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Kaercher et al.

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[54] **PLASTIC FILM FOR CONTAINER END CLOSURES**

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[52] **U.S. Cl.** **220/53**

[51] **Int. Cl.** **B65d 17/24**

[58] **Field of Search** 220/53, 54, 48, 27; 222/541

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[57] **ABSTRACT**

An improvement in a container end closure having a central panel and which can have secured to it within an aperture therein, a substantially rigid plug having a tear-out portion defined by score lines, the improvement which comprises including on the interior primer-coated surface of the container end and/or plug, a film which preferably is an unplasticized acrylic multipolymer comprising a blend of (1) a hard resinous terpolymer of acrylonitrile, styrene and methyl methacryalte, and (2) polybutadiene grafted with methyl methacrylate, styrene and acrylonitrile. The film can also be a hard, unplasticized thermoplastic comprising from about 85 to 100 percent polyvinyl chloride and from about 15 to 0 percent polyvinyl acetate. The film isolates the closure or plug metal from the container product and prevents corrosion of the metal and consequent contamination of the product. The acrylic multipolymer film can be applied in a single pass as a direct extrusion coating or film lamination.

45 Claims, 3 Drawing Figures

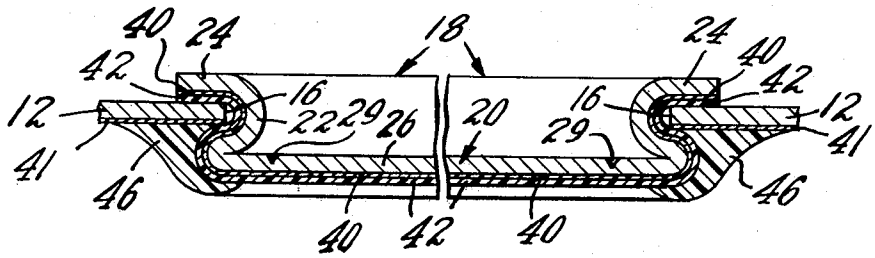

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Fig. 1

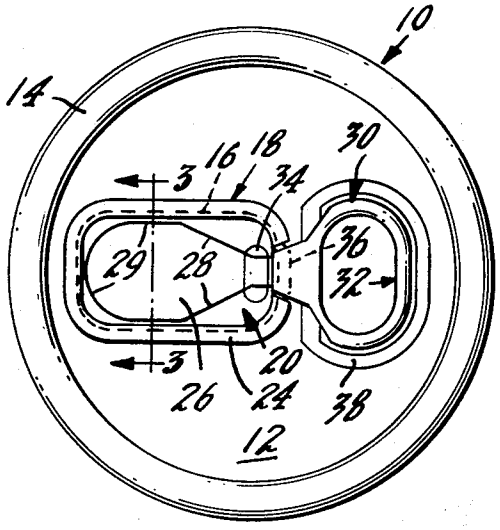
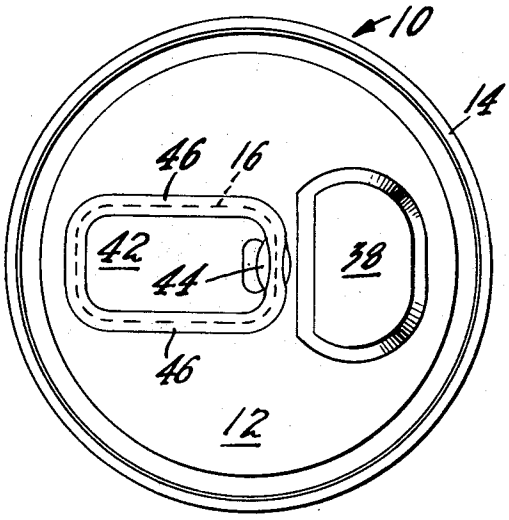


Fig. 2



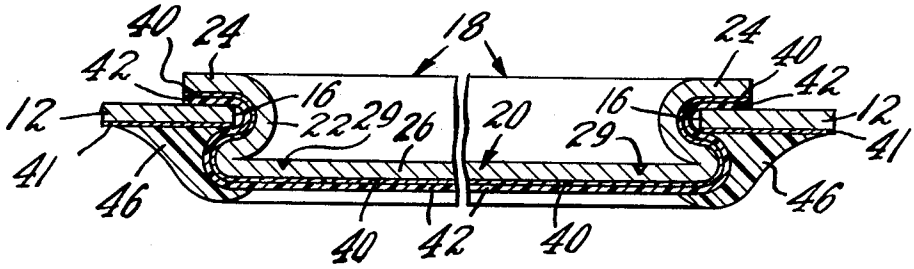


Fig. 3

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PLASTIC FILM FOR CONTAINER END CLOSURES

BACKGROUND OF THE INVENTION

Easy-open end closures for beverage containers are commonly comprised of a basic steel end having inserted in it an aluminum plug having a score-line-defined tear-out portion removable therefrom by means of a pull tab. The interior surfaces of the end closures and/or aluminum plugs are coated with polymeric materials to prevent the plugs from coming into contact with, being degraded by, affecting the taste of and contaminating beverage products. The coatings can be considered primers when one or more layers are placed thereover.

