LIDDED PAPERBOARD CONTAINER

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ABSTRACT

This invention relates generally to lidded disposable pressed paperboard containers and more particularly to a disposable lid with an engagement profile particularly useful for paperboard containers comprising evert outer portions. The lid of the present invention provides a good fit for paperboard container bases having evert outer portions while still allowing the lid to be removed from the base without the need for excessive force. The lid profile is relatively insensitive to size variations of paperboard container bases having evert outer portions and allows for flexing of paperboard during application so as to provide an unexpectedly good seal so as to provide lidded, disposable paperboard containers.
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CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application is a continuation-in-part of co-pending U.S. patent application Ser. No. 10/963,686, filed Oct. 13, 2004, entitled “Pressed Paperboard Serveware with Improved Rigidity and Rim Stiffness”, which was based upon Provisional Application Ser. No. 60/512,811, filed Oct. 20, 2003, of the same title. The priorities of the above-noted patent applications are hereby claimed and their disclosures incorporated herein by reference in their entirety.

TECHNICAL FIELD OF THE INVENTION

[0002] This invention relates generally to lidded disposable paperboard containers and more particularly to a disposable lid with an engagement profile particularly useful for paperboard containers comprising evert outer portions. The lid of the present invention provides a good fit for pressed paperboard container bases having evert outer portions while still allowing the lid to be removed from the base without the need for excessive force. The lid profile is relatively insensitive to size variations of pressed paperboard container bases having evert outer portions and allows for flexing of paperboard during application so as to provide an unexpectedly good seal so as to provide lidded, disposable pressed paperboard containers.

BACKGROUND OF THE INVENTION

[0003] Disposable containers with domed lids are widely used in the food service industry, typically in connection with plastic plates and platters that are intended for take-out use. U.S. Pat. No. 6,733,852 to Littlejohn et al. (which disclosure is incorporated herein in its entirety by this reference) discloses a disposable serving plate with a side-wall-engaged sealing cover. In a construction of the ’852 patent invention, a plate includes a substantially planar central area, a plate sidewall extending outwardly and upwardly from the central area, a recessed sealing area and a container base stop ridge adjacent the sealing area. A convex outwardly extending rim adjoins the base stop ridge and has an outer lip or border formed thereabout. A resilient mating domed lid is fitted to the plate to provide a lidded container.

[0004] A further example of domed lids for use with disposable plates, here pressed paperboard containers, is disclosed in co-pending U.S. application Ser. No. 10/170, 675, filed Jun. 13, 2002, the disclosure of which is incorporated by reference herein. As shown in FIG. 1 of the ’675 application, a groove defines at its outer wall an engagement perimeter. This engagement perimeter is substantially continuous (except for the tab portion) around the perimeter of the container such that a seal is formed when the lid is placed on the container for use.

[0005] The design of the ’675 application is particularly well-suited for use with containers having outer perimeters that terminate in a downward slope, such as the pressed paperboard container disclosed and claimed in U.S. Pat. No. 6,715,630, (the disclosure incorporated herein in its entirety by this reference), for example, see FIG. 1D therein. However, the assignee of the present invention (Georgia Pacific Corporation, Dixie® Business, Atlanta, Ga.) has recently introduced a paperboard container exhibiting markedly improved rigidity. This paperboard container is disclosed and claimed in co-pending U.S. patent application Ser. No. 10/963,686, (disclosure previously incorporated herein in its entirety by this reference). The pressed paperboard container of the ’686 application comprises a rim that terminates in an evert outer portion, that is, in an outwardly and/or upwardly direction.

[0006] The inventors herein have found that the substantially continuous engagement portion of the ’675 application lid provides an unsatisfactory seal with the ’686 application paperboard container. In particular, the design of the ’675 application lid results in a seal that is overly tight when used with the paperboard container of the ’686 application. While a tight seal is desirable so that the lid will not inadvertently disengage from the container in use, if the seal is too tight, the user must apply considerable force to disengage the lid from the container. During application of such force, it is quite possible that the user will apply too much force to result in spilling of the contents. Also, over exertion can cause the lid to become cracked.

[0007] In addition to the difficulties seen in designing a lid for a disposable pressed paperboard container having evert outer portions, lidding of paperboard container bases can be especially problematic. Unlike plastic containers that are typically thermoformed or injection molded and which are generally uniform in final size and shape, paperboard containers are more subject to size and shape variances, especially pressed paperboard containers made from paperboard blanks. Sources of variance can include moisture content, forming conditions, relaxation, spring back and so forth. As discussed above, lids with continuous or substantially continuous engagement portions have been disclosed for use on paperboard plates; however, such lids are frequently difficult to install properly on a consistent basis due to size variations in the containers.

[0008] In view of the above, there is a need for a lid for a disposable pressed paperboard container where the container comprises a rim that terminates in an evert outer portion so as to provide a lid with a “just right” fit. Still further, there is a need for a lid for a disposable paperboard container that provides a good fit even when the paperboard containers are not of a consistently uniform size and shape.

