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CONTAINER CLOSURE AND SEAL

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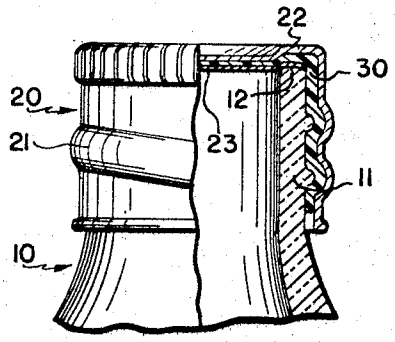


FIG.1

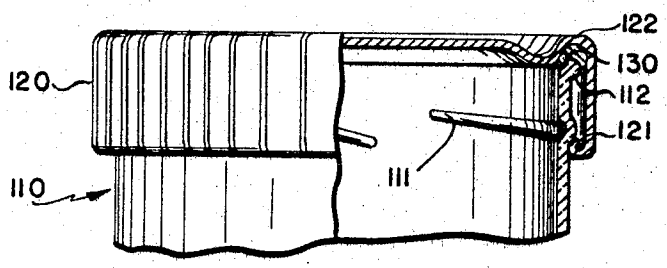


FIG.2

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CONTAINER CLOSURE AND SEAL

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ABSTRACT OF THE DISCLOSURE

A container closure has a seal made of an over-plasticized plastisol. When the closure is tightened the plasticizer bleeds from the plastisol and wets the interface between the closure and container.

This invention relates to closures for containers, and, more particularly, to very readily removable and resealable closures for containers, particularly rigid containers and packages.

With minor exceptions, such as glass containers employing tapered ground glass-to-glass seals, most closures for rigid containers, and particularly, resealable closures depend upon deformation of a sealing member engaged between the container at its opening and the closure member. Examples of such deformable sealing members are the familiar rubber jar rings, the cork lining and spots of crown closures, the gummy sealants or lutings lining the crimped joints of tin cans, and the like.

The closures made according to this invention overcome a long existent need of container closures, namely, a container closure that effectively and efficiently closes and seals after the contents are packaged therein but which may be readily opened and re-closed. A particular advantage of this invention is that it may be applied to conventional reclosable container closures without requiring significant, if any, changes in the equipment for manufacturing them or for alteration or modification of the package closing equipment employed in conventional packaging machinery. The absence of this feature has been an economic obstacle to many efforts heretofore made to improve and simplify the opening and closing of container closures. Another advantage of this invention is that the very physical characteristic of the sealing element of closures made according to this invention which effects its sealing function also allows it to function as a lubricant which makes the container easily opened and resealed.

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

FIGURE 1 is a fragmentary elevation, partly in section, of one specific embodiment of this invention, namely, a screw threaded closure cap secured on the mouth of a necked glass bottle.

FIGURE 2 is a fragmentary elevation, partly in section, of a wide-mouthed metal can closed by a metal lid. The relative thicknesses and proportions of the several components are distorted for purposes of illustration of these two exemplifications of the many types of containers and closures in which this invention may be employed.

As shown in FIG. 1 of the drawings, the bottle **10** is provided with a conventional closure thread **11** molded therein below the rim **12** of the bottle mouth. The bottle is closed by a conventional metal cap **20** having a closure

thread **21** formed in the depending skirt thereof, and an annular well **22**, in which the rim **12** may be received, the well and rim being spaced by the sealant **30**. The inside of the cap may carry the usual liner or spot **23** of inert metal, film, or paper carying an organic coating or laminated film to protect the metal of the cap from corrosion by the packaged contents and the contents from contamination or appearance of contamination by such corrosion.

In the bottle closure illustrated in FIG. 1, the sealant **30** may be confined in the conventional manner to the well **22** so that it may be deformed and provide sealing contact with the surface of the rim **12** only. In this preferred embodiment of a screw-top closure, however, the sealant **30** extends down the inside of the skirt of the cap **20**, particularly so as to line the load-carrying inner surface of the thread **21** in order to take full advantage of the lubricating property of the material of the sealant **30**.

