HERMETIC PACKAGING WITH PLASTIC CONTAINER

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ABSTRACT

A hermetic package for processed food products. The container and lid are made of plastic materials. The lid snaps on the container lip, or may be heat-sealed thereto. A shrink band embracing the container and the lid rim reinforces the grip and supplements the seal of the lid to the container. For large, elongated packages, the container and lid may be formed with relatively thin, uniform walls, reinforced to afford a homogenous flexural characteristic in the completed package which ensures integrity of the closure, while minimizing failure due to stresses imposed under vacuum or handling loads on the package.

7 Claims, 10 Drawing Figures
HERMETIC PACKAGING WITH PLASTIC CONTAINER

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention pertains to packaging with plastic materials, more particularly to hermetically sealed package with plastic container and lid, suitable for vacuum packing such food products as hams, poultry, and the like. Such products are often put up in whole or reconstituted cuts, or parts, up to 5 pounds or more in weight. The package type is best represented by that for hams or picnics. However, the invention is not limited in its application to packaging of particular products or particular capacities, those named being merely indicative of the field in which the invention may be utilized to best advantage.

2. Prior Art

Fresh or partly prepared foods which are to be stored or shelved for long periods of time, without freezing, refrigeration or other preservative storage conditions, generally require a hermetically sealed, durable package or container. Metal cans have heretofore been found suitable and economical as large containers for many such uses. However, in some cases, metal cans are objectionable in various respects, such as corrosivity, seam failure, product tainting, shape and design limitation, difficult opening, high cost, and the like. Various proposed improvements, such as special constructions, coatings, and easy-opening features, have often proven costly or otherwise not entirely satisfactory.

The properties or characteristics of various plastic materials lend themselves to use for food containers. However, plastic containers heretofore devised, such as tubs for cheese and other dairy products, are not suitable or adaptable for permanent, hermetic packaging. In particular, prior forms of plastic containers do not provide the requisite permanent seal properties, strength, durability and economy for packaging of the types here considered, such as vacuum packing of large meat cuts.

SUMMARY OF THE INVENTION

The principal object of this invention is to provide a plastic container and closure therefore, suitable for hermetic packaging, having the requisite facility of sealing, seal longevity, overall durability, and economy in manufacture and use.

More particularly, it is an object of the present invention to provide a plastic container with dependable closure and seal which is suitable to full-opening containers of various shapes and sizes, especially for large containers of non-circular shapes, as used for packing hams and similar whole-meat cuts for non-refrigerated storage.

The foregoing and other objects are achieved in this invention by virtue of a novel dual-seal closure, with structuring of the lid and the container to minimize differential distortion before, during and after applying and sealing the lid to the container. In one embodiment of the invention, a uniformly thin-walled lid and container are reinforced in a novel manner whereby to achieve selective stiffening with substantial economy of material, ease of manufacture and assembly, yet assuring the integrity of the package and minimizing warpage, fracture, or perforation. A primary closure is effected upon applying the lid to the container. In one form of closure, a gasket or sealing compound carried by the cover rim seals against the lip of the container. In another form of closure, the lid rim is welded to the container lip. With either primary closure, a band of shrink film is applied around the rim and beneath the container lip, a bead or shoulder being provided for engagement by the lower margin of the shrink band. The band is preferably a biaxially oriented polymeric film, shrunk in situ, drawing the band tightly against the container wall and down on the lid rim, thereby effecting a supplementary seal, with retentive force maintaining the integrity of the closure against the effects of buckling by varying temperature changes, and other forces or distortive effects tending to separate the lid from the container. The shrink band also prevents contamination of the interstice between the overhanging rim and the container wall.

Other features, objects, advantages, and details of the invention will be apparent from the description and accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of a completed package constructed and closed in accordance with this invention;

FIG. 2 is a top plan view of the lid shown in FIG. 1;

FIG. 3 is a section of the lid taken on line 3--3 of FIG. 2;

FIG. 4 is a partial section on line 4--4 of FIG. 1, showing the closure structure and arrangement;

FIG. 5 is a top plan view, similar to FIG. 2, showing a rectangular modification;

FIG. 6 is a side elevation of a modified container similar to that of FIG. 1, but showing another form of reinforcement;

FIG. 7 is a partial section on line 7--7 of FIG. 6, additionally showing the lid of FIG. 5 sealed to the container in a manner similar to that of FIG. 4;

FIG. 8 is a partial section similar to FIG. 4, showing a modification;

FIG. 9 is a partial section similar to FIG. 8, showing another modification;

FIG. 10 is a partial section similar to FIGS. 8 and 9, showing yet another modification.