SUMMARY OF THE INVENTION

[0009] This invention relates generally to lidded disposable paperboard containers and, more particularly, to a disposable lid with an engagement profile particularly useful for pressed paperboard containers comprising evert outer portions. The lid of the present invention provides a good fit for pressed paperboard container bases having evert outer portions while still allowing the lid to be removed from the base without the need for excessive force. The lid profile is relatively insensitive to size variations of pressed paperboard container bases having evert outer portions and allows for flexing of the base during application so as to provide an unexpectedly good seal to provide lidded, disposable pressed paperboard containers. In the engagement of the lid with the pressed paperboard container, the plurality of undercut lugs on the lid rim are sized to secure the lid to the container base. In particular aspects of the invention, the
plurality of lugs are substantially equally distributed around the perimeter of the lid, and the outer perimeter of the container and the annular engagement portion of the lid rim are sized to engage each other when the lid is installed on the base.

Additional advantages of the invention will be set forth in part in the detailed description which follows and in part will be obvious from the description, or may be learned by practice of the invention. The advantages of the invention will be realized and attained by means of the elements and combinations particularly pointed out in the appended claims. It is to be understood that both the foregoing general description and the following detailed description are exemplary and explanatory aspects of the invention and are not restrictive of the invention, as claimed.

BRIEF DESCRIPTION OF DRAWINGS

The invention is described in detail below with reference to the drawings wherein like numerals designate like parts. In the drawings:

FIG. 1 is an isometric view of a prior art lid having a substantially continuous engagement portion.

FIG. 2 is a view in perspective of a fluted dome lid configured for use in connection with the present invention.

FIG. 3 is a top plan view of the domed lid of FIG. 2.

FIG. 3A is a view in section and elevation of the lid of FIG. 3 along line 3A-3A.

FIG. 3B is a schematic view in elevation and section along line 3B-3B of FIG. 3.

FIGS. 3C and 3D are enlarged schematics illustrating features of the lid of FIG. 3.

FIG. 4 is a view in perspective of a paperboard container having a horizontal outward projection from its brim.

FIG. 5 is a schematic view illustrating various angles.

FIGS. 6 through 8 are schematic views in section showing the installation of the lid FIG. 2 to a paperboard container base of the class shown in FIG. 4.

FIG. 8A is an enlarged schematic illustrating features of the inventive containers.

DETAILED DESCRIPTION OF THE INVENTION

The invention is described in detail below with reference to the various Figures. Exemplary definitions used in the specification and claims appear immediately below.

“Domed” refers to an inverted bowl type structure with a sidewall and a topwall. It also refers to segmented domed structures.

“Evert outer portion” is the portion at the outer perimeter of the paperboard container. This portion is substantially ring-shaped where the outer portion of this ring is defined by the outer edge of the container rim and the inner portion of this ring is defined by the junction of the evert outer portion and the brim transition point. In one example, the evert outer portion is illustrated as element 68 on FIGS. 4 and 5 herein. The evert outer portion can deviate some from a ring shape (to be substantially ringed-shaped) if the outer perimeter of the pressed paperboard container is not exactly circular.

Referring to FIG. 5, the eversion angle, β, is an outward change in downward slope at the outer flange of a container and is calculated as the angle between a tangent to the brim portion at its lower terminus and a tangent to the evert outer portion at its junction with the brim transition to the evert outer portion. As used throughout this specification and in the claims, “slope” refers to inclination as one moves outwardly from the center of the product. Thus, a sidewall of a container base is typically referred to as upwardly sloping and a brim has a downwardly sloping outer portion.

A container with a brim sloping downwardly at 60 degrees from horizontal transitioning to a horizontal ring (0 slope) has an eversion angle of 60 degrees, while a container with a brim sloping downwardly at 45 degrees transitioning to a ring sloping upwardly 5 degrees has an eversion angle of 50 degrees. Alternatively, the eversion angle can be conveniently determined by measuring the angle, γ, between the downwardly sloping brim and the outwardly extending evert and subtracting γ from 180 degrees because γ and β are supplementary angles as is seen in FIG. 5.

“Mils” means thousandths of an inch.

“Rim” as used in connection with the lids of the invention refers to that portion of the lid flange adapted to engage the outer border or perimeter of a container base and secure the lid to the base at the lid’s outer flange. The periphery of the rim and like references are used interchangeably with ring engagement circumference for circular lids.