In FIG. 2 a can **110** has interrupted threads **111** formed adjacent the bead **112** rolled at the mouth of the can. The can is closed by a conventional cap **120** having inwardly extending lugs **121** formed in the depending skirt of the lid. An annular well **122** is formed in the cap **120** and is filled with a sealant **130**. It is to be noted that in this embodiment in which only the well **122** is filled with the sealant, rather than having the sealant extend down inside the cap and between the lugs **121** which engage the underside of the thread **111**, the width of the well is preferably slightly greater than the width of the bead **112** and the bead does not touch either side of the well. The depth of the well is preferably equal to or greater than the width of the bead. This construction permits, due to the elastic property of the sealant **130**, a tight seal for contents packaged under pressure or vacuum, while allowing the cap to be opened or reclosed with a minimum of torque applied to disengage or engage the lugs **121** from the threads **111**.

The sealant **30** or **130** is an over-plasticized plastisol or organisol of an elastomeric thermoplastic resin, usually a vinyl homopolymer or copolymer or a mixed homopolymer and copolymer, such as a mixture of vinyl chloride and vinyl chloride-acetate. The term "over-plasticized" as used in this specification and its appended claims means that the plasticizer, as a non-volatile, relatively inert solvent or partial solvent for the resin is incompletely dissolved in the resin and "bleeds" as a slippery liquid film on the surface of the resinious sealant at the expected temperature of use of the closed container. Thus, the plasticizer may be a single solvent for the resinous component but in excess of the proportion which the resin can effectively and compatibly dissolve or absorb at room and storage temperatures for the products packaged in the closed container. Or the plasticizer may be a mixture of solvents comprising one liquid which is fully dissolved or absorbed in the resinous compound and a second less compatible liquid which is a solvent or swelling agent for the resinous component at the gelling and/or fusing temperatures of the plastisol or organisol but which is at least partially thrown out of solution when the gelled or fused plastisol returns to storage temperatures. Or the plasticizer may comprise a nonvolatile liquid which is fully incompatible with the resin at any temperature less than that at which the resin chars or dissociates but which couples directly or through a coupling agent with the non-volatile solvent for the resin.

The over-plasticized sealant, as applied in the closure at and during the time of use may be either gelled or have

been subjected to sufficiently higher temperatures beyond that at which gellation has occurred to bring the plastisol to a state of fusion or at least partial fusion. Plastisols which have been merely gelled may be perfectly satisfactory as sealants for closures or as lutings for container joints which may never be opened or opened only once. Due to the low tensile strength and "cheesy" nature of plastisols which have been gelled but not fused, plastisols which have been brought to their fusion temperatures to develop full strength and toughness are generally preferred as the sealants for closures which may be repeatedly opened and closed.

The use of an over-plasticized fused or gelled resilient plastisol as a sealant for a closure represents, in many respects, a backward step in the plastisol art, since heretofore an objective of the developments in the plastisol art has been to avoid the "bleed" or often "greasy" feel of the early plastisols. It is acknowledged that, in the light of the complex physical chemistry of plastisols and organisols, the following explanation of the operation and function of an over-plasticized plastisol as the sealant in closures made according to this invention may be, if not wholly incorrect, at least over-simplified.

Being a resilient composition, an over-plasticized plastisol, when employed as the material of a sealing member, of which the sealing members **30** and **130** are exemplifications, deforms under pressure to accommodate surface deviations in the area of contact between a sealing member and a container and its closure member. At the same time, such an over-plasticized plastisol is believed to behave as though it were a sponge having molecular-sized interstices in which the non-volatile plasticizing liquid is carried. Thus, the local pressure in the area of sealing contact on a sealing member made according to this invention need be only sufficient to deform the sealing member until it accommodates the deviations from the geometrically true surface of the sealing areas sufficiently to permit the plasticizing liquid to wet and, thereby, seal the interface between the sealing member and the adjacent container or closure. Accordingly, whereas a conventional resilient sealing member would require that the sealing member, to be effective, must be very tightly clamped between a container rim and closure to create very high localized ceiling pressures, a sealing member made according to this invention need have only a comparatively loose fit.