DESCRIPTION OF PREFERRED EMBODIMENT

The preferred embodiment is one which is particularly suitable for vacuum packing. A significant advantage of the embodiment of FIGS. 1 to 4 is that, after sealing, the differential of pressure between the atmosphere and the container interior assists in maintaining the closure. However, the package of FIG. 1 also incorporates certain novel features which counteract a disadvantage of vacuum packing in relatively light, semi-rigid containers, namely, the collapsive effect of the pressure differential, which hazard is aggravated by external forces imposed on the container in handling, stacking or the like.

The configuration and proportions of the package shown in FIGS. 1 and 2 are those suitable to such purposes as vacuum packing hams on the order of 5-pound weight. Such meat products are preferably prepared and packed as a whole cut, to be removed intact and sliced in suitable portions. The cut may be boned and rolled, or chunks may be pressed to reconstitute a whole cut. Therefore, the container 20 is preferably somewhat elongated and rather deep, as shown. The bobbed-ellipse shape is attractive and suited to shaping ham cuts in the package. The container shape lends itself to molding, minimizes corner fitting and sealing problems, and provides the arching wall 21, for collapse resistance along the long sides, when subjected to vacuum. However, it will be understood that other shapes and proportions may be used for various products and packaging conditions.

The configuration of the lid 22 is best seen in FIGS. 2 and 3. Lid 22 comprises a cover panel 23 and rim 24. Panel 23 is depressed. The upstanding rim 24 is curled out and down, terminating in a downwardly depending skirt 25, somewhat inverted toward the inner rim wall 26, with the extreme lower skirt margin 25a flared out. Referring now to FIG. 4, the lip of container 20 has an outwardly turned flange 27, designed to mate with lid rim 24. Flange 27 is slightly wider than the minimum distance between cover skirt 25 and inner rim wall 26, so that lid rim 24 has a firm snap fit over lip flange 27. Such snap assembly is facilitated by flexibility and resilience of the plastic materials used, such as high-density polyethylene, for example.

The joint between lid 22 and container 20 is sealed by a ring gasket or sealing compound 28, which is most conveniently nested in the rim curl 24 prior to assembly. When lid 22 is pressed down on container 20, the seal member 28 lies on the upper face of container flange 27, the inner rim wall 26 closely
hugging container wall 21, precluding any lateral shift of lid 22 relative to container 20. In vacuum packaging, the container 20, holding product M, is held in a vacuum chamber while the lid 22 is pressed down to seal gasket 28 along the flange 27. Thus, upon removal of the closed package to atmosphere, the external atmospheric pressure acts to maintain the seal of the gasket 28.

Since the total area of cover panel 23 is many times the sealing area along flange 27, a high initial safety factor is provided against leakage and loss of vacuum in the container 20. However, in practice, a number of factors operate upon the vacuum seal, tending to a high rate of ultimate failure, thus precluding safe dependence on the pressure differential alone to maintain a hermetic seal. Gaskets or sealing compounds are often subject to age hardening, shrinkage, and corresponding loss of optimum sealing properties. The packages are necessarily subject to a wide variety of mechanical and ambient conditions tending to break the seal, or even to separate the lid from the container. Packages may be squeezed or dropped, lids may be accidentally snagged or deliberately pried. Even a momentary disturbance of the seal may permit sufficient air leakage to cause spoilage. The fact of such spoilage may be undetected if the lid does not actually work loose. Possible extreme temperature variations, with consequent adverse deformation, may also result in seal failure, even though the packages are otherwise carefully packed and handled.