“Thermoforming”, “thermoformed” and like terminology is used herein in accordance with its ordinary meaning. In the simplest form, thermoforming is the draping of a softened sheet over a shaped mold. In the more advanced form, thermoforming is the automatic high speed positioning of a sheet having an accurately controlled temperature into a pneumatically actuated forming station whereby the article’s shape is defined by the mold, followed by trimming and regrind collection as is well known in the art. Still other alternative arrangements include the use of drape, vacuum, pressure, free blowing, matched die, bilow drape, vacuum snap-back, bilow vacuum, plug assist vacuum, reverse draw with plug assist, pressure bubble immersion, trapped sheet, slip, diaphragm, twin-sheet cut sheet, twin-sheet roll-fed forming or any suitable combination of the above. Details are provided in J. L. Throne’s book, Thermoforming, published in 1987 by Coulthard. Pages 21 through 29 of that book are incorporated herein by reference. Suitable alternate arrangements also include a pillow forming technique that creates a positive air pressure between two heat softened sheets to inflate them against a clamped male/female mold system to produce a hollow product. Metal molds are etched with patterns ranging from fine to coarse in order to simulate a natural or grain like texturized look. Suitable formed articles are trimmed in line with a cutting die and regrind is optionally reused since the material is thermoplastic in nature. Other arrangements for productivity enhancements include the simultaneous forming of multiple articles with multiple dies in order to maximize throughput and minimize scrap.
“Undercut and like terminology refers to the profile of a part having a recess, groove or wall that extends laterally under (or over) a portion of the same part. The “draft” of a thermoformed part can be thought of in the case of a (female) mold as the difference between the upper lateral span of a mold cavity and that span below it. A positive draft allows the pattern to be pulled cleanly from the mold, however, undercuts inherently have a negative draft. Articles that are thermoformed must be so designed as to permit the die section to be parted free of the molded articles without undue interference with the surfaces of the articles. Typically, the surfaces of thermoformed articles have a so-called positive “draft” with respect to the direction in which the die sections are moved during parting to insure that there is no interference between the molded article and the interior surfaces of the die sections during parting. Interference between the articles and the dies is commonly known as “negative draft” and occurs when undercuts are molded into a part. In the present invention, the undercut depth or distance of the lid rim required to secure the lid to a container base is generally kept to a minimum.

“Unfluted” when used to describe a dome sidewall means the unfutluted portion has a curvature equal to or less than the curvature of the dome sidewall generally.

“Wall caliper”, “caliper” or like terminology refers to the wall thickness of a lid or container base.

Typical materials for the lids of the invention include polystyrene containing compositions, oriented polystyrene sheet and the like, as well as thermoplastic materials comprising polypropylene.

The lids of the invention are used for pressed paperboard containers, that is, those that are made from paperboard blanks that are typically cut to size. Coated paperboard is typical, printed, coated with a functional grease/water resistant barrier and moistened prior to blanking and forming. The printed, coated and moistened paperboard roll is then transferred to a web fed press where the blanks are cut in a straight across, staggered, or nested pattern (to minimize scrap). The blanks are transferred to the multi-up forming tool via individual transfer chutes. The blanks will commonly hit against blank stops (rigid or pin stops that can rotate) for final positioning prior to forming. The stop heights and locations are chosen to accurately locate the blank and allow the formed product to be removed from the tooling without interference. Typically the inner portions of the blank stops or inner blank stops are lower in height since the formed product must pass over them.

The following U.S. patents contain further information as to materials, processing techniques and equipment for paperboard container manufacture and are incorporated by reference into this application: U.S. Pat. No. 6,715,630, entitled “Disposable Food Container With A Linear Sidewall Profile and an Arcuate Outer Flange”; U.S. Pat. No. 6,893,693 entitled “High Gloss Disposable Pressware”; U.S. Pat. No. 6,585,506, entitled “Side Mounted Temperature Probe for Pressware Die Set”; U.S. Pat. No. 6,592,357, entitled “Rotating Inertial Pin Blank Stops for Pressware Die Set”; U.S. Pat. No. 6,589,043, entitled “Punch Striper Ring Knock-Out for Pressware Die Sets” and U.S. application Ser. No. 09/978,484, entitled “Deep Dish Disposable Pressed Paperboard Container”; Ser. No. 10/600,814, entitled “Disposable Servingware Containers with Flange Tabs” See also, U.S. Pat. Nos. 5,249,946; 4,832,676; 4,721,500; and 4,609,140, which are also pertinent and are disclosed herein in their entireties by this reference.

For pressed paperboard plate stock of conventional thicknesses in the range of from about 0.010 to about 0.040 inches, the springs upon which a lower die half of a forming set is mounted are typically constructed such that the full stroke of the upper die results in a force applied between the dies of from about 6000 to about 14,000 pounds or higher. Similar forming forces and control thereof can likewise be accomplished using hydraulics as will be appreciated by one of skill in the art. The pressed paperboard that is formed into the blanks is conventionally produced by a wet laid paper making process and is typically available in the form of a continuous web on a roll. The paperboard stock can have a basis weight in the range of from about 100 pounds to about 400 pounds per 3000 square foot ream and a thickness or caliper in the range of from about 0.010 to about 0.040 inches as noted above. Lower basis weight paperboard stock is generally used for ease of forming and to save on feedstock costs. Paperboard stock utilized for forming paper plates is typically formed from bleached pulp fiber and is usually double clay coated on one side. Such paperboard stock commonly has a moisture (water) content varying from about 4.0% to about 8.0% by weight.

The effect of the compressive forces at the paperboard rim is greatest when the proper moisture conditions are maintained within the paperboard: at least about 8% and less than about 12% water by weight, or from about 9.0 to about 10.5%. Paperboard stock having moisture in this range has sufficient moisture to deform under pressure, but not such excessive moisture that water vapor interferes with the forming operation or that the paperboard is too weak to withstand the forces applied. To achieve the desired moisture levels within the paperboard stock as it comes off the roll, the paperboard is treated by spraying or rolling on a moistening solution, primarily water, although other components such as lubricants can be added. The moisture content can be monitored with a hand held capacitive-type moisture meter to verify that the desired moisture conditions are being maintained or the moisture is monitored by other suitable means, such as an infra-red system. The paperboard plate stock generally will not be formed for at least about 6 hours after moistening to allow the moisture within the paperboard to reach equilibrium.

