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DESCRIPTION

[0001] The invention relates to a process for producing a lid closure for cans for receiving foodstuff, which are subject to a thermal treatment above 50°C in the form of sterilization or at least pasteurization.

[0002] Lids are concerned having an annular ring for seaming to the can body, the lid can be firmly and tightly connected with the can body rim and is in particular made from metal, and a "lid diaphragm" (diaphragm or panel) in the form of a cover surface which is affixed to the annular ring (for seaming to the can body) in such a way that, for the opening of the can, the panel can be pulled off from the seamable annular ring or may be peeled off from it by means of pulling. This relates on the one hand to peeling foils and, on the other hand, also to foils which are to be torn at the edge or are to be further torn.

[0003] One design of such a lid cover is known from US-A 4,211,338 (Bublitz). Difficulties arise at high temperatures, at any rate above 50°C, as they are - as a rule - present in sterilization or pasteurization processes in continuous autoclaves (retorts). The lid will leak or the lid diaphragm even begins to detach itself from the annular ring under the action of a difference in pressure which acts upon the lid, or can be damaged in such a way that this would result in a later leakage at the sealing line.

[0004] Consequently, these cans are mostly sterilized in such autoclaves (batch retort stations) which are equipped with means for generating an outer air or vapor pressure in order to apply a sufficient counter-pressure onto an outer surface of the lid, opposing the internal pressure in the closed can, due to which the lid, in particular the lid diaphragm, will be protected against too high differences in pressure ΔP.

[0005] It is not possible (or it requires great effort) to equip "continuous autoclaves" with such counter-pressure means that are suitable for continuous passage.

[0006] Continuous autoclaves (for a pasteurization or a sterilization process) with a counter-pressure due to a vapour atmosphere certainly generate a low permanent counter-pressure on the lid surface of up to 1.6 bar (0.16 MPa), but they are not sufficient for stabilizing customary "peel lids" without damage.

[0007] In addition to this, the lid surface would not form a smooth, fine-looking surface after cooling of the cans, which impairs acceptance by the customers and results in illegibility of any type of inscriptions or bar codes by scanners.

[0008] EP 0683 110 A1 (Carnaudmetalbox, Ramsey) discloses several embodiments of a container-lid combination. In figures 6, 7 and 10 of this document, there is provided a surrounding annular component that is seamed to the upper end of the body wall and has an inward directed web that is slanted upwards, item 42 in figure 6 and 7. The inner end of this slanted surface is somewhat curled, see item 42A in both referenced figures. A panel portion 32 is provided that is curved over this inner curl 42A and has either a flat definition in figure 6 or has a surrounding outer groove 41 in figure 7. A different embodiment is shown in figure 10, having a portion of the upper end wall of the container body that is slanted outwards. This slanted upper end portion is sealed with a panel or membrane that is shown in several operational conditions 76, 76a and 76b. An explanation of figure 10 is given in this document on page 5, line 10 ff. According to increasing pressure in the inside of the container, the lid 71 of polymeric material as stated there starts to bulge in the middle first and develops complete eversion (shown in dashed lines in said document). Thereby the volume of the liquid container is increased by about 10%. It is mentioned there that the container body has the outward inclined flange portion having an angle of about 120° and on page 6, lines 25 to 37, the heating and the developing of the bulging from the concave arcuate cross section to bulge as a convex form 76a, 76b is in more detail explained. There is no explanation of how this lid will develop or behave when the pressure in the inside is reduced and the can is cooled.

[0009] Another lid is disclosed by US 5,752,614 (Sonoco, Nelson). This reference has lid ring in figures 4 and 5 and develops a bulging inner panel portion 30 in said reference, especially shown in figures 5 and 7. Still, this container is said to be easy openable, see column 1, line 45. Still, this design has to have a maximum strength to resist the retort forces, as explained in column 5, line 23 to 40. There is no explanation of how the membrane 30 develops after pressure of the retort station is reduced and cooling takes place. The other embodiment of this reference, figure 1 and 2, operates with a bending inner lid ring, that extends further upwards, when pressure occurs in the inside of the can, see figure 2 and item 20, called "membrane ring". This ring 20 is according to column 2, line 48 to 54 "positioned" to protect the bond between the metal end ring and the membrane ring from being placed into tensile or shear. The drawing explains that this is an upward directed change of angle of the membrane ring.

[0010] In US 1,162,520 (Shaffer), a can is shown that has a corrugated shape in figure 1 and changes its corrugated inward shape to a corrugated outward shape in figure 3 and returns in figure 4 to a somewhat flat, but still corrugated shape. This panel is explained on page 2, lines 121 to 130 and on page 3, lines 1 to 8. The central bend which is explained as a small circular corrugation helps in bulging and collapsing, page 3, lines 3/4.

