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Fourier

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[54] **EASY OPENING CONTAINER WITH SAFETY EDGE COMPOUNDS**

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[52] **U.S. Cl.** ..... **220/271;** 220/276; 220/90.6; 260/30.4 R; 260/30.4 A; 260/30.4 EP; 260/30.4 N; 260/32.8 R; 260/32.8 A; 260/32.8 EP; 260/32.8 N; 260/33.6 A; 260/33.6 EP; 260/33.6 UA; 260/42.47; 260/42.49; 260/42.52; 260/42.54; 260/890

[51] **Int. Cl.**.. **A47g 19/22;** B65d 17/20; C08c 11/32

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[57] **ABSTRACT**

Easy open containers, particularly those of the full-panel type, having safety edge compound applied to the scored metal area of the end are provided whereby, upon pulling the tab to open the container, the compound tears at the score line with a portion remaining on the metal edge of the removable panel as well as on the container rim giving protection to the consumer against cutting on raw metal edges to the ends thus treated.

18 Claims, 3 Drawing Figures

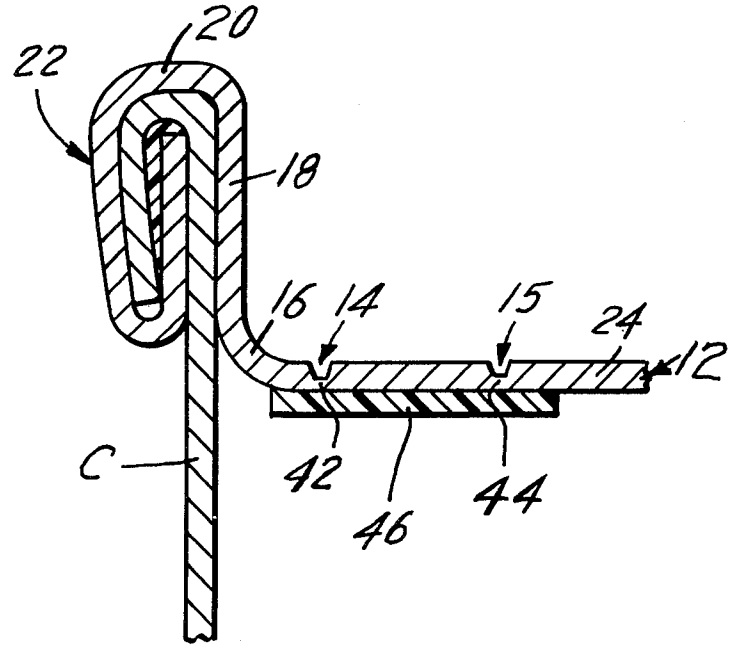


FIG. 1

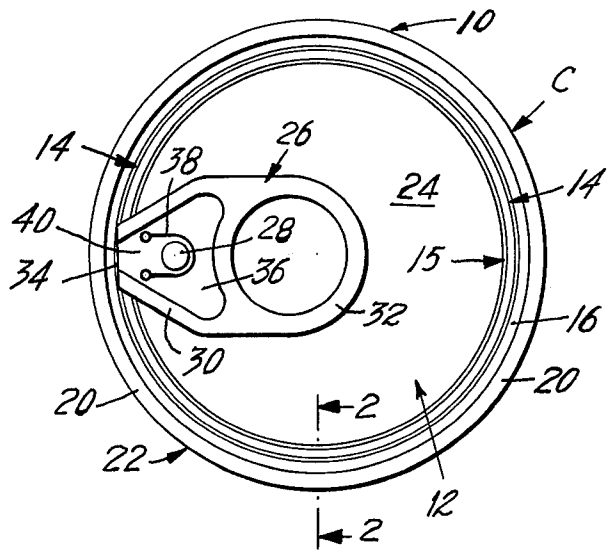


FIG. 2

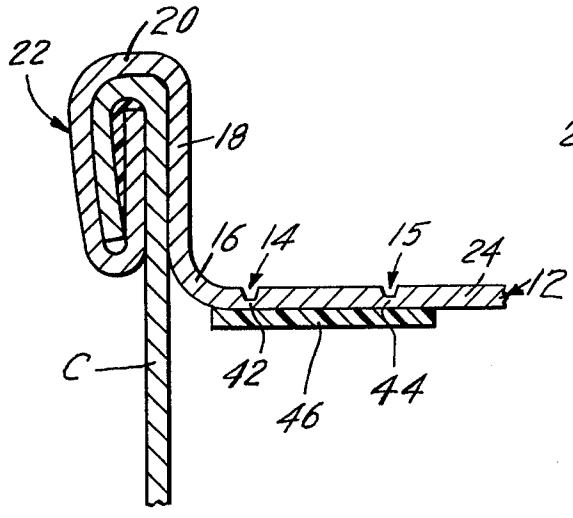
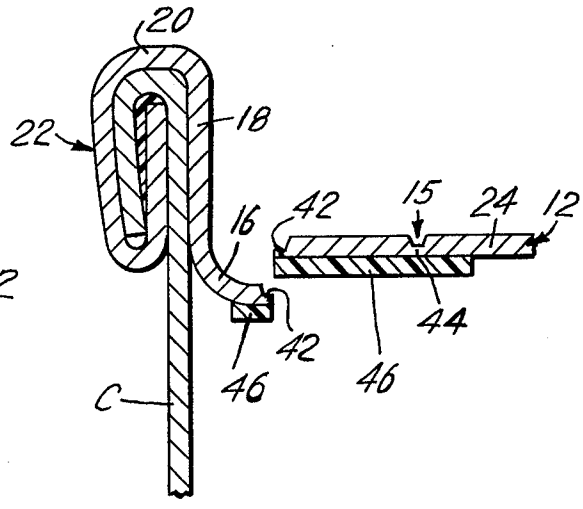


FIG. 3



EASY OPENING CONTAINER WITH SAFETY EDGE COMPOUNDS

BACKGROUND OF THE INVENTION

This invention relates to containers and in particular to new and improved easy opening ends for containers.

Heretofore metallic containers have been provided with easy-opening means to facilitate the emptying of the contents therefrom. These prior structures have been generally characterized by a structure in which a tear potion defined by a scored line in the container is separated from the container. Although such easy opening containers have been readily accepted by the public, several disadvantages have made their use less than totally satisfactory. Perhaps the major disadvantage has been insufficient protection of the raw, sharp metal edges which result when the removable portion is torn from the end.