The paperboard stock is typically impregnated with starch and coated on one side with a liquid proof layer or layers comprising a press-applied, water-based coating applied over the inorganic pigment typically applied to the board during manufacturing. Carboxylated styrene-butadiene resins can be used with or without filler if so desired. In addition, for aesthetic reasons, the paperboard stock is often initially printed before being coated with an overcoat layer. As an example of typical coating material, a first layer of latex coating can be applied over the printed paperboard with a second layer of acrylic coating applied over the first layer. These coatings can be applied either using the conventional printing press used to apply the decorative printing or can be applied using some other form of a conventional press coater. Coatings utilized in connection with the invention can include about 2 pigment (clay) containing layers, with a binder, of about 6 lbs/5000 ft² ream or so followed by
about 2 acrylic layers of about 0.5-1 lbs/3000 ft² ream. The clay containing layers are generally provided first during board manufacture and the acrylic layers are then applied by press coating methods, i.e., gravure, coil coating, flexographic methods and so forth as opposed to extrusion or film laminating methods which are expensive and can require offline processing as well as large amounts of coating material. An extruded film, for example, can require about 25 lbs/3000 ft² ream.

[0038] A layer comprising a latex can contain any suitable latex known to the art. By way of example, suitable latexes include styrene-acrylic copolymer, acrylonitrile styrene-acrylic copolymer, polyvinyl alcohol polymer, acrylic acid polymer, ethylene vinyl alcohol copolymer, ethylene-vinyl chloride copolymer, ethylene vinyl acetate copolymer, vinyl acetate acrylic copolymer, styrene-butadiene copolymer and acetate ethylene copolymer. The layer can comprise a latex comprising styrene-acrylic copolymer, styrene-butadiene copolymer, or vinyl acetate-acrylic copolymer. Still further, the layer comprises a latex containing vinyl acetate ethylene copolymer. A commercially available vinyl acetate ethylene copolymer is "AERFLEX® 100 HS" latex (Air Products and Chemicals, Inc., Allentown, Pa.). The layer can comprise a pigmented latex. Pigmenting the latex increases the coat weight of the layer comprising a latex thus reducing runnability problems when using blade cutters to coat the substrate. Pigmenting the latex also improves the resulting quality of print that can be applied to the coated paperboard. Suitable pigments or fillers include kaolin clay, delaminated clays, structured clays, calcined clays, alumina, silica, alumino-silicates, talc, calcium sulfate, ground calcium carbonates, and precipitated calcium carbonates. Other suitable pigments are disclosed, for example, in Kirk-Othmer, Encyclopedia of Chemical Technology, Third Edition, Vol. 17, pp. 798, 799, 815, 831-836. The pigment can be selected from the group consisting of kaolin clay and conventional delaminated coating clay. An available delaminated coating clay is "HYDRAPRINT" slurry, which is believed to be supplied as a dispersion with a slurry solids content of about 68% (J.M. Huber Company, Edison, N.J.). The layer comprising a latex can also contain other additives that are well known in the art to enhance the properties of coated paperboard. By way of example, suitable additives include dispersants, lubricants, defoamers, film-formers, antifoamers and crosslinkers. By way of example, "DISPEN X-4" is one suitable organic dispersant and comprises about 40% solids dispersion of sodium polycarboxylate (Allied Colloids, Bradford, UK). By way of example, "BERCHEM 4925" (Bercen, Cranston, R.I.) is one suitable lubricant and which is believed to comprise 100% active coating lubricant based on modified glycercides. By way of example, "Foamaster DF-177NS" is one suitable defoamer (Henkel, Gulp Mills, Pa.). In one form, the coating comprises multiple layers that each comprise a latex.

[0039] Typically, paperboard for containers contains up to about 6% starch; however, the rigidity can be considerably enhanced by using paperboard with from about 9 to about 12 weight % starch. See, for example, U.S. Pat. Nos. 5,938,112 and 5,326,020, the disclosures of which are incorporated herein by this reference.

[0040] The paperboard stock is generally moistened on the uncoated side after all of the printing and coating steps have been completed. In a typical forming operation the web of paperboard stock is fed continuously from a roll through a scoring and cutting die to form the blanks which are scored and cut before being fed into position between the upper and lower die halves. The die halves are heated as described above, to aid in the forming process. It has been found that good results can be obtained if the upper die half and lower die half—particularly the surfaces thereof—are maintained at a temperature in the range of from about 250°F to about 400°F, or at about 325°F±25°F. These die temperatures have been found to facilitate the plastic deformation of paperboard in the rim areas if the paperboard has suitable moisture levels. At such die temperatures, the amount of heat applied to the blank is generally sufficient to liberate the moisture within the blank and thereby facilitate the deformation of the fibers without overheating the blank and causing blisters from liberation of steam or scorching the blank material. It is apparent that the amount of heat applied to the paperboard stock will generally vary with the amount of time that the dies dwell in a position pressing the paperboard together. Suitable die temperatures are based on the usual dwell times encountered for normal plate production speeds of about 40 to about 60 pressings a minute, and commensurately higher or lower temperatures in the dies would generally be required for higher or lower production speeds, respectively.