[0011] Further references are originating from Japan. JP 558-192257 U has in its figures 4 and 5 a panel shape that domes or flexes axially outwards, but is a complete lid that has a seat 3 surrounding the outer lid upper end that is according to the drawings not a seamed position of a lid ring. A similar disclosure is found in JP 554-28638 U, where a cup is shown, and a lid closes this cup that has certain inner radial rings 13a, 13b and 13c in said reference, that give a cross-sectional shape or a staggered circular- or ring-shaped portion of the whole lid 12 in figure 3 of this reference. Apparently, an inner ring might flex upwards, where a further thin line 13b is shown in figure 4, making a small portion of the lid 12 to change its shape, but the closure is not a closure that can be called a lid ring that is fixed by seaming to a can body.

[0012] WO 2005/005277 A1 (Crown) discloses a lid that has a lid ring and a central panel which includes at least one concentric bead. The lid ring has an inclined flat web that is tilted axially upwards. Onto this slanted seal, that is called bonding panel in said document, the diaphragm as central foil is sealed. This diaphragm is deflectable outwards and gives the container an increase in volume, when subject to a pressure differential, as is the case during thermal processing. As said diaphragm has stretch introduced prior to processing (by the provision of said beaded profile), this beaded profile is deflected and serves for a generally domed shape after thermal treatment, page 2, bottom paragraph, page 3, first paragraph. The pre-stretching therefore concerns said at least one concentric bead (beaded profile) in the diaphragm, and pressure control takes place (page 4, second paragraph).

[0013] **It is an object of the invention,** to suggest a method for producing a lid closure of peel type which allows a safe sterilization of filled and closed cans in continuous autoclaves (high temperature prevailing there and a resultant high pressure in the can) avoiding risk of breaking, breaking up or detaching said plane (surface oriented) cover panel on or from the seamable annular ring. After the cooling of the can, the lid should also have an acceptable appearance.

[0014] These objects are achieved according to claim 1 concerning the production process of the lid closure.

[0015] The invention comprises steps for "ensuring" the tightness of the can closures during sterilization in a continuous autoclave in the sense of a securing or providing of tightness on the can closures that work with an "annular ring" (for seaming to the can body).

[0016] The invention is not limited to lids for cans of a circular shape, but can also be applied with the same effect and the same advantages to cans of other circumferential or cross-sectional shapes such as oval, rectangular, rectangular with rounded corners or square shapes of cans (can bodies).

[0017] The "dome-shaped or bowl-shaped preforming" of the cover panel allows - after filling with food or foodstuff and upon closing of each can with the lid - to substantially reduce the headspace in the can. The curved shape with its center may project substantially downwards beyond that area of the annular ring that is placed innermost of a can body inside. If, under the internal pressure formed during the thermal treatment in the interior of the can, the dome-shaped or bowl-shaped cover panel portion changes, in particular abruptly (suddenly) changes, to a bulging position that is mirror-inverted to the original position, now towards the outside, resulting in a substantial enlargement of the headspace and thus a reduction of the pressure in the can formed during thermal treatment.

[0018] This change function is supported by a stiffening of the cover panel at least in the central portion by the preformation of this portion. A plane material is used for this purpose, which itself or a layer thereof will get harder due to the preferred deep-drawing process. Thus, a certain shape keeping hardness or stability results from this as a tightening. Said stability is distributed across the entire panel surface, radially within the annular ring. The panel surface is named plane or "areal oriented" as the surface has a lateral extension but on a curved panel, that is plane, but not flat.

[0019] This stability achieves that practically the same, but reversed or inverted panel shape is obtained upon outwards directed bulging. It corresponds to the inverted original dome shape without increasing the surface area, without plastic preformation, in particular without a "stretching" of the panel. After the temperature is reduced, the central portion of the cover panel is again returned to its preformed original shape upon cooling, which it adopts without any further help (due to the vacuum formed in the inner space and "under the cover panel").

[0020] The smooth dome or bowl shape (preformed bulging) of the lid of the can that is ready for sale is very fine-looking and does not encounter any problems as regards acceptance by customers.

[0021] The process is for producing a lid closure for cans containing foodstuff (claim 1). The lid provides tightness during sterilization or pasteurization in a continuous autoclave. Said cans being closed with a can closure as lid. The can closure is produced from an annular ring (adapted for seaming to the can body, a so called "Deckelring") and a lid panel having an outer ring band. The band is sealingly placed onto an inner flat web. Prior to attaching the lid to the filled can a central area of the lid panel is reshaped by preferably deep drawing to a smooth bowl shape or a dome shape with a plane surface, this as "original shape". An outer ring band limits the central area (surrounds it in case of a circular lid). A material of this central area is solidified or hardened by the deep drawing process (step), this to such an extent that under an increased pressure in a headspace of the can during the can's passage through an autoclave station, the central area changes to an axially outwardly bulging shape that is mirror-inverted. The inversion is with respect to the "original shape". During a subsequent cooling of the closed can, the central area automatically returns to the "original shape". This is at least substantially the same.