Many proposals have been made in the can making industry to solve the problems presented by the unprotected raw metal edges of such containers. Many of such proposals include application of plastisols to the score area of the removable portion so that when the can end is opened, the plastisol will separate along the score line with a portion remaining on the end in the areas of the score line which serves to protect, to a certain extent, the raw metal edge thereby diminishing the likelihood of being cut. Plastisol materials proposed as safety edge compounds are basically vinyl chloride-resin containing suspensions in non-aqueous liquids which do not dissolve the resin at ordinary temperature, such liquids normally being plasticizers. Such suspensions can be converted to films by heating to approximately 340°F to above 380°F depending upon the type of plasticizer used. While the use of plastisols has afforded some protection from raw metal edges, such compounds are totally unsatisfactory for many applications.

A satisfactory safety edge compound should desirably possess the following properties for broad application and use; particularly for containers packed with edible goods:

1. Resistance to edible fats and oils
2. Suitable extractive levels required by the FDA for food contact surfaces, i.e. insolubility in common solvents such as water, alcohol, etc.
3. Resistance to heat thereby achieving acceptance for aseptic container steam sterilization and thermal heat processing of the packed products.
4. Good adhesion to the various types of resinous coated substrates as well as to laminate and/or unprimed substrates.
5. Curing and drying at low temperatures for easy and economical manufacture.
6. Ready application through conventional equipment and simplicity of manufacture.
7. Satisfactory physical properties, for example, elongation, tensile strength, tear strength, etc. to permit the compound to tear cleanly, i.e. without fragments, stringing and frills when the container is opened.