In view of the foregoing and other hazards to the integrity of the package, this invention includes means for mechanical retention of the lid in sealing position on the container. This objective is achieved by means of the band 29, which is preferably a biaxially oriented shrink film, such as a regenerated cellulose film, for example. Band 29 consists of a ribbon or a tube slice. A ribbon may be wrapped about the rim 24 and along wall 26, the ribbon being of such width as to extend beyond cover skirt 25 and along container wall 21. The ends of such ribbon may be lapped and heat-sealed to constitute an endless band. However, the tubular form is preferred for best performance and economy. Suitable tubes of shrink film are readily made by extruding and drawing, with axial and circumferential stretching at finish to provide the biaxial shrink orientation and the required circumference for application around the container. The tube thus formed and prepared is sliced to the required band width. The film material may be of heat-shrink or wet-shrink type, according to which is best adapted for the packaging process and equipment to be employed.

Band 29 is initially stretched upon and around rim 24 in the position shown in broken lines, then is shrunk by heating or drying, according to the particular characteristics of the band material selected. Circumferential and axial shrinkage causes the upper portion of band 29 to hook over rim 24 while the lower portion draws in, hooking upon rim skirt 25 and binding against container wall band 30. The constrictive action effects a tight seal on rim 24 and wall band 30, and shrink band 29, under tension between rim 24 and wall band 30, also grips the lid 22 to container 20, whereby to increase compression on seal 28 and maintain the mating relation of lid and container. Frictional resistance to creep along wall band 30 is supplemented by anchorage under shoulder 31. Separation of the lid is also resisted by virtue of the close, reverse-wedge fit between the inner rim wall 26 and the corresponding reverse-tapered upper margin of container wall portion 30 just below flange 27.

Thus, the shrink band enhances and maintains the sealing effect of gasket 28 against flange 27 with respect to distortive or disruptive effects which may be imposed at or near the joint between lid 22 and container 20 in handling or storage. The band 29 provides a supplementary permanent seal, as an added safety factor against failure of the primary seal provided by gasket 28, as well as a sanitary seal against possible contamination by foreign material, band 29 hermetically sealing the under-flange interstitial space 34 from the ambient atmosphere. Until the package is opened for removal of the contents, the upper exterior margin of container 20 is maintained in hygienic condition as originally packed, keeping the container sanitary for possible reuse, subsequent to removal of the original product, or partial consumption thereof. The lid 22 can be replaced as a protective cover, for refrigerator storage.

For the sake of best economy in material and manufacturing costs, container 20 has a relatively thin, uniform wall. Such design not only permits use of minimal quantities of inexpensive thermoplastic or thermosetting material, but facilitates the adoption of the most economical vacuum, thermoforming or injection molds, methods and apparatus for the desired sizes and quantities. Desirably, the wall should be no greater than necessary to insure against porosity and accidental perforation. For example, a wall thickness on the order of 1/16 inch of high density polyethylene meets these basic requirements. However, a plain wall of such thickness is excessively subject to flexure or buckling, particularly on the long side of the container shown in FIG. 1, for which representative dimensions are 7 inches long × ¾ inches wide at the waist × 3½ inches deep.

The exigencies of packing products of the principal types for which the container and package of this invention are intended preclude reliance on the product for substantial resistance to collapse of the container. The representative product is generally of irregular shape, only roughly conforming to the container shape. Furthermore, a tolerance has to be provided in the packing volume for variable trimming to meet a predetermined net weight requirement. The package thus must be designed to be self-sustaining as vacuumized, without reliance on support by the product. It is necessary to stiffen the container in order to minimize excessive distortion and particularly to preclude collapse under vacuum conditions, yet retain sufficient flexibility to accommodate slight mismatching with the lid in assembly, to withstand handling loads without risk of permanent deformation or rupture, and to afford substantially unitary resistance to distributed loads.

Considering the completed, vacuumized package, as shown in FIGS. 1 and 4, the effect of external pressure is most severe in the tendency to collapse the long side wall 21. Some collapse resistance is provided near the bottom by the bottom panel 35 and at the mouth by lip flange 27 and cover panel 23, aided by the telescoping of rim wall 26, and stiffening provided by the rim curl 24. The collapse resistance afforded by the panel 35 and the lid 22 is in part negated by their susceptibility to dishing. In any case, because of discontinuity and shaping irregularity at the closure, some flexural differential is inherent in the container, and a portion of the lid may be anticipated, with potentially adverse effect upon the seal. Accordingly, the principal desideratum is to minimize flexure of the parts in the vicinity of the container mouth, achieving corresponding minimum flexure differential between lid and container.