The foregoing is believed to explain why, when the sealing member is itself engaged between the two positions or elements of a container and closure, as is the case of the sealant **30** carried in the threads **21** of the bottle cap **20**, as shown in FIG. 1, minimal torque is required to twist the cap **20** off and on the bottle **10** to break the seal and seal it again. The liquid plasticizer carried by the over-plasticized plastisol of the sealing member **30** not only effects a tight seal but also functions as a non-drying lubricant to reduce any friction or drag between the threads of the bottle and cap. When there is no sealing member between the elements of the container and the closure which clamp the sealing member, as in the case of the embodiment shown in FIG. 2, the lugs **121** need not be tightened on the threads **111** to a degree whereby substantial resistance to opening and effectively reclosing the container is required. The sealing member **130** need only be compressed to the point that the plasticizing liquid carried by it wets the bead **112** of the can **110**. If a pressure differential exists between the contents of the can and the ambient atmosphere, it is believed that sealing is aided by the very pressure differential; this may be due to the fact that the sealant need not be fully compressed and, thereby, becomes relatively immobilized. Thus, if the contents are packaged under a vacuum, air pressure exerted on the sealant between the outside of the bead **112** and the skirt of the cap will tend to wedge the volume of the resilient sealant **130** between the inside of the bead **112** and the well **122**. Likewise, if the pressure on the contents is greater than atmospheric, then the sealant **130** will tend to be wedged between the outside of the bead and the cap, effecting in either case a sealing pressure which is not carried entirely by the load between the lugs **121** and the threads **111**.

Formulation of the plastisols from which the sealing members made according to this invention are made may vary widely according to the particular resins and plasticizers. The resins and plasticizers are dictated in many instances by the nature of the contents being packaged; that is, both the resin and plasticizers should be relatively inert with respect to the packaged contents. A typical formulation of a suitable vinyl plastisol for many types of packaged contents is as follows.

	Parts by weight
Resins:	
High molecular weight vinyl chloride homopolymer	45
Vinyl chloride acetate copolymer (96% vinyl chloride)	10
Plasticizers:	
Dioctyl phthalate	30
Triethylene glycol	10
Adjuncts:	
Stabilizer (cadmium naphthanate)	2
Pigment (titanium dioxide)	3

The resins, in the form of fine powders, and the adjuncts are dry-mixed and then stirred into the plasticizers, final stirring being under vacuum to provide a creamy de-aerated liquid, which gels at the temperature of 225–250° F. and fuses at approximately 375° F. Sealing members such as the members **30** or **130** may be cast directly in the caps **20** or **120** or cast or injection molded separately and then adhered in the closures by suitable adhesive, such as a phenolic varnish, depending upon whether the caps are painted or printed after or before receiving the sealing member. Whereas a resin-to-plasticizer ratio of 75:25 of the above resins and plasticizers will provide a fully plasticized, if rather stiff and dry, elastomeric product, the above ratio of 55:40 provides an over-plasticized and relatively soft elastomeric product having a somewhat "wet," i.e., greasy or slimy, feel.

It is to be understood that the term "plastisol" as used in the foregoing specification and the appended claims does not exclude organisols in which a solvent for the resin includes a component which volatilizes during gelling and/or fusion, providing there is a residual non-volatile solvent which leaves the resin over-plasticized. Nor is the term "plastisol" limited to gelled and fused dispersions of vinyl resin or thermoplastic resin only, but may include, for example, polystyrene or rubbers which have been over-plasticized or over-extended with aromatic oils.

What is claimed is:

1. In a rigid container having a seam therein, a sealing member extending between and contacting adjacent surfaces of the seam, said sealing member being a plastisol of an elastomeric resin containing sufficient incompletely dissolved non-volatile liquid plasticizer to wet the interface between said member and a surface of the container seam.

2. A rigid container as defined in caim **1** in which said seam is the area of contact between the mouth of a container and a closure therefor and the plastisol of said sealing member has been at least partly fused.

3. A rigid container as defined in claim **2** in which said container closure is provided with an annular well and said sealing member is located in said well and the mouth of the container is annular and may be seated against said sealing member.

4. A readily opened and closed rigid container as defined in claim **3** in which the mouth of the container is held in engagement with said sealing member by means providing a mechanical connection between the container and the closure therefor.

5. A readily opened and closed container as defined in

claim 4 in which said connecting means comprises mating threads on said closure and container and said sealing member extends between said threads.

6. A readily opened and closed container as defined in claim 4 in which the radial width of said annular well is greater than the width of the edge of the mouth of the container seated against said sealing member and the depth of said well is at least the width of said edge.

7. The method of sealing a seam in a rigid container comprising the steps of locating a sealing member consisting of an over-plasticized plastisol between adjacent surfaces of the container at said seam and creating sufficient pressure on said sealing member to bring it into contact with and wet at least one of said surfaces with a non-volatile liquid plasticizer which bleeds from said plastisol.

8. The method as defined in claim 7 in which said seam constitutes an area of contact between the mouth of a rigid container and a closure therefor.

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