Solvent-containing organic primers or coatings developed and found adequate for isolating plugs from products such as beer and other carbonated beverages have been found inadequate as protection against more highly corrosive acid-salt containing products such as tomato juice. Conventional solvent coatings are inadequate for protecting, for example, aluminum plugs against acid-salt products because the coatings usually are low molecular weight polymers and usually have an elongation below about 5 percent. These factors mean that the coatings usually are not very tough or extensible. The coatings are thin and easily abraded. They crack, abrade and perforate during scoring, forming and staking plug fabrication operations, and thereafter allow the acid-salt products to seep through the coating and contact the aluminum metal. When this happens and such a product is also in contact with another metal such as steel in the container body walls or container end, the container and product act like a battery. The acid-salt content of the product acts as an electrolyte. This electrical occurrence causes relatively rapid corrosion of the more active metal.

Conventional solvent coatings are also inadequate because they are applied as a solution in thin layers, each of which must be baked to drive off its solvents. Acid-salt products require several such layers to attain an overall thickness giving sufficient protection. Applying the layers requires multiple steps, and, when several layers are employed, solvents are not as readily driven off and some remains to affect product taste. A further disadvantage to having several such layers is that they do not tear cleanly along a line of weakness. They leave objectionable frilling around the edges of the pouring and drinking hole when the container is opened as the easy-open tear-out portion and pull tab are removed from the plug.

The plastic film of this invention is advantageous because it is a tough, continuous, protective coating that withstands plug fabrication operations and truly protects end closures and/or aluminum plugs from deterioration by corrosive products, especially highly corrosive products such as food products like tomato juice. The plastic film is essentially solvent-free and can be applied as a relatively thick layer in comparison to conventional solvent-containing primers, in a single pass as a direct extrusion coating or film lamination. The film is taste and odor free, non-toxic, approved by the Food and Drug Administration, capable of being drawn into plug shape, does not degrade during plastisol baking operations, and cuts cleanly, not leaving objectionable frilling. Also, the film adheres to and is compatible with conventional metal-adhesive primers and with plastisols used to provide a hermetic seal between the container plug and end.

BRIEF SUMMARY OF THE INVENTION

This invention is an improvement in an end closure for a container body. The improvement comprises including on the interior surface of a central panel of an end closure and/or on a thin, substantially rigid plug inserted in an aperture of the panel, the panel or plug having a pull tab and a tear-out portion defined by score lines, an essentially solvent-free hard unplasticized thermoplastic film, preferably an acrylic multipolymer comprising a blend of (1) a hard, resinous terpolymer of acrylonitrile, styrene and methyl methacrylate, and (2) polybutadiene grafted with methyl methacrylate, styrene and acrylonitrile. The film can also be a polyvinyl chloride or a copolymer comprising from about 85 to 100 percent vinyl chloride and from about 13 to 0 percent vinyl acetate, preferably about 85 percent vinyl chloride and about 13 percent vinyl acetate. The film is applied over metals primed with conventional organic primers which adhere to container metals. The film isolates the metal surfaces from a product to be contained within a container body and prevents deterioration of the plug and contamination of the product. The plug can be of aluminum or an aluminum metal alloy and can be secured along all or only a major portion of the panel. If the latter, the tab can extend from the aperture at a point where the plug is not secured to the panel. The closure can be steel and can include a relatively hard sealing material such as a solid plastisol which can be placed over the film to seal the plug to all or a major portion of the surrounding portion of the end panel, and it can include a soft, pliable sealing material which can be placed over the film to seal the plug with the panel where the plug and tab join. The tear-out portion includes weakened lines such as score lines which define the tear-out portion of the plug.

Referring to the drawing:

FIG. **1** is a top plan view of an end closure embodying the instant invention.

FIG. **2** is a bottom plan view of the end closure of FIG. **1**.

FIG. **3** is an enlarged fragmentary cross sectional view taken substantially along lines **3—3** of FIG. **1**.

