to cause such preferential adhesion which makes the opened can body attractive for pouring or as a drinking vessel. If this difference in surface area is insufficient, the preferential adhesion may be provided by surface treatment and use of an adhesion primer.

For any particular container assembly made according to this invention, the most critical member is usually the adhesive sealant 30. Many details, some seemingly minor, such as (a) the contents to be packaged and the packaging pressures required, (b) the materials of the top 10 and the bead 21 and their respective surface finishes, (c) the ability of the package contents, of the material of the can 20 and 10, and of the surface ornamentation of the can body (labeling, lithography, printing, etc.) to withstand the temperatures for activating the sealant, (d) whether the seal 30 must be activated before filling (in which case the can is usually filled through the bottom and sealed in conventional filling and sealing equipment) or must be activated after filling, (e) the size of the container opening, (f) specific inertness or non-toxicity, etc., are all factors which may dictate selection of a particularly formulated adhesive for a specific packaging assembly.

Because of the vast variations dictated by specific packaging needs, it is impossible, in view of the current state of the art, to categorize all adhesive sealants which will meet the requirements of the sealant 30 so that it will be relatively weaker in strength and/or adhesiveness in direct shear than it is under tensile loads. By and large, the sealants having these physical characteristics are of the organic type which are activated by heat without significant evolution of volatile solvents or products of reaction. In somewhat more detail, this includes a wide variety of thermoset and reacted materials, such as plasticized epoxies, plastisols (or organosols which have substantially eliminated volatiles when processed to the gel stage), many of the vast number of so-called "hot melt" adhesives based on olefins, polyesters, and cellulosic resins modified by plasticizers and elastomers.

The following is the formulation of a specific embodiment of a sealant which was found operative for 0.004 in. plated steel foil tops 10 adhered to a 12 oz. beaded can body of 65 mm. diameter suitable for packaging soft drinks or the like:

	Parts (By weight)
Polyvinyl chloride resin, dispersion grade (Geon 121)	50
Polyvinyl chloride extender resin (Marvinol VR 10)	50
Non-toxic plasticizer ("DOP", such as Goodrich GP 264 alone, or mixed with, or replaced by a relatively tasteless plasticizer such as Citroflex A-4	20 to 120
Stabilizer (M&T Thermolite 13	1 to 5
Epoxy stabilizing plasticizer (Paraplex G-62	5 to 10
Adhesion-promoting plasticizer (Kodaflex AD-2)	30 to 70

The plastisols according to the foregoing formulas were prepared with the proportion of resin plasticizer varied according to the shear strength desired, the greater the proportion of plasticizer, the lower the shear strength. When the lower shear strength plastisols are employed, thixotropic thickening agents, such as non-toxic colloidal silicas (e.g., Cab-O-Sil) in the order of two to five parts are usually employed.

The sealant 30 was deposited as a ring in the groove 15 of the inverted top 10 and heated to 200° F. to gel the plastisol in the groove. The top, with the gelled sealant down, was then placed on the can body which was open at both ends and then contacted by a hot plate which quickly raised the gelled plastisol to 350° F. to fuse the sealant on the bead of the can body. The lid 25 was then placed on the can over the sealed top 10. Because the contents were to be packaged under pressure, the can body, with the lid 25 and top 10 forming the bottom closure, were then passed through a conventional filling and closing machine which closed with a conventional crimped seam. Depending upon the internal pressure, the cans withstood simulated handling and, upon manual removal of the lid, the top 10 was easily lifted from the can body. Because the relatively stiff top 10 was merely peeled away without permanent bending and distortion, it was easily replaced and the can re-closed by the lid 25.

If the contents are to be packaged at atmospheric pressure or under vacuum, it can be as convenient to close the filled container with the assembly of the sealed top 10 and lid 25. Other factors directing the choice of assembling the top 10 and lid 25 before or after filling may also be the type of labeling or orna-

mentation employed. The heat of fusion of the plastisol might discolor the lithography and, thus, closure before lithographing and filling would usually be recommended.

Although the above specific and illustrated examples were directed to the closure of metal cans, it is to be understood that, with a properly selected sealant, the closure may be applied to thermoplastic or thermosetting plastics as well as to glass bottles and jars, the rounded edge of the rim of the mouth of many heavier-walled bottles and jars constituting the appropriate bead. Further, the lid 25 is disclosed as a lid for a circular mouth opening which is mechanically engaged or dis-engaged by twisting. Particularly for closure with rectangular openings, it is to be understood that a sliding interlock for the outer lid 25 will be employed. Also, the lid 25 in any event may be of glass of appropriate plastic.

Accordingly, this invention is not to be limited to the particular embodiment disclosed but may be varied and modified without departing from the scope of this invention as set forth in the following claims.

What is claimed is:

1. In the method of making a sealed container assembly comprising a container body whose vertical walls provide a circular top opening having a planar edge closed by a top member, the steps of
 - a. forming said top by stamping the same from sheet material wherein a given top comprises an essentially circular closure area and an integral pull tab area and said areas are arranged in rows with the closure areas for other tops, said rows being arranged to locate four circular closure areas substantially tangentially to define an essentially quadrilateral area from which a pull tab area may be stamped integrally with its associated closure area,
 - b. reversely folding the said pull tab area at its line of juncture to the periphery of said circular closure area to a position substantially parallel to the surface of said closure area, and
 - c. thereafter joining the periphery of said top to the planar edge of the top opening of said container body with an organic sealant having greater tensile than shear strength and adhering the same to said periphery and edge to seal said opening.
2. The method as defined in claim 1 in which the substantially tangent closure areas are arranged in offset rows to provide for a given closure area one essentially rectangular oblong area from which an integral pull tab of greater length than width may be formed.
3. The method as defined in claim 1 including the step, prior to joining the top to the top opening of said container body, of forming a peripheral groove in said top to receive the planar edge of said top opening, the opening of said groove being in the surface of said top opposite the surface toward which said pull tab area is folded, the depth of said groove being adjusted with respect to the tensile strength of said organic sealant whereby the seal between said top and planar opening will, in the absence of external forces, withstand the internal pressures which the can body is otherwise to be subjected.
4. A method as defined in claim 1, including the step of assembling said sealed container with a lid enclosing said top and seal and connected to said container body with a releasably removable connection.
5. A method as defined in claim 1 in which said resinous sealant is a vinyl chloride plastisol and including the step of fusing said plastisol with the sealant located between said top and said planar edge.

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