Plastisols are decidedly deficient in many of the above mentioned criteria particularly where the container is to be packed with edible goods. For example, plastisols, in general, do not meet FDA extractive levels, do not possess resistance to heat and moisture encountered under aseptic processing conditions and require specific primers for adhesion to substrates. Moreover, plastisols require special equipment for their manufacture, heavy duty pump equipment for application and high temperature curing ovens (they generally require temperatures above 380°F for adequate curing) and once applied, the compositions frequently fragment or frill when the container is opened, and flows during the aspetic sterilization process.

Elastomeric polymers, sometimes referred to in the art as "rubber sealants" have long been known in the art as excellent gasketing and end lining materials resulting in tough gaskets or seals having resistance to fat and oils, usually conveyed by inclusion of organic solvent-insoluble rubbers and resistance to moist heat, usually conveyed through use of a tackifying resin. Such compositions are disclosed and claimed in U.S. Pat. No. 2,767,152, for example, and usually include a solvent-soluble rubber in combination with a solvent-insoluble rubber, tackifying resin and filler, diluted with solvent to proper viscosity, to a solids content usually between about 34 to 40%. Such compositions are not suitable for use as safety edge compounds as illustrated further hereinbelow because they are normally too highly elongated resulting in "stringing" or frilling when the structure is torn. Additionally, the tackifying resin necessarily present in gasketing or lining compounds to prevent deterioration and afford moist heat resistance, when employed in a safety edge compound inhibits drying of the film, causes blocking and sticking and other problems.

The primary object of this invention is to provide an improved easy-opening container with a safety feature which protects the ruptured score edge of the removable section as well as the metal edge remaining on the container.

Another object of the invention is to provide an easy-opening container having protected metal edges employing safety edge compounds which possess all of the advantages above enumerated including resistance to fats and oils, resistance to heat, good adhesion to a variety of substrates, coated and unprimed, and proper elongation and tear properties.

Numerous other objects and advantages of the invention will be apparent as it is better understood from the following description, which, taken in connection with the accompanying drawing, discloses a preferred embodiment thereof.

SUMMARY OF THE INVENTION

This invention relates to an easy-opening container, preferably of the type having a full-open end closure seamed to a container body, wherein the end closure includes a peripheral countersink wall, a full-open removable central panel section defined by a peripheral score, an opening tab secured to the central panel and operative upon manipulation to impress an opening force to cause aa rupture in the score to leave a rim between the countersink wall and the score. The improvement comprises providing a safety edge compound, comprising a mixture of an elastomeric polymer and a vinyl chloride polymer compounded with suitable fillers, on the score line to protect the metal edges upon rupturing the score.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a top plan view of an end closure of an easy-open container of this invention.

FIG. 2 is an enlarged fragmentary vertical section taken along line 2—2 of FIG. 1.

FIG. 3 is an enlarged fragmentary sectional view similar to FIG. 2 showing a portion of the removable central panel section removed from the container body.

DETAILED DESCRIPTION OF THE INVENTION

As a preferred and exemplary form of the present invention, FIG. 1 shows a cylindrical can C having a conventional top end closure 10 having a central wall 12 defined by a substantially peripheral primary score line 14, which defines a removable central panel 24 that includes most of central wall 12, a peripheral secondary score line 15, a rim 16 which merges into an upwardly extending annular countersink wall 18 (FIG. 2) and an annular flange 20 interfolded with the upper end portion of a container body C into a double seam 22 (FIG. 2).

Central panel 24 has an opening tab 26 secured thereto by conventional means, for example, a rivet 28. The opening tab, as illustrated in FIG. 1, has a front portion 30 at one end adjacent score line 14 and a handle portion 32 at the other end. The front poprtion 30 at one end adjacent score line 14 in this embodiment includes a web portion 36 having a U-shaped slit cut 38 therethrough which defines a flap 40 wherein is located the hole in which rivet 28 is secured. The major portion of front end portion 30 lies outside of U-shaped slit cut 38 so that when handle 32 is lifted upwardly, the front end portion 30 and the rest of tab 26 are free to pivot about rivet 28 to allow nose 34 to rupture score line 14, while flap 40 is held flatly against central panel 12 by rivet 28. The opening tab as illustrated is described only as a specific embodiment herein and it should be understood that other suitable forms of the opening tab may be substituted.