Referring to the Figures in detail:

FIG. **1** shows one embodiment of this invention. It shows an end closure generally designated **10** having a substantially flat circular central panel **12** and a peripheral, annular, outwardly extending cover hook **14** adapted to be secured to a container body by means of a conventional double seam (not shown). Panel **12** has an aperture or opening **16** (dashed line in FIG. **1**) in which is situated and to the edges of which is attached a plug generally designated **18** which closes and has the same general configuration as aperture **16**. Plug **18** includes a recessed panel **20** substantially parallel to the plane of central panel **12**, an integral, substantially U-shaped peripheral wall **22** (FIG. **3**) and an integral peripheral flange **24**. Recessed panel **20** includes a tear-out portion **26** defined by weakness or score lines **28** and **29**, a debossment **34**, and, extending from the tear-out portion of the panel and from the debossment, a pull or ring tab **30** having a grasping opening **32** for

receiving a finger and facilitating a pulling and lifting removal of tear-out portion **26** from the plug. Debossment **34** provides a reservoir or gathering spot for excess metal resulting from material being cut away from wall **22** and flange **24** adjacent to and under tab **30**. Panel **12** also includes a downwardly angled portion **36** which makes room for the neck of tab **30** and a D-shaped recessed tab area **38** in which ring tab **30** sits to prevent it from protruding too far above the plane of panel **12** and to obviate inadvertent container openings.

FIG. **2** is a bottom plan view of the container closure of FIG. **1** and shows film **42**, the improvement of this invention, on the bottom or interior surface of plug **18** (not specifically shown in FIG. **2**). Film **42** covers primer **40** (also not shown in FIG. **2**) on panel **12**, and is itself coated with a soft, pliable foamed plastisol sealing material **44** adjacent and juxtaposed to the junction of debossment **34** and downwardly angled portion **36** (not shown). A relatively hard, solid plastisol sealing material **46** covers a portion of foamed plastisol **44** and covers and runs along the entire perimeter of the substantially rectangular plug **18** covered by film **42**. The plastisols seal the plug to central panel **12**. Central panel **12** has a thin conventional end coating system (**41** in FIG. **3**) on it, and plastisols **42** and **44** partially lie thereover.

FIG. **3** is an enlarged fragmentary cross section taken along lines **3—3** of FIG. **1**. Plug **18** is shown secured and sealed within the edges of aperture **16** of central panel **12**. The Figure shows plug **18** having organic primer **40** on and along its entire bottom surface. On primer **40** there lies film **42**, the improvement of this invention.

Film **42**, shown in the drawing, is a relatively thin, essentially solvent-free acrylic multipolymer film comprising a blend of (1) a hard resinous terpolymer of acrylonitrile, styrene and methyl methacrylate, and (2) polybutadiene grafted with methyl methacrylate, styrene and acrylonitrile. Essentially solvent-free here means that before any plastisol baking operations, if any, only mere traces of solvent are present in the film. The acrylic multipolymer is one of a group of materials called XT polymers, sold by American Cyanamid Company and disclosed in U.S. Pat. No. 3,354,238 issued to Schmitt et al. on Nov. 21, 1967. The polymers are described in American Cyanamid Technical Data Sheet No. ACT 4 entitled "XT-Polymers, Typical Properties." Although any of the known XT polymers, i.e., XT 150, 250, 375 or 500, can advantageously be employed as the protective film of this invention, XT 375 is the preferred film.

Film **42** can also be a hard, unplasticized non-toxic thermoplastic material comprising from about 85 to 100 percent polyvinyl chloride and from about 15 to 0 percent polyvinyl acetate. Of these combinations, 100 percent polyvinyl chloride is preferred, and preferably it has a molecular weight of about 142,000. The polyvinyl chloride material can be a solution cast material such as sold under the code designation of C–105 by Cadillac Plastics & Chemical Company, a Division of DAYCO Corporation, or it can be a calendered material such as sold as U.S. 2000 by American Hoechst Corporation, and the polyvinyl acetate can be a material extrudable as a film such as sold as VG AA 0403 by Union Carbide Corporation. Properties of the C–105 polyvinyl chloride are described in a publication entitled "Cast Films: Properties and Uses" published by the aforementioned Cadillac Company.

The aforementioned materials which can be employed as film **42** according to this invention, have been found to have a tensile strength generally ranging above from about 5,500 psi.

Preferred protective multipolymer film **42** can be directly extruded or laminated as a film onto a web of any of the primer-coated metals currently used as container end closures such as aluminum alloys, tin plate and Tin Free Steel (TFS), and used as plugs, such as aluminum and aluminum alloys. The metals preferably are webs when the film is applied, but they can also, though less preferably, be sheets or be already formed into ends and plugs or formed and secured to each other. It is essential that the metals be primed. The XT polymers do not adhere satisfactorily to container metals, but adhere well to the metals when primed with conventional metal-adhering primers (discussed later).