For the purpose of collapse and buckle resistance, the container wall 21 is stepped. As best seen in FIGS. 1 and 4, wall 21 is formed as a cascade of bands, decreasing in periphery downwardly of container 20. The bands are connected with each other by substantially plate shoulders or ledges, as at 31, which operate as gussets to stiffen the wall panel 21 as a whole. The several bands are not of equal width, but are proportioned to provide a particular flexure characteristic, which minimizes distortion at the mouth, while permitting sufficient general flexure to absorb external loads safely, particularly to sustain external pressure when the container is used in a vacuum pack. The uppermost wall shoulder 31 is located in a plane a short distance below the plane of cover panel 23, as assembled. Such location of shoulder 31 on container 20 enhances flexural resistance to collapsive pressure in the region of the closure and minimizes the hazard of excessive shear in the container wall, as may result were the stiffening shoulder too close to the plane of the cover panel 23. That is, excessive localized stiffening tends to produce an abrupt change in the flexure gradient, reflected in stress concentration conducive to rupture of the relatively thin container wall 21.
The next lower shoulder 36 is spaced about the same distance from shoulder 31 as the latter is from panel 23. Additional step shoulders 37 and 38 are somewhat more widely spaced in a manner to establish somewhat wider bands along the lowermost portion of the container than along the portion toward the mouth. The effect of such spacing in the steps of the container wall banding is to establish a plane of maximum deflection, under uniform external pressure, somewhat closer to the bottom panel 35 than to the plane of lip flange 29 and gasket 28. The corresponding flexure gradient is one in which displacement is minimal for a substantial distance along the wall 21 in the vicinity of flange 29, without unduly abrupt departures of flexure gradient in planes of stress concentration.

As previously observed, the lid 22 is subject to gently under external pressure, as seen in FIG. 4, the free condition of lid 22 being shown in FIG. 3. The stiffening effect of the rim 24, wall 26, close nesting in the stiffened container wall 21, and accompanying mutual reinforcement tends to effect high bending and shear stress at the juncture of wall 26 and panel 23. The stress would be particularly aggravated were panel 23 a highly flexible membrane of the span and area contemplated for packages of the size here represented. Therefore, cover panel 23 is stiffened in a manner to minimize abrupt change in flexure gradient throughout the extent of the panel, yet to retain flexibility.

As best seen in FIGS. 2 and 3, cover panel 23 has a number of ribs forming a waffle grid, criss-crossing the entire face of panel 23. Ribs 39 are formed from the web of panel 23, so that the thickness of the material constituting the ribs is substantially the same as that of the main web portions. Thus, while the upstanding ribs 39 appreciatively stiffen panel 23 in its general flexural characteristic, the ribs have a flexural characteristic within certain limits through the crests which is substantially the same as that of the panel generally. Under uniform pressure against the plane of the panel 23, there is a substantially smooth flexure and stress gradient across panel 23 between the margins bounded by rim 24, while the maximum deflection and total deformation of the panel are substantially less than that of a flat panel having the same material thickness. The spacing and height of ribs 39 are so selected as to produce a flexure characteristic in panel 23 which is compatible with safe, combined bending and shear stress at or near the juncture of the panel with rim 24, due consideration being given to the substantial additional stiffness and strength provided by the rib formations extending into the juncture. A rib cross-sectional shape approximating that of an equilateral triangle, as shown, provides a desirable accordant effect, without excessive stress concentration at the peaks and corners. While the ribbing pattern shown is that of a waffle grid, a pattern best suited to the container size and shape illustrated, it will be understood that other patterns may be suitable and effective with covers of other sizes and shapes, pursuant to the principles stated.

An additional feature in the structuring of lid 22 is that the panel 23 and the closure generally are sufficiently flexible safely to permit a substantial cover panel deformation as shown in FIG. 4. The inward flexure reduces the head space toward the center of the package and thus insures the most effective evacuation of the container and minimal residual air, when the package is sealed. Such residual space reduction is conducive to longer shelf life, the spoilage hazard being generally a function of the residual air content in the package.