To facilitate opening and easy initial rupture of the primary score 14, a secondary score 15 may be formed in the central panel although the invention is equally applicable to structures devoid of such an auxiliary score.

As best seen in FIGS. 2 and 3, a safety edge compound 46 comprising an elastomeric polymer is present on the undersurface of removal panel section 24 adjacent and covering score line 14 (and score line 15 if present) to protect the edge of the panel section 24 and the rim 16 once the score is ruptured and panel 24 is partly or fully removed from rim 16 and container body C. As shown in FIG. 3, the safety edge compound covers the rim 16 and score lands 42 and 44 so that should the score rupture with all or a portion of the land remaining with central panel 24 or rim 16, there remains on all edges a protective elastomeric edge.

The compositions employed as safety edge compounds according to the invention consist essentially of a polyvinyl chloride-elastomeric polymer mixture, compounded with suitable fillers.

Typical safety edge compounds of the invention will have the following composition:

Ingredients		Parts By Weight
Elastomeric polymer	50% to 75% preferably 65% to 70%	
Polyvinyl chloride	50% to 25% preferably 35% to 30%	100
Filler		200–500 parts per 100 parts of polymer mixture, preferably 290–435
Epoxy Resin		0 to 30 parts per 100 parts of polymer mixture
Solvent or Diluent (Vehicle)		
Ratio of Solids to Non-Solids		
Solids % by Weight		
45%–75% preferably about 50–70%		

To achieve the desired results herein, the relative proportions of the components should be maintained within the stated ranges. For example, compositions containing substantially less than 50% elastomer or more than 50% vinyl polymer result in compounds that are too brittle and friable and lack suitable adhesion for the purposes of the invention. Conversely, more than 75% elastomer or less than 25% vinyl polymer results in compounds that are too stringy and soft for satisfactory use both as a safety edge compound and in conventional nozzle equipment.

Similarly, a solids content substantially lower than about 45% will result in a solution that is too thin for satisfactory application while with amounts substantially above 75%, the compounds are too viscous and difficult to apply.

An optional ingredient of the composition may be an epoxy resin as indicated above. It has been found with some compositions of the invention that the presence of the additional resin may aid in the fat resistance of the compound and additionally adds favorably to the tearing characteristics thereof. It will be understood, however, that such compounds are not mandatory and satisfactory results are obtained in the absence of such optional ingredients.

The elastomeric polymer component of the compounds of the invention are well known in the art and include butadiene-acrylonitrile copolymers, butadiene-styrene copolymers, isobutylene-isoprene copolymers, natural rubber (polyisoprene), ethylene-propylene copolymer, neoprene, polyacrylic rubber, chlorosulfonated polyethylene (Hypalon), etc. and mixtures thereof. Expecially preferred are mixtures of soluble elastomers, particularly those including butadiene-acrylonitrile polymers containing about 50 to about 72 percent by weight butadiene and about 28 to 50 percent acrylonitrile. An example of such a copolymer

which is commercially available and suitable for use in the present invention is "Hycar 1001"—F available from the B.F. Goodrich Chemical Company. An example of a suitable butadiene-styrene copolymer is Kraton 1101 available from Shell Chemical Company while a suitable isobutylene-isoprene polymer is Butyl 007 available from Exxon Chemical Company. While the above elastomers constitute preferred embodiments of the invention, it should be understood that other elastomeric polymers may be substituted therefor provided they exhibit suitable elongation, tear and tensile strengths to tear cleanly and evenly without fragmenting, frilling or stringing when compounded in accordance with this invention.

The vinyl chloride resin used is a resinous polymer of vinyl chloride or copolymers thereof with minor proportions of other vinyl monomers such as vinyl acetate, vinyl butyrate, vinyl alcohol, vinylidene chloride, vinyl ethyl ether and the like and mixtures thereof. The particular monomer employed in making the copolymers is not critical as long as the essential character of the vinyl chloride resin is not changed by the incorporation of these monomers. In general, copolymers containing up to 20%, based upon the weight of the copolymer, may be employed.

The vinyl chloride resin employed herein is preferably a long-chain resin having a number average molecular weight of about 15,000 or above such as Geon 121, Geon 222, Vinyl VAGH, etc.