The aforementioned less preferred materials which can be employed as film **42** can be applied to primed container metals by any suitable means known in the art. Film **42** can be used on primed container components, i.e., on container bodies, end closures or plugs, or on any combination thereof.

Film **42** is thick in comparison to conventional solution-applied solvent-containing coatings or primers. The thickness of film **42** can range from about 0.5 to about 3.5 mils or more, preferably from about 1.0 to 3.0 mils and more preferably from about 1.0 to 2.0 mils. The latter range is preferred for easy-opening ends because at such thicknesses there is little or no frilling. It has been found that at thicknesses below about 1.0 mil, pinholes and gel particles increase in number and become increasingly problematical. At thicknesses above about 3.0 mils, for easy-opening ends, frilling increases and becomes increasingly unacceptable, but such thicknesses can be acceptable for ends not having easy-opening means. It has been found that highly satisfactory results are obtained at thicknesses of about 1.0 mil. For example, performance studies of various containers holding tomato juice and stored at 98° F showed that after two months storage, containers having plain, i.e., uncoated, tin plate bodies and having conventional end closures, i.e., tin plate ends and aluminum plugs, coated with conventional solvent-containing organic vinyl primers, suffered severe corrosion and plug perforations and failures, whereas after about three months storage at the same temperature, containers having the same bodies and end closures having aluminum plugs protected by a 1.0 mil XT 375 film had only very slight corrosion.

Primer **40** can be any suitable organic primer commonly used on and adhering to metals used for container bodies, ends and plugs. Examples of such metals are steel, i.e., tin plate or TFS, aluminum, or aluminum alloys. The primer can be pigmented or non-pigmented. It can be a thermoset-modified vinyl such as a phenolic-modified vinyl, or a thermoset-modified acrylic such as an acrylic epoxy-phenolic material, either of which is commonly used to coat beer and beverage containers, or it can be a hot melt adhesive,

i.e., a dry adhesive film rendered tacky or fluid by the application of heat or heat and pressure, or a combination of more than one such materials such as a blend of an ethylene-vinyl acetate-acrylic acid terpolymer, e.g., Elvax-4355, sold by E. I. du Pont de Nemours and Company, and a polyterpene resin, e.g., Nirez 1135, sold by Hayden-Newport Chemical Corporation. Another example of a hot melt adhesive which can be utilized as primer **40** is a polyamide adhesive such as Versalon XR 513 or XR 1140, sold by General Mills Company. Still other suitable primers which are adherent to container metals and to film **42** can be employed by individuals skilled in the art.

Primer **40** can be applied to desired container surfaces by any suitable means such as roller coating or other means utilizable by those skilled in the art.

Primer **41** is a conventional coating system for end closures. The primer can be an organosol or a two-part system of an epoxy-U.F. base coat and a modified vinyl top coat. When the primer is used to coat easy-open ends utilizing a plug protected by film **42**, the primer must be compatible, i.e., adhere to, sealants **44** and **46**, which in turn adhere to film **42**. It is therefore not necessary that film **42** adhere to primer **41**.

Primer **40**, when it is a conventional solvent-containing primer, is, due to characteristics of its component polymers, applied as a solution as a thin layer. It is then baked to drive off solvents and effect a bond to, for example, aluminum. After solvents are driven off, the remaining baked primer **40**, by itself, is too thin, i.e., from about 0.05 to 0.2 mil, and not tough enough to withstand considerable and severe plug forming operations during which it acquires pinholes and perforations to make it sufficiently discontinuous that it is not an acceptable protection against electrolytically corrosive acid-salt-containing or other corrosive products. Primer **40** adheres well to container metals and film **42** adheres to primer **40**.

Soft, pliable sealant **44**, shown in the drawing and employed along the uncrimped side of plug **18** at the junction of debossment **34** and downwardly angled portion **36**, is a foamed plastisol, but can be a highly filled plastisol or any other strongly adherent material having low cohesive strength such that when force is applied by lifting tab **30**, the material fractures along lines substantially parallel to the lines of weakness in the end closure. A typical plastisol formation suitable for use as sealant **44** is disclosed in U.S. Pat. No. 3,002,641, herein incorporated by reference. Briefly, the function of the soft sealant is to hermetically seal plug **18** with panel **12** and stretch during initial rupture of the end closure along score lines **28** and **29**. Subsequently, the material tears, and, it is thought that the material reduces tensional forces subjected to ring tab **30** and tending to fracture the tab at its inner end adjacent to where it merges with tear-out portion **26**. Although use of sealant **44** is limited to areas such as the aforementioned juncture for containers having high internal pressure, the sealant can be used by itself, i.e., without had sealant **46**, to seal entire peripheries of plugs for containers having little internal pressure such as those for vacuum packed products.