The package described may be opened by slitting band 25 beneath dependent lid skirt 25, puncturing the cover to break the vacuum, and then prying off the lid 22 with the fingers, or a prying tool, such as a bottle opener.

MODIFICATIONS

FIGS. 5 through 7 illustrate a package and parts similar in general form, construction and purpose to the form of FIGS. 1 to 4, but with certain modifications. In this case, the package is a rectangular one of about the same overall dimensions of those previously described, as may be desirable for loaf meat or the like. In the view of FIGS. 5 to 7, parts corresponding to those of the form shown in FIGS. 1 to 4 are identified by the same reference numerals, with the addition of letter "T".

As best seen in FIGS. 5 and 7, the cover panel 123 of lid 122 is stepped in a panel cascade, in which the panel bands are connected by vertical shoulders or ribs 139. The step panel provides a stiffening and flexural characteristic generally similar to the provided by the ribs 29 of lid 22, FIG. 2.

Container 120 has its upper wall 121 step-tapered in narrow bands 130, 132, below lid flange 127, each band connected to the succeeding bands by shoulders, as at 131, 136. The lower portion of the container wall is provided with a series of vertical flutes extending from approximately the center plane of the container to the bottom panel 135, the flutes being displacements in the web of wall 121. This combination of narrow band stepping at the top and fluting in the bottom half produces substantially the stiffness gradient characteristic provided in the form of FIGS. 1 to 4 by the varied stepped wall 21.

As seen in FIG. 7, the inner rim wall 126 is relatively shallow in order to compensate for container space occupied by the stepped cover. Therefore, shrink band 129 in this case preferably extends horizontally inward across the outermost step of cover panel 122, the inner facing being desirably heat sealed to anchor band 129 over the rim crown 120. Other respects, the closure structure associated with the seal 128 performs in the manner and for the purposes described in relation to FIG. 4.

FIGS. 8, 9 and 10 illustrate modifications adapted to the use of container materials whose properties are best suited to formation of a relatively thick-walled, substantially rigid container rather than the flexible or semi-rigid forms heretofore described. In FIGS. 8, 9 and 10, parts corresponding to those of the form in FIGS. 1 to 4, inclusive, are identified by like reference numerals, with the addition of 200, 300 and 400, respectively.

Container 220, FIG. 8, has a plain, relatively heavy wall 221 with an outwardly projecting bead 230 near its upper end. Wall 221 terminates in a flat lip 227. Ring gasket 228 rests on lip 227. The cover rim bead channel 224 telescopes container wall 221 rather loosely, the downwardly extending outer rim 225 terminating short of the container bead 230. The rim 225, inner wall 226 and container wall 221 overlap just sufficiently to provide satisfactory confinement for the gasket 228. In this arrangement, the container wall 221 is self-sufficient in resistance against collapse or other deformation, and the lid 222 is substantially independent of container wall 221. The panel 223 may flex freely within the limits of the clearance at the rim channel 224 and the safe flexure limits of the material used, without special regard for effect on seal 228. As panel 223 flexes under vacuum container conditions, the rim channel 224 is sufficiently free to rock upon the half-round resilient gasket 228 to obviate rupture of the lid 222.

The shrink film band 229 may be heat-sealed to the rim crown 228 and the container bead 230, whereupon shrinkage of the band 229 operates to reinforce and retain the closure in the manner previously described in association with other forms of the invention.

The containers and closures heretofore described have been intended primarily for vacuum packaging. While the shrink bands contemplated provide substantial resistance to separation of the lid from the container, the use of such band retention unaided will generally be limited to relatively low internal pressure, particularly with large containers. Therefore, a container suitable for atmospheric or pressure packing is preferably provided with a different type of primary cover seal than the plain ring gasket heretofore shown and described.

One form suitable for general use is shown in FIG. 9. Container 320, with its wall 321, bead 320 and flat lip 327, is substantially in accordance with the container of FIG. 8. However, the flat panel 323 of cover 322 extends across container lip 327, to which the marginal portion of panel 323 is heat-
sealed or spin-welded, according to the shape and size of the container involved. The shrink-film of band 329 is sealed to the outer margin of the upper face of panel 323 and to the bead 330, and upon welding operations in the manner heretofore described for reinforcing and supplementing the bond of cover 322 to lip 327. The external depending rim 325 of cover 322 serves to position the cover over the mouth of container 331 and as a tension lip for the band 329.