The vinyl chloride resin-elastomer may be a prefluxed or separate ingredient mixture of vinyl chloride resin-elastomer.

The epoxy resin components are well known in the art and are readily available commercially. A suitable epoxy resin is Epon 1001, a diglycidyl ether of bisphenol A.

The filler component of the compounds of the invention is likewise selected from compounds well known in the art and includes titanium dioxide, silica, zinc oxide, Buca clay, talc, hydrated alumina and other fillers that function in accordance with the present invention. Especially preferred is a hydrated alumina, commercially available as Hydrated alumina C-331, Aluminum Company of America. The effect of this particular filler component when employed in the safety edge compounds of the invention has been especially satisfactory. For example, it has been possible to readily obtain thicker layers of product, e.g. of the order of about 0.015 to 0.025 inches as compared to 0.008 to 0.012 inches when other fillers are employed. Such increased thicknesses of protective product is highly desirable and conveys, among other advantages, increased protection against cutting to the consumer. Such components may be employed alone, in combination with each other or with other fillers and/or pigments well known in the art.

The liquid medium or vehicle employed herein may include suitable solvents or diluents which may be selected to form solutions, dispersions, etc., based on the solubility of the particular polymer, ease of drying and ecological properties, as desired. Thus the vehicle may include water, organic and inorganic solvents diluents and combinations thereof. Particularly preferred herein are organic solvents, especially aromatic and aliphatic hydrocarbons, ketones and cyclic ethers such as toluene, methyl ethyl ketone, acetone, dioxane, tetrahydrofuran, methyl isobutyl ketone, hexane, heptane and mixtures thereof. Methyl ethyl ketone, toluene, and mixtures thereof are especially preferred herein.

In formulating the compositions to be applied according to the present process, the ingredients may be mixed in any order desired. Preferably, the filler will be added to the vehicle, with or without milling as deemed necessary after which the polymer mixture will be added, preferably with agitation to aid in solvation or dispersion of the same.

In a typical procedure of the process, metal sheet, which may be aluminum, tinplate, tin-free steel, etc., is coated with typical primer coatings which may be any of a variety of conventional coatings including oleoresinous lacquers or enamels such as tung oil or linseed oil based materials, epoxy esters, epoxy-phenolics, acrylics, vinyls, etc. The primed sheet is formed into the basic end and converted to an inside or outside scored full-panel, easy-open end by any of conventional procedures known in the art. A safety edge compound of the invention is applied to the score area by any suitable means, employing preferably conventional nozzle equipment, and is dried to evaporate at least a portion of the vehicle, utilizing standard equipment, for example, a helical dryer, at a temperature from about room temperature up to 180°F, preferably about 125° to 130°F for about 6 minutes. Complete cure of the compound is not necessary so long as sufficient vehicle is removed to preserve the integrity of the compound whereby it can serve the desired function.

The primary score land may be of any length desired, generally from about 0.001 to 0.005 inch and may be formed by either an inside or outside score. The secondary score depth, when present, will be substantially less than that of the primary score, normally about 0.003 inch less than the primary score, likewise may be on the interior or exterior surface of the end.

Thicknesses of the safety compounds may vary as desired and preferably will be in the range of about 4 to 25 mils with 8 to 15 mils being the preferred range except as above noted when hydrated alumina is employed. The width of the compound as applied likewise may vary as desired, usually from about a ⅛ inch minimum to as wide as desired and as is economically feasible. The compound may or may not be applied to cover the secondary score, as desired although it will preferably cover both the primary and secondary score in the practice of this invention. Similarly, the compound may be applied to the interior or exterior surface of the end with interior application being most preferred herein.