Sealant **46**, employed along and adjacent to the adjoining areas of recessed panel **20**, peripheral wall **22**, and panel **12** outwardly of tear-out portion **26** defined by weakness or score line **28**, is a suitable relatively hard, solid plastisol. A typical such plastisol formulation suitable for employment at this location is also disclosed in the aforementioned U.S. Pat. No. 3,002,641. Sealant **46** seals the crimped major portion of plug **18** to central panel **12** in the embodiment shown on the drawing and as described in U.S. Pat. No. 3,308,986, herein incorporated by reference, but the sealant can also be used to seal the entire periphery of the plug without use of a soft sealant as shown and described in U.S. Pat. No. 3,223,277, also incorporated herein by reference. Both sealants **44** and **46** are non-toxic, relatively impermeable, and together the materials provide a hermetic, liquid-tight seal between plug **18** and central panel **12**.

Briefly, the hard and soft plastisols can be applied in liquid form to the sides of the plug, thereby allowing the plastisols to flow into any of the interstices between plug **18** and panel **12**. The end closure can then be placed in an oven to fuse and cure the plastisols. The heat of the baking operation causes unfoamed plastisol **46** to fuse and cure in a known manner and also produces a foamed or cellular structure in the hot, liquid plastisol **44**.

During cooling, subsequent to the baking operation, plastisol **44** hardens and forms a strong, permanent, liquid-tight, hermetic seal along peripheral wall **22** where the plug periphery is crimped to the panel surface adjacent to the aperture **16**. This plastisol seal and the mechanical and frictional crimping of the plug coact to establish a strong rigid connection between the crimped periphery of the plug and the panel, thereby causing the end closure to function as a conventional unitary end closure. Upon cooling, foamed plastisol **44** retains its cellular disposition and thereby insures a soft, pliable structure inherently weaker than that of hard plastisol **46**. When both plastisols are employed, it is preferred that cross sectional dimensions of foamed plastisol **44** be larger than corresponding dimensions of hard plastisol **46**. By enlarging the cross sectional area of foamed plastisol **44**, adequate strength and sealing of the uncrimped side of plug **18** is insured. If desired, other soft, pliable materials with low internal strength may be substituted for the foamed plastisol. Examples of substitutes are solid plastisols compounded with a suitable percentage of inert filler.

The end closure shown in the drawing is merely one embodiment of the end closures on which film **42** can be employed. The end closures need not but can have a plug and/or pull tab, and the closures, components and attachments can be of other types, configurations and features. For example, the end can be non-circular, non-planar, have reinforcing beads, and have or not have plugs or integral or inverted pull tabs. The end closures, components and attachments can be of any suitable container metal. Usually, the closures are of tin plate or tin free steel and the plugs are aluminum or an aluminum alloy. Preferably, the aluminum or aluminum alloy materials are Alodine treated, i.e., subjected to a chemical conversion treatment to provide them with a uniform and stable oxide surface which enhances adhesion of coatings and primers applied thereto.

We claim:

1. An improvement in an end closure for a container body comprising:

a central panel having an aperture therein;

a thin, substantially rigid plug within said aperture and secured to said panel along the portion of said panel that forms and surrounds said aperture, said plug including a tear-out portion defined by weakened lines in said plug, and said plug being coated on its bottom surface with an organic primer that is adherent to container metals;

a pull tab for removing said tear-out portion from said plug;

the improvement which comprises including on said primercoated surface an essentially solvent-free acrylic multipolymer film comprising a blend of (1) a hard, resinous terpolymer of acrylonitrile, styrene and methyl methacrylate, and (2) polybutadiene grafted with methyl methacrylate, styrene and acrylonitrile, said film being adherent to said primer and being for isolating said surface from a product to be contained within said container body and for preventing deterioration of said plug and/or contamination of said product.

2. The improvement of claim **1** wherein said plug is an aluminum metal alloy.

3. The improvement of claim **2** wherein said plug is secured to said panel along the major portion of said panel that forms and surrounds said aperture.

4. The improvement of claim **3** wherein said pull tab extends away from said aperture at a point where said plug is free from securement to said panel.

5. The improvement of claim **1** wherein said end closure also comprises:

a relatively hard sealing material sealing said plug to said panel along said surrounding portion of said plug;

and a soft, pliable sealing material hermetically sealing said plug with said panel where said plug and said tab join to reduce tensional forces tending to fracture said tab as it is pulled to remove said tear-out portion from said plug.