The form of FIG. 10 may be used with substantially equal facility and satisfaction in either pressure or vacuum packaging. The wall 421 of container 420 terminates in a T-flange lip 427. The rim channel 424 of lid 422 is adapted to snap over flange 427, hugging the flange closely when the cover is pressed down to seal gasket 428 against flange 427. The inner rim wall 426 of cover 422 telescopes into the inside of container wall 421 closely, to guide and maintain cover 420 in correct locking and sealing position, minimizing the tendency of the rim channel 424 to roll away from flange 427 as the closure is made up. Shrink band 429 is formed around cover rim channel 424, with the inner margin lying along cover wall 426 and the outer margin along the outside of wall 421 in the channel formed by outer cover rim 425 and container bead 430. In this arrangement, the shrink band 429, in addition to providing the supplementary seal in the manner heretofore described, operates to hold cover 422 in its sealed position by preventing the rim 428 and inner rim wall 426 from spreading under the effect of internal pressure or other force tending to raise the lid 422 upwardly of the flanged lip 427.

Certain forms of the invention have been presented by way of example. It will be understood that the invention is adaptable to containers of other sizes and configurations than those particularly shown and described, and that the specification herein will enable those skilled in the art to devise other forms and modifications.

What is claimed is:

1. A package comprising: a plastic container having a lip, a side wall of substantially uniform thickness, and a bottom; a plastic lid having a rim mated to said lip and therewith forming a sealed joint, said rim being priable from said lip to unseal said joint; a band of plastic film shrunk tight upon and around said rim and said wall; and band anchorage means associated with each of said rim and said wall for substantially inhibiting slippage of said band transversely thereof relative to said rim and said wall so as to securely restrain said rim against prying thereof from said lip and to grip said lid to said container, said wall having a peripheral portion defining a shoulder facing downward externally below said lip and said rim, the lower-most margin of said film band engaging said shoulder, said shoulder constituting a first one in a series thereof, said wall comprising stepped wall bands connected by said shoulders, reinforcing said wall, said wall bands generally increasing in width toward said bottom, said reinforced wall being characterized in that the plane of maximum wall deflection under uniform external pressure is closer to said bottom than to said lip.

2. A package according to Claim 1, said stepped wall bands, reinforcing the portion of said wall immediately below said lip, and further including vertical flutes in said wall toward said bottom, reinforcing the lower portion of said wall.

3. A package comprising: a plastic container having a lip, a side wall, and a bottom; a plastic lid having a rim mated to said lip and therewith forming a sealed joint, said rim being priable from said lip to unseal said joint; a band of plastic film shrunk tight upon and around said rim and said wall; and band anchorage means associated with each of said rim and said wall for substantially inhibiting slippage of said band transversely thereof relative to said rim and said wall so as to securely restrain said rim against prying thereof from said lip, said lid being welded to said container along said rim and said lip, whereby to grip said lid to said container and protect said joint against leakage or spoilage by tampering, accident, or contamination, with said band supplementing and reinforcing the seal effected by said weld.

4. A package according to Claim 3, wherein said wall includes an external bead below said lip, said band embracing said bead, whereby to anchor said band to said container.

5. A package according to Claim 4, wherein said rim includes a flat portion around said lip, said band being heat-sealed to said flat portion, whereby to anchor said band to said rim.

6. A package according to Claim 1, wherein said lip is a flange projecting outwardly and inwardly of said wall, said rim being curled to define a channel confining said flange, the opening of said channel being less than the width of said flange, said band embracing said curl substantially throughout the cross-sectional extent thereof, whereby to restrain said curled rim against disengagement from said flange under force tending to pry said rim from said flange and separate said lip from said container.

7. A package according to Claim 6, further including a seal member confined in said channel under compression against said flange, the restraint of said curl by said band being sufficient to substantially preclude enlarging deformation of said curl and consequent reduction of said compression.