[0041] In view of the multiplicity of potential sources of variation in pressed paperboard container dimensions, it is not surprising that a modulus of size and shape variation occurs, even under carefully controlled conditions. As will be appreciated from the foregoing, formation of a pressed paperboard container is a complex process where stretch, shape relaxation, moisture control and other factors can each cause some size variation. The inventive lid design readily accommodates the observed variations, as is further discussed below.

[0042] In the particular design illustrated, a lid for a nominal 9 inch plate includes about 48 outwardly convex flutes and a lid for a ten inch plate includes about 54 outwardly convex flutes. The flutes are generally positioned close to the outer rim of the lid in order to aid in lid-to-plate application. It has been determined in accordance with the present invention that a flute position closer in relation to the outer rim or outer horizontal periphery area in a plate with a horizontal extension at its outer rim can significantly increase the ease of the lid application to the paperboard container base. The number of flutes around the perimeter of the dome and the relationship of crush resistance is further explained in U.S. patent application Ser. No. 10/170,675 entitled "Crush-Resistant Disposable Lid", filed on Jun. 13, 2002, as well as U.S. patent application Ser. No. 11/351,100, filed on Feb. 4, 2005, entitled "Crush-Resistant Disposable Lid and Containers Utilizing Same", the disclosures of which are incorporated herein by reference. The flutes of the sidewall can consist essentially of outwardly convex flutes, that is, contain less than about 10% by number inwardly convex flutes. In the example illustrated herein the flutes are spaced by a substantially equal number of unfluted areas.

[0043] It has been discovered in accordance with the present invention that from about 7 to about 15 and more particularly from about 10 to about 12 evenly-spaced undercut lugs around the domed rim perimeter provide a particularly suitable combination of properties in terms of lid application, retention and lid removal when the container
base comprises an evert outer portion. The inventors herein have determined that the undercut lug design of the present invention performs much better than a continuous undercut design as disclosed in the '675 application when used with a pressed cardboard container having an evert outer portion. In particular, pressed cardboard containers having evert outer portions can range in size as a result of varying formation factors including paper stretch during forming, plate formation/rim pressing and subsequent plate shape relaxation and spring back after forming. Plate diameters can also vary from differing paper moisture contents as a result of humidity where the plates are stored. An 11-lug design of the invention created an effective and flexible lid to fit on a range of pressed cardboard plate diameters with the plates tested.

[0044] Significantly, the lids could be lifted and transported with a food load/or weight even if all of the undercut lugs were not fully engaged. This was found to be important when used with the pressed cardboard containers comprising an evert outer portion because the variations in size can make it difficult to fully engage the continuous undercut design of the '675 application. In particular, the continuous undercut design requires full engagement around the container base circumference, otherwise the lid would readily fall off during lifting with a food load.

[0045] In particular, it was found that pressed cardboard plate diameters for nominal 9 inch plates range from about 8.48 inches (loose fit) to about 8.56 inches (tight fit). Most plates were between about 8.5 inches and about 8.54 inches and fit well with the lid of the present invention sized for that plate size. The 11-lug design worked well over this range i.e., loose to tight fit, of pressed cardboard containers. With respect to the nominal 10 inch plates, the pressed cardboard plate diameters ranged from about 9.90 inches (loose fit) to about 10.10 inches (tight fit). Most plates were from about 10.03 inches to about 10.060 inches. These plates all had a good fit with the lid design of the present invention sized for this plate. Eleven lugs worked well over this range with the nominal 10 inch plate from loose to tight fit. Thus, the lid of the present invention is relatively insensitive to variations in container diameters experienced with pressed cardboard containers.

[0046] It has been found by the inventors herein that a continuous undercut design can disengage too easily when used with container bases having evert outer portions. The release of a single area of attachment (or incomplete attachment around the entire perimeter of the container) causes the disengagement of the lid from the container moving away from the location of disengagement. Incomplete attachment of the lid to a container base having an evert outer portion causes the lid to separate from the container starting from the point of disengagement moving outward from that point. Once the separation process starts, it is difficult to stop (especially if there is food on the plate) and the failure of the lid contact is likely swift. Therefore, upon commercial use of container bases having evert outer portions, it was found that prior art lidding solutions for pressed cardboard containers would not be effective for such containers.

[0047] Many prior art pressed cardboard containers have downward sloping outer rims. The use of lugged lid designs were not desirable with the downward sloping pressed cardboard container design because when one portion of the plate was disengaged from a lug, the prior art pressed cardboard containers experienced flexing of the container base which, in turn, caused the portions of the prior art containers engaged with the remaining lugs to more tightly engage (e.g. lock) with the lugs. When a hinged lid was used with a pressed cardboard container having a downward slope and a user attempted to remove the lid, the act of removing the lid by pulling on the lid caused the lid to lock tightly on the pressed cardboard container. This normally resulted in a user needing to apply considerable force to the lid to get it to come off, which could result in the food spilling from the container.