6. The improvement of claim **2** wherein said end closure also comprises:

a relatively hard sealing material sealing said plug to said panel along said surrounding portion of said plug;

and a soft, pliable sealing material hermetically sealing said plug with said panel where said plug and said tab join to reduce tensional forces tending to fracture said tab as it is pulled to remove said tear-out portion from said plug.

7. The improvement of claim **3** wherein said end closure also comprises:

a relatively hard sealing material sealing said plug to said panel along said surrounding portion of said plug;

and a soft, pliable sealing material hermetically sealing said plug with said panel where said plug and said tab join to reduce tensional forces tending to fracture said tab as it is pulled to remove said tear-out portion from said plug.

8. The improvement of claim **4** wherein said end closure also comprises:

a relatively hard sealing material sealing said plug to said panel along said surrounding portion of said plug;

and a soft, pliable sealing material hermetically sealing said plug with said panel where said plug and said tab join to reduce tensional forces tending to fracture said tab as it is pulled to remove said tear-out portion from said plug.

9. The improvement of claim **5** wherein said hard sealing material is a solid plastisol.

10. The improvement of claim **9** wherein said soft sealing material is a foamed plastisol.

11. The improvement of claim **6** wherein said hard sealing material is a solid plastisol and said soft sealing material is a foamed plastisol.

12. The improvement of claim **7** wherein said hard sealing material is a solid plastisol and said soft sealing material is a foamed plastisol.

13. The improvement of claim **8** wherein said hard sealing material is a solid plastisol and said soft sealing material is a foamed plastisol.

14. An improvement in an end closure for a container body comprising:

a central panel having an aperture therein;

a thin, substantially rigid plug within said aperture and secured to said panel by crimping along the major portion of the periphery of said plug, and said plug being coated on its bottom surface with an organic primer that is adherent to container metals;

a pull tab for removing a tear-out portion from said plug, said tab extending away from said aperture at a point where said plug is free from securement to said panel, said tear-out area defined by score lines in said plug;

a relatively hard solid plastisol sealing material sealing said plug with said panel along said major secured portion of the periphery of said plug;

and a soft, pliable foamed plastisol sealing material hermetically sealing said plug with said panel where said plug and said tab join to reduce tensional forces tending to fracture said tab as it is pulled to remove said tear-out portion from said plug, the cross section of said soft sealing material being greater than the cross section of said hard sealing material in order to provide adequate strength where said plug is free from securement to said panel;

the improvement which comprises including on said primercoated surface an essentially solvent-free acrylic multipolymer film comprising a blend of (1) a hard, resinous terpolymer of acrylonitrile, styrene and methyl methacrylate, and (2) polybutadiene grafted with methyl methacrylate, styrene and acrylonitrile, said film being adherent to said primer and being for isolating said surface from a product to be contained within said container body and for preventing deterioration of said plug and/or contamination of said product.

15. The improvement of claim **14** wherein said plug is an aluminum metal alloy.

16. The improvement of claim **15** wherein said primer and said film are also included on said panel.

17. An improvement in an end closure for a container body comprising a central panel having score lines and easy-opening means for effecting an opening within said score lines in said panel, said panel being coated with an organic primer that is adherent to container metals;

the improvement which comprises applying to said primer an essentially solvent-free acrylic multipolymer film comprising a blend of (1) a hard, resinous terpolymer of acrylonitrile, styrene and methyl methacrylate, and (2) polybutadiene grafted with methyl methacrylate, styrene and acrylonitrile, the film being adherent to said primer and being for isolating said panel from a product to be contained within said container body and for preventing deterioration of said panel and/or contamination of said product.

18. An improvement in an end closure for a container body comprising a central panel coated with an organic primer that is adherent to container metals;

the improvement which comprises applying to said primer an essentially solvent-free acrylic multipolymer film comprising a blend of (1) a hard, resinous terpolymer of acrylonitrile, styrene and methyl methacrylate, and (2) polybutadiene grafted with methyl methacrylate, styrene and acrylonitrile, the film being adherent to said primer and being for isolating said panel from a product to be contained within said container body and for preventing deterioration of said panel and/or contamination of said product.

19. An improvement in an end closure for a container body comprising:

a central panel having an aperture therein;

a thin, substantially rigid plug within said aperture and secured to said panel along the portion of said panel that forms and surrounds said aperture, said plug including a tear-out portion defined by weakened lines in said plug, and said plug being coated on its bottom surface with an organic primer that is adherent to container metals;

a pull tab for removing said tear-out portion from said plug;

the improvement which comprises including on said bottom surface an essentially solvent-free hard unplasticized thermoplastic film comprising from about 85 to 100 percent polyvinyl chloride and from about 15 to 0 percent polyvinyl acetate, the film being adherent to said primer and being for isolating said surface from a product to be contained within said container body and for preventing deterioration of said plug and/or contamination of said product.