The following examples are illustrative of various compositions suitable for use in this invention:

EXAMPLE I

Ingredients	Parts by Weight
Prefluxed mixture	
70% butadiene-acrylonitrile-30% polyvinyl chloride (Hycar 1203F)	12.1
TiO_2	9.3
SiO_2	25.5
Epon 1001	3.0
ditertiarybutyl-p-cresol antioxidant	0.1
Solvent	
Methyl ethyl ketone/toluene	50.0

EXAMPLE II

Ingredients	Parts by Weight
butadiene-acrylonitrile	8.54

-Continued

EXAMPLE II

Ingredients	Parts by Weight
copolymer (Hycar 1431-P-65)	
ISOBUTYLENE—ISOPRENE COPOLYMER (Butyl 007)	0.42
40% vinylidene chloride 60% vinyl chloride copolymer (Geon 222)	3.63
Hydrated Alumina	51.26
TiO_2	1.07
Di-tert-butyl-p-cresol	.08
MEK/Toluene	35.00

EXAMPLE III

Ingredients	Parts by Weight
butadiene-acrylonitrile copolymer (Hycar 1001-F)	7.47
91% vinyl chloride-3% vinyl acetate 7% vinyl alcohol terpolymer (Vinyl VAGH)	3.21
SiO_2	32.17'
TiO_2	12.07
Di-tert-butyl-p-cresol	.08
MEK/Toluene	45.00

EXAMPLE IV

Hycar 1203F of Example 1	12.74
Hydrated alumina	50.90
TiO_2	1.30
Antioxidant of Example III	.06
MEK/Toluene	35.00

The following examples are illustrative of elastomeric compositions known in the art as gasketing or sealing compounds, which are not satisfactory as safety edge compounds in accordance with this invention.

EXAMPLE V

This formulation is as disclosed in U.S. Pat. No. 2,767,152 to Biermann:

Ingredients	Percent by Weight
Butadiene-styrene elastomer	9.28
Butadiene-acrylonitrile elastomer	2.32
Zn O	5.74
Buca clay	6.26
Rosin acid (tackifying resin)	11.22
di-beta-naphthyl-p-phenylene diamine	0.22
Carbon black	0.06
Hexane solvent	65.00

EXAMPLE VI

This formulation is a typical plastisol employed as a safety edge compound:

Ingredients	Percent by Weight
Polyvinyl chloride resin	58.5
Epoxol 9-5 (plasticizer)	36.0
Azodicarbonamide (expanding agent)	1.5
TiO_2	1.5
Butyl hydroxytoluene (Antioxidant)	0.15
Barium-cadmium complex (Stabilizer)	0.15

The above formulations (Examples I to VI) were applied to a primed, scored, metal end and dried until a substantial amount of vehicle was evaporated. The compositions of Examples I to IV had a solids content of about 64 percent, were applied with a nozzle and were dried at 130°F. The composition of Example V had a solids content of about 36 percent, was likewise applied with a nozzle and dried at 130°F. The composition of Example VI had a viscosity of about 25,000 centipoises, was applied by roller coater and dried at a temperature of about 340°F.

The compound of Example V was found to be totally unsatisfactory for use as a safety edge compound. Drying was inhibited by the tackifying resin necessitating at the least doubling of drying time. Upon rupturing the score line, the compound of this example was excessively "stringy" and found to be too soft to give raw edge protection. Additionally, ends containing compounds of this example was extremely difficult to process because of the tackiness of the compounds which caused blocking or sticking of the ends one to the other.

The compound of Example VI had unsatisfactory adhesion in the absence of a special vinyl primer, for example an acrylic-epoxy-phenolic coating, and only provided partial protection to the scored metal, generally only partially to the removable central panel with little or no rim protection. In addition to the high temperature drying needed, the dried compound was not sufficiently resistant to heat to be suitable for use on containers subjected to aseptic sterilization or thermal heat processing.

The compounds of Examples I to IV however, were not tacky, did not block, provided excellent protection to the metal edges including those of the removable panel and the rim, tearing cleanly and easily without stringing, fragmenting or frilling, exhibited good retention of adhesion to the metal ends, were resistant to fat and heat and suitable for use under aseptic conditions.

It is thought that the invention and many of its attendant advantages will be understood from the foregoing description and it will be apparent that various changes may be made in the matter of the ingredients, the identify and proportions of the formulation and that changes may be made in the form, construction and arrangement of the parts of the article without departing from the spirit and scope of the invention or sacrificing all of its material advantages, the form hereinbefore described being merely a preferred embodiment thereof.