[0048] Because the lugs in the lids of the present invention are distributed around the perimeter of the lid so that from about 15% to about 30%, or from about 20% to about 25%, of the lid periphery is available for engagement with the lugs, the lids of the present invention are more easily removed from pressed cardboard containers having evert outer portions. It has thus been found that an excellent (or “just right”) seal is possible using the lid design of the present invention.

[0049] The lidded containers of the present invention are to be distinguished from the lidded container disclosed in U.S. Design Pat. No. 415,024 (the disclosure of which is incorporated herein in its entirety by this reference). As apparent from the number of “fluted” portions, the plate therein is necessarily formed from a polymeric material, such as polystyrene or the like. This is evident because, as would be recognized by one of ordinary skill in the art, it is not technically possible to form a pressed cardboard container having the large number of “flutes” (or pleats) pictured in the ‘024 patent. Additionally, although FIG. 1-3 of the ‘024 patent might, at first glance, appear to show an evert-type outer portion, the actual shape of the polymeric plates of the ‘024 patent are shown in detail in FIG. 4 of the patent. In that FIG. 4, the plates terminate in a downward slope (like the cardboard plates of U.S. Pat. No. 6,715,030, discussed previously herein). As such, when viewing all of the figures of the ‘024 patent together, one of ordinary skill in the art would not interpret the ‘024 patent to disclose a lidded container for use on a pressed cardboard container having an evert outer portion.

[0050] Further details will become apparent from the discussion which follows. It is noted that the lid annular engagement portion defines a diameter corresponding to its engagement circumference which is substantially identical to, but slightly smaller than, the average plate diameter for which the lid is sized. A lid for a nominal 9 inch plate (average diameter about 8.5 inches) has an annular engagement portion which defines a diameter of about 8.4 inches, while a lid for a nominal 10 inch plate (average diameter about 10.0 inches) has an annular engagement portion which defines a diameter of about 9.9 inches. The optimal lid sizes for pressed cardboard containers of other sizes can be determined by those of ordinary skill in the art without undue experimentation.

[0051] Referring to the drawings, in particular, FIGS. 2, 3, 3A and 3B, there is shown a domed lid 10 which includes a central portion 12, a fluted sidewall 14 extending downwardly from the central lid portion; the fluted sidewall of the domed lid being provided with a plurality of flutes such as flutes 16, 18, and 20. The fluted sidewall thus defines a fluted base 22 at its lower portion.
A rim 24 extends outwardly and downwardly from the fluted sidewall 14 and defines an annular engagement portion 26. Annular portion 26 is sized to engage the perimeter of a container having an event outer portion (not shown). The rim is further provided with a plurality of generally equally spaced undercut lugs, such as 28, 30, 32, 34, 36, 38 and so forth around the annular engagement portion of the domed lid. The lugs are for securing the lid to a perimeter of a container as noted above. The lugs are generally equally spaced around the circumference; in other words, the lugs are separated by an angular displacement which is generally uniform. Some variation is of course permissible in cases where other features are disposed around the perimeter of the container such as removal tab 37, for example. Likewise, the lugs adjacent removal tab 37 have slightly less arc length, as noted below.

The plurality of undercut lugs define a collective undercut span indicated schematically at 40 of from about 15% to about 30% of the circumference of the annular engagement portion of the rim. The diameter of annular engagement portion 26 is a minimum internal diameter of the rim which is measured between opposite undercut, that is, at a point of maximum interference with the plate. This distance is about 8.4 inches for a nominal 9 inch plate and about 9.9 inches for a nominal 10 inch plate as noted above. The about 15% to about 30% refers to the collective undercut span of the lugs. That is to say, in cases where 11 lugs are present, their collective undercut span is from about 15% to about 30% of the total circumference of the annular engagement portion of the rim based on the diameter of annular engagement portion 26. The lid engagement circumference is calculated based on the diameter of annular engagement portion as noted above for purposes of determining the fraction or percentage of the collective span of the lugs. The span of individual undercut is shown as distance 40 in the various diagrams, while their additive or collective span 40 is the sum of the spans 40 of each individual lug.

In some examples, the plurality of generally equally spaced undercut lugs defines a collective (additive) undercut span of from about 20% to about 25% of the circumference of the annular engagement portion of the rim.

While any suitable number of generally equally spaced undercut lugs can be provided, there is provided in some separate examples from about 7 to about 15 generally equally spaced undercut lugs and in some cases from about 10 to about 12 undercut lugs. In the example illustrated herein, there is provided 11 generally equally spaced undercut lugs.

The undercut lugs have an undercut depth 42 (FIG. 3C) of from about 25 to about 100 mils. The undercut depth is measured from the inner engagement portion 26 of the lid and the inner edge 42 of the undercut lug. Typically, the undercut lugs have an undercut depth of from about 40 to about 75 mils.