20. The improvement of claim **19** wherein said plug is an aluminum metal alloy.

21. The improvement of claim **20** wherein said plug is secured to said panel along the major portion of said panel that forms and surrounds said aperture.

22. The improvement of claim **21** wherein said pull tab extends away from said aperture at a point where said plug is free from securement to said panel.

23. The improvement of claim **19** wherein said end closure also comprises:

a relatively hard sealing material sealing said plug to said panel along said surrounding portion of said plug;

and a soft, pliable sealing material hermetically sealing said plug with said panel where said plug and said tab join to reduce tensional forces tending to fracture said tab as it is pulled to remove said tear-out portion from said plug.

24. The improvement of claim **20** wherein said end closure also comprises:

a relatively hard sealing material sealing said plug to said panel along said surrounding portion of said plug;

and a soft, pliable sealing material hermetically sealing said plug with said panel where said plug and said tab join to reduce tensional forces tending to fracture said tab as it is pulled to remove said tear-out portion from said plug.

25. The improvement of claim **21** wherein said end closure also comprises:

a relatively hard sealing material sealing said plug to said panel along said surrounding portion of said plug;

and a soft, pliable sealing material hermetically sealing said plug with said panel where said plug and said tab join to reduce tensional forces tending to fracture said tab as it is pulled to remove said tear-out portion from said plug.

26. The improvement of claim **22** wherein said end closure also comprises:

a relatively hard sealing material sealing said plug to said panel along said surrounding portion of said plug;

a soft, pliable sealing material hermetically sealing said plug with said panel where said plug and said tab join to reduce tensional forces tending to fracture said tab as it is pulled to remove said tear-out portion from said plug.

27. The improvement of claim **19** wherein said hard sealing material is a solid plastisol.

28. The improvement of claim **27** wherein said soft sealing material is a foamed plastisol.

29. The improvement of claim **24** wherein said hard sealing material is a solid plastisol and said soft sealing material is a foamed plastisol.

30. The improvement of claim **25** wherein said hard sealing material is a solid plastisol and said soft sealing material is a foamed plastisol.

31. The improvement of claim **26** wherein said hard sealing material is a solid plastisol and said soft sealing material is a foamed plastisol.

32. An improvement in an end closure for a container body comprising:

a central panel having an aperture therein;

a thin, substantially rigid plug within said aperture and secured to said panel by crimping along the major portion of the periphery of said plug, and said plug being coated on its bottom surface with an organic primer that is adherent to container metals;

a pull tab for removing a tear-out portion from said plug, said tab extending away from said aperture at a point where said plug is free from securement to said panel, said tear-out area defined by score lines in said plug;

a relatively hard solid plastisol sealing material sealing said plug with said panel along said major secured portion of the periphery of said plug;

and a soft, pliable foamed plastisol sealing material hermetically sealing said plug with said panel where said plug and said tab join to reduce tensional forces tending to fracture said tab as it is pulled to remove said tear-out portion from said

plug; the cross section of said soft sealing material being greater than the cross section of said hard sealing material in order to provide adequate strength where said plug is free from securement to said panel;

the improvement which comprises including on said primercoated bottom surface an essentially solvent-free hard unplasticized thermoplastic film comprising from about 85 to 100 percent polyvinyl chloride and from about 15 to 0 percent polyvinyl acetate, the film being adherent to said primer and being for isolating said surface from a product to be contained within said container body and for preventing deterioration of said plug and/or contamination of said product.

33. The improvement of claim 32 wherein said plug is an aluminum metal alloy.

34. The improvement of claim 14 wherein said primer and said film are also included on said panel.

35. An improvement in an end closure to a container body comprising a central panel having score lines and easy-opening means for effecting an opening within said score lines in said panel, said panel being coated with an organic primer that is adherent to container metals;

the improvement which comprises including on the bottom surface of said panel an essentially solvent-free hard unplasticized thermoplastic film comprising from about 85 to 100 percent polyvinyl chloride and about 15 to 0 percent polyvinyl acetate, the film being adherent to said primer and being for isolating said panel from a product to be contained within said container body and for preventing deterioration of said panel and/or contamination of said product.

36. An improvement in an end closure to a container body comprising a central panel coated with an organic primer that is adherent to container metals;

the improvement which comprises including on the bottom surface of said panel an essentially solvent-free hard unplasticized thermoplastic film comprising from about 85 to 100 percent polyvinyl chloride and about 15 to 0 percent polyvinyl acetate, the film being adherent to said primer and being for isolating said surface from a product to be contained within said container body and for preventing deterioration of said panel and/or contamination of said product.