We claim:

1. In a metal container wherein a full-open end closure is seamed to a container body, wherein the end closure includes a peripheral countersink wall, full-open removable central panel defined by a substantially peripheral score line and an opening tab secured to the central panel and operative upon manipulation to cause a rupture in the score to leave a rim between the countersink wall and the score, the improvement which comprises:

a safety edge compound having sufficient elongation, tear and tensile characteristics to tear without substantial fragmenting or stringing upon removal of the central panel derived from a composition having a solids content of from about 45 to about 75 percent by weight comprising a polymer mixture consisting essentially of from about 50 to about 75 percent by weight of an elastomeric polymer or mixtures thereof and from about 50 to about 25 percent by weight of a vinyl chloride polymer, liquid vehicle and filler, said compound covering the score to protect the metal edges of the removable panel section and the rim upon rupture of the score.

2. The container of claim 1 wherein the compound is applied to the interior surface of the scored end.

3. The container of claim 1 wherein the composition contains about 200 to 500 parts of filler per 100 parts of polymer mixture.

4. The container of claim 3 wherein the composition additionally contains up to about 30 parts, per 100 parts of polymer, of an epoxy resin.

5. The container of claim 4 wherein said elastomer is selected from the group consisting of copolymers of butadieneacrylonitrile, butadiene-styrene, isobutylene-isoprene, ethylene-propylene, polyisoprene, neoprene, polyacrylic rubber, chlorosulfonated polyethylene and mixtures thereof.

6. The container of claim 5 wherein said elastomer is butadiene-acrylonitrile copolymer.

7. The container of claim 4 wherein said vinyl chloride polymer is derived from vinyl chloride or mixtures thereof with at least one of vinyl acetate, vinylidene chloride, and vinyl alcohol.

8. The container of claim 7 wherein said vinyl chloride polymer is polyvinyl chloride.

9. The container of claim 3 wherein said filler is hydrated alumina, titanium dioxide, zinc oxide, silicon dioxide and mixtures thereof.

10. The container of claim 1 wherein said elastomer is butadiene-acrylonitrile, said vinyl chloride polymer is polyvinyl chloride, said filler is a mixture of titanium dioxide with hydrated alumina or silicon-dioxide and said vehicle is a mixture of methyl ethyl ketone and toluene.

11. The container of claim 1 wherein said compound is derived by evaporation of at least a portion of the vehicle from said composition after application to the metal end.

12. The container of claim 9 wherein said compound is derived by heating said composition to a temperature of about 125°F to about 180°F.

13. A method for making an improved, full-open end closure comprising, in combination:

a. forming a can end, including a peripheral countersink wall and flange means to be seamed to the end of a container body,

b. forming a score line in said end, said score line defining a removable central panel portion which is separate from a rim in said countersink wall of said end,

c. attaching finger tab means to a portion of said removable central panel portion,

d. applying to said score line a composition having a solids content of from about 45 to about 75 percent by weight and comprising a polymer mixture consisting essentially of from about 50 to about 75 percent by weight of an elastomeric polymer or mixtures thereof and from about 50 to about 25 percent by weight of a vinyl chloride polymer, organic solvent and filler and

e. removing at least a portion of said vehicle to provide a compound which protects the metal edges of the removable central panel portion and the rim upon rupture of the score, said compound having sufficient elongation, tear and tensile characteristics to tear without substantial fragmenting or stringing upon removal of the central panel.

14. A method as defined in claim 13 in which said composition is applied to the interior surface of the scored end.

15. A method as defined in claim 13 wherein the composition additionally contains up to about 30 parts, per 100 parts of polymer, of an epoxy resin.

16. A method as defined in claim 13 wherein said elastomer is selected from the group consisting of copolymers of butadiene-acrylonitrile, butadiene-styrene, isobutyleneisoprene, ethylene-propylene, polyisoprene, neoprene, polyacrylic rubber, chlorosulfonated polyethylene and mixtures thereof.

17. A method as defined in claim 13 wherein said vinyl chloride polymer is derived from vinyl chloride or mixtures thereof with at least one of vinyl acetate, vinylidene chloride and vinyl alcohol.

18. A method as defined in claim 13 wherein said compound is provided by baking said end at a temperature of about 125° to about 180°F.

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