The undercut lugs have an individual circumferential span 40 of from about ¼ inch to about 1 inch, with from about 0.5 to about 0.75 inches being typical. The individual circumferential undercut span of the lugs is measured as the arc length from one edge of the undercut to the other edge of the undercut as is indicated schematically at 40 in the various diagrams. This distance is a "circumferential distance". In a suitable example, each of the lugs has an undercut span of about 0.625 inches except that the two lugs on either side of a removal tab 37 have a somewhat shorter undercut span of about 0.5 inches in order to facilitate lid removal.

The sidewall of the lid is suitably provided with a plurality of outwardly convex flutes. These flutes have been found to provide superior strength characteristics as noted above. The flutes can have a radius of curvature indicated at 44 of from about 0.125 inches to about 0.5 inch. In the embodiment illustrated, the flutes have a radius of curvature of about 0.25 inches for nominal 9 and 10 inch lugs. The flutes have a flute depth 46 of from about 0.05 inches to about 0.2 inches (see FIG. 3D). The flute depth is the distance from the outermost portion of the flute to its innermost portion at the base thereof as indicated schematically in the diagrams. Curvature can be measured at the base as well. There is provided in some examples from about 1.5 to about 1.9 outwardly convex flutes per inch of engagement perimeter of the lid. The engagement perimeter of the lid is the circumference of an annular engagement portion 26 as shown in the various diagrams. A particularly suitable range is from about 1.6 to about 1.85 outwardly convex flutes per inch of engagement circumference of the lid. In this respect it is noted that a lid for a 9 inch plate has 48 flutes while a lid for a 10 inch plate has 54 flutes. Thus the domed lid of the invention is typically provided with from about 35 to about 75 generally uniform outwardly convex flutes. In many cases there is provided from about 45 to about 60 generally uniform outwardly convex flutes.

While the inventive lid can be made from a variety of materials, thermoformed lids made from oriented polypropylene having a caliper of about 12½ mils are suitably employed. Other thicknesses can also be used just so long as the lid does not become too thick or too thin for efficient use of the lid.

To improve the usability of the lids of the present invention on pressed paperboard containers, the domed lids can be configured such that the fluted base of the sidewall is disposed near the outer perimeter of the lid. Suitably fitted on a paper plate the fluted base of the sidewall can be vertically aligned with the perimeter of a container within an offset distance 48 of about ¼ inch or so. An offset distance of from about ¼ to ¼ inch or less, for example, is particularly suitable. The offset distance is measured as the horizontal distance between a vertical line at the perimeter of the container base and a vertical line at the base of the fluted sidewall at a point of maximum convexity of the flutes. See FIG. 8A, in particular.

A pressed paperboard container base such as plate 50 (FIG. 4) can include a generally planar bottom portion 52, a first annular transition portion 54 extending upwardly and outwardly from the generally planar bottom portion of the container. There is further provided an optional sidewall portion 56 extending upwardly and outwardly from the first annular transition portion 54. A second annular transition portion 58 flares outwardly with respect to the first annular transition portion 54, while an outer flange portion 60 extends outwardly with respect to the second annular transition portion.

Outer flange portion 60 includes a downwardly sloping brim portion 62 defining a declivity angle α at its
terminus with respect to a horizontal substantially parallel to the bottom portion of the container base. The downwardly sloping brim portion 62 transitions to a brim transition portion 66 which, in turn, transitions to an annular evert outer portion 68 which extends outwardly with respect to downwardly sloping brim portion 62 at an evasion angle $\beta$ (FIG. 5) of at least about 25 degrees. The evert outer portion 68 thus defines a container base perimeter. The annular engagement portion of the rim of the domed lid is sized to engage the base perimeter of the pressed paperboard container and the lugs are adapted to secure the lid to the container paperboard base by engaging evert outer portion 68 as is appreciated from the drawings. The annular evert outer portion is suitably a substantially horizontal projection which projects outwardly from the brim. The paperboard which can have a caliper of from about 10 to about 25 mils flexes when the lid is placed on the base.

[0065] FIG. 5 illustrates the various angles $\alpha$, $\beta$, and $\gamma$ of the outwardly projecting annular portion of containers that can be used in connection with the present invention. In each case there is illustrated a profile of a plate 50 having a substantially planar bottom portion 52 as well as a downwardly sloping brim portion 62, a brim transition 66 and an evert outer portion 68. Angle $\alpha$ is the angle between a tangent 59 at the terminus of downwardly sloping brim portion 62 and a line 53 generally parallel to bottom portion 52. The evasion angle $\beta$ is the angle between a tangent 61 to evert 68 adjacent its junction with transition portion 66 and tangent line 59 which is tangent to the terminus of portion 62 as shown. $\beta$ is an outward change in downward slope of the outer portion of the article and can be measured directly or can alternatively be calculated as $180^\circ - \gamma$ where the angle, $\gamma$, is the angle between tangent line 59 to portion 62 and tangent line 61 to evert outer portion 68. Angle $\beta$ is typically anywhere from about 25$^\circ$ to about 160$^\circ$ on an absolute basis. Portion 68 can have an upward slope, a downward slope or have 0 slope as is shown in FIG. 5 where evert 68 is horizontal, generally in a parallel direction to the plane of bottom 52. Suitably, $\beta$ is from about 30$^\circ$ to about 160$^\circ$; typically from about 30$^\circ$ to about 90$^\circ$ such as from about 35$^\circ$ to about 65$^\circ$ or from about 45$^\circ$ to about 55$^\circ$. Declivity angle $\alpha$ is typically about 80$^\circ$ or less such as about 65$^\circ$ or less, but typically more than about 25$^\circ$.