37. An improvement in an end closure for a container body comprising:

a central panel having an aperture therein;

a thin, substantially rigid plug within said aperture and secured to said panel along the portion of said panel that forms and surrounds said aperture, said plug including a tear-out portion defined by weakened lines in said plug, and said plug being coated on its bottom surface with an organic primer that is adherent to container metals;

a pull tab for removing said tear-out portion from said plug;

the improvement which comprises including on said bottom surface an essentially solvent-free hard unplasticized thermoplastic film selected from the group consisting of (A) a blend of (1) a hard, resinous terpolymer of acrylonitrile, styrene and methyl methacrylate, and (2) polybutadiene grafted with methyl methacrylate, styrene and acrylonitrile, (B) a polyvinyl chloride, and (C) a copolymer comprising about 85 percent vinyl chloride and about 13 percent vinyl acetate, the film being adhered to said primer and being for isolating said surface from a product to be contained within said container body and for preventing deterioration of said plug and/or contamination of said product.

38. The improvement of claim 37 wherein said plug is an aluminum metal alloy.

39. The improvement of claim 38 wherein said end closure also comprises:

a relatively hard sealing material sealing said plug to said panel along said surrounding portion of said plug;

and a soft, pliable sealing material hermetically sealing said plug with said panel where said plug and said tab join to reduce tensional forces tending to fracture said tab as it is pulled to remove said tear-out portion from said plug.

40. The improvement of claim 39 wherein said hard sealing material is a solid plastisol and said soft sealing material is a foamed plastisol.

41. An improvement in an end closure for a container body comprising:

a central panel having an aperture therein;

a thin, substantially rigid plug within said aperture and secured to said panel by crimping along the major portion of the periphery of said plug, and said plug being coated on its bottom surface with an organic primer that is adherent to container metals;

a pull tab for removing a tear-out portion from said plug, said tab extending away from said aperture at a point where said plug is free from securement to said panel, said tear-out area defined by score lines in said plug;

a relatively hard solid plastisol sealing material sealing said plug with said panel along said major secured portion of the periphery of said plug;

and a soft, pliable foamed plastisol sealing material hermetically sealing said plug with said panel where said plug and said tab join to reduce tensional forces tending to fracture said tab as it is pulled to remove said tear-out area from said plug, the cross section of said soft sealing material being greater than the cross section of said hard sealing material in order to provide adequate strength where said plug is free from securement to said panel;

the improvement which comprises including on said bottom surface an essentially solvent-free hard unplasticized thermoplastic film selected from the group consisting of (A) a blend of (1) a hard, resinous terpolymer of acrylonitrile, styrene and methyl methacrylate, and (2) polybutadiene grafted with methyl methacrylate, styrene and acrylonitrile, (B) a polyvinyl chloride, and (C) a copolymer comprising about 85 percent vinyl chloride and about 13 percent vinyl acetate, the film being adherent to said primer and being for isolating said surface from a product to be contained within said container body and for prevent-

ing deterioration of said plug and/or contamination of said product.

42. The improvement of claim **41** wherein said plug is an aluminum metal alloy.

43. The improvement of claim **37** wherein said primer and said film are also included on said panel.

44. An improvement in an end closure for a container body comprising:

a central panel having score lines and easy-opening means for effecting an opening within said score lines in said panel, the bottom surface of said panel being coated with an organic primer that is adherent to container metals;

the improvement which comprises including on said bottom surface an essentially solvent-free hard unplasticized thermoplastic film selected from the group consisting of (A) a blend of (1) a hard, resinous terpolymer of acrylonitrile, styrene and methyl methacrylate, and (2) polybutadiene grafted with methyl methacrylate, styrene and acrylonitrile, (B) a polyvinyl chloride, and (C) a copolymer of about 85 percent vinyl and about 13 percent vinyl acetate, said film being adherent to said primer and being for isolating said surface from a product to be contained within said container body and for preventing deterioration of said panel and/or contamination of said product.

45. An improvement in an end closure to a container body comprising a central panel coated with an organic primer that is adherent to container metals;

the improvement which comprises including on the bottom surface of said panel an essentially solvent-free hard unplasticized thermoplastic film selected from the group consisting of (A) a blend of (1) a hard, resinous terpolymer of acrylonitrile, styrene and methyl methacrylate, and (2) polybutadiene grafted with methyl methacrylate, styrene and acrylonitrile, (B) a polyvinyl chloride, and (C) a copolymer of about 85 percent vinyl and about 13 percent vinyl acetate, said film being adherent to said primer and being for isolating said surface from a product to be contained within said container body and for preventing deterioration of said panel and/or contamination of said product.

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