[0064] Referring to the schematic diagrams of FIG. 6 and following, rim 24 has an outwardly extending wall 72 adjacent the fluted base 22 of sidewall 14. A downwardly extending engagement wall 74 defines annular engagement portion 26 of the rim above the undercut lugs. Outwardly extending wall 72 thus defines a headspace 76 (FIG. 8A) just outwardly of the uppermost point 78 of the brim. The headspace is the distance between flute base 22 and a vertically aligned portion of the rim when the lid is installed on a pressed paperboard container base as is shown in FIG. 8A. A headspace of at least about 30 mils or about 50 mils above the brim of the container base when the lid is installed on the base is desirable in some embodiments. The headspace can be more than about 150 mils above the brim and is suitably between about 30 mils and about 250 mils above the brim when the lid is installed on the base. It is typically desirable to have an outwardly extending wall such as wall 72 on the brim to provide stiffness to the lid.

[0065] Operation of the domed lid and the cooperation with a suitable container is better appreciated with reference to FIGS. 6 through 8

[0066] In FIG. 6 the domed lid 10 is shown prior to engaging container base 50. In FIG. 7 the dome lid is pushed downwardly such that an outer portion 80 below the engagement portion 26 of the dome begins to bear upon and flex evert outer portion 68 downwardly as the dome is installed on the container.

[0067] In FIG. 8, evert outer portion 68 is shown as having re-flexed outwardly with respect to the dome and is again in a substantially horizontal position. It will be appreciated from FIGS. 6 to 8 that the headspace is necessary to allow the flexing of the container to occur while the lid is being installed such that a secure fit of the dome and container is achieved as is shown in FIG. 8.

[0068] While the invention has been described in connection with various embodiments, modifications within the spirit and scope of the invention, set forth in the appended claims, will be readily apparent to those of skill in the art.

What is claimed is:

1) A disposable container comprising:

a) a domed lid having:

i) a central lid portion;

ii) a fluted sidewall extending downwardly from the central lid portion, the fluted sidewall of the domed lid being provided with a plurality of flutes, such that the fluted sidewall defines a fluted base at its lower portion; and

iii) a rim extending outwardly and downwardly from the fluted sidewall providing an annular engagement portion defining a lid engagement circumference, the rim being further provided with a plurality of generally equally spaced undercut lugs around the annular engagement portion of the domed lid; and

iv) a pressed paperboard container having an evert outer portion;

wherein the plurality of undercut lugs of the lid rim are sized to secure the lid to the container and have a collective undercut span of from about 15% to about 30% of the lid engagement circumference, wherein the perimeter of the base and the annular engagement portion of the lid rim are sized to engage each other when the lid is installed on the base.

2) The container of claim 1, wherein the plurality of undercut lugs of the lid rim define an undercut span of from about 20% to about 25% of the lid engagement circumference.

3) The container of claim 1, wherein the lid rim is provided with from about 7 to about 15 generally equally spaced undercut lugs around the annular engagement portion thereof.

4) The container of claim 1, wherein the lid rim is provided with from about 10 to about 12 generally equally spaced undercut lugs around the annular engagement portion thereof.

5) The container of claim 1, wherein the undercut lugs of the lid rim have an undercut depth of from about 25 mils to about 100 mils.
6) The container of claim 1, wherein the undercut lugs of the lid rim have an undercut circumferential span of from about \( \frac{1}{4}'' \) to about 1''.

7) The container of claim 1, wherein the lid rim has an outwardly extending wall adjacent the fluted base of the sidewall and a downwardly extending engagement wall defining the annular engagement portion of the rim above the undercut lugs, wherein the outwardly extending wall defines a headspace of at least about 30 mils above the brim of the container base when the lid is installed on the base.

8) The container to claim 1, wherein the lid rim has an outwardly extending wall adjacent the fluted base of the sidewall and a downwardly extending engagement wall defining the annular engagement portion of the rim above the undercut lugs, wherein the outwardly extending wall defines a headspace of from about 30 mils to about 150 mils when the lid is installed on the base.

9) The container of claim 1, wherein the sidewall of the lid is provided with a plurality of outwardly convex flutes.

10) The container of claim 9, wherein the flutes have a radius of curvature of from about 0.125'' to about 1''.

11) The container of claim 9, wherein there is from about 1.5 to about 1.9 outwardly convex flutes per inch of engagement circumference of the lid.

12) The container of claim 1, wherein the domed lid is provided with from about 35 to about 75 generally uniform outwardly convex flutes.

13) The container of claim 1, wherein the domed lid and container base are configured and dimensioned such that the perimeter of the container base is vertically aligned with the fluted base of the sidewall within an offset distance of about \( \frac{1}{4}'' \) to about \( \frac{3}{8}'' \) when the domed lid is installed on the base.