[0022] The suggested cover panel permits a sterilization or pasteurization of the filled cans at the pertinent high temperatures and differential pressures in continuous autoclaves readily and without any risks, i.e. without any measure for generating a counter-pressure that additionally acts from the outside (other than the steam pressure). The steam pressure (vapor pressure) is regularly present, higher than atmospheric pressure, but not high enough to support forces on the outer surface of the lid.

[0023] The dimensions of the preformed shape (of the central portion) can be adjusted to the diameter and the volume of the cans. Likewise, the inclination of the flat web of the annular ring for seaming to the can body to which the outer ring band of the panel is affixed is adjusted in such a way with respect to a horizontal plane that an imaginary extension of the surface of the flat web extends at best tangentially to the dome- or inverted-bowl shaped central portion that bulges outwardly under pressure. The change of shape occurs preferably on an inner pressure level of 0.15 MPa.

[0024] The inclination of the web is directed upwards; this is "outwards axially" when the can body is taken as a reference, that is closed by the lid panel and the lid ring.

[0025] A preferred lid is adapted for closing a can with a diameter of 83mm. The depth of the preformed lid panel is between 5mm and 6mm, approx. 5,6mm, the lowermost point of it being about 3mm below the lowermost points of the annular ring for seaming to the can body. The bulging corresponds to a sphere segment in the case of a circular cross-section of the lid. The angle of the flat web is preferably between 22° and 25° with respect to the horizontal. Here, peeling forces are practically completely avoided.

[0026] The smooth/plane bowl/dome surface of the preformed lid panel is not disturbed by or interfered with any undulations or grooves.

[0027] The filled can with the lid can be at least pasteurized, in particular even sterilized, in practically any of the known continuous autoclaves without additional counter-pressure means. The food in kept therein for a long time, resulting from thermal treatment.

[0028] The production process of the lid closure is the subject matter of claim 1. The preformation (preforming) of the panel in the central area takes place in the same fashion. The processes permit the use of already used machines, in particular during a sealing on a plane flat web with subsequent inclined deformation of the web upwards/outwards (claim 3).

[0029] The panel surface may be applied onto the already inclined flat web or the - still plane - flat web which is to be inclined after heat sealing.

[0030] The invention is explained in greater detail in the following, using schematic drawings and **embodiments** serving as examples.

Fig. 1
: shows a section through a lid according to one example of the invention.

Fig. 2
: shows the transition area between annular ring for seaming to the can body and lid diaphragm on a larger scale.

Fig. 3
: shows a schematic sectional representation of a concrete example of a can with a predetermined diameter.

Fig. 4
: shows a representation of a concrete example of a preformed lid panel.

Fig. 5
: shows a lateral view of a representation of the concrete example.

Fig. 6
 2D sphere shape of a panel on a can body in theoretical evaluation (no annular ring displayed).
Fig. 6a
 is a 2D sketch of Figure 6.
Fig. 7
 shows the 3D model of Figure 6a.
Fig. 7a
 is a 3D representation for explanation of force and tensile stress.

[0031] As can be seen from **Figure 1**, a lid 1 has an outer annular ring 2 suitable for seaming to a can body and a lid panel 3.

[0032] The annular ring 2 (for seaming to the can body, in short: "lid ring", seaming ring or "annular ring") is e.g. made of sheet metal. It comprises an outer rim portion 4 as a "flared flange" for firm and liquid tight connection with a rim 24 of an opening of the can body, cf. **Fig. 3**. The flange 4 is connected through a core wall 5 with the flat web 6 projecting generally radially inwards. The flat web 6 that extends all around is axially outwardly inclined or tilted at an angle larger than zero with respect to a horizontal plane that extends perpendicular to a vertical axis 8 of the lid 1. The radially inner edge of the flat web 6 is axially bent towards the inside and is designed in a sterile fashion, in particular by means of a curling 7. It may also be replaced with a relatively blunt inner edge. In the case of other can shapes, the lid shapes and the "annular ring" for seaming to the can body are accordingly adapted (seen in the horizontal direction).

[0033] The lid panel 3 comprises an outer continuous ring band 3a which at least partially covers the flat web 6 of the annular ring from the outside, if the panel 3 is tightly connected with the annular ring 2 in a fastening strip 13, e.g. by means of contact sealing or induction sealing (pressure sealing, ultrasonic sealing, laser sealing). This ring band 3a limits the central portion 3b (provides its outer limit), a transition portion 3c between the two being within the area of the curling 7 after connection of the panel with the annular ring.

[0034] The central cover portion 3b of the lid panel is preformed by a deep-drawing process. This process can be implemented prior to or after the connection of cover panel 3 and annular ring 2 in the fastening strip 13. The stabilizing reshaping only covers the central portion. It is implemented across the entire surface of the panel.

[0035] The preforming converts the central portion 3b into a dome or bowl shape in the axially inwards direction, the edge of the bowl is in the transition portion 3c to the outer ring band 3a and the lowermost centre 3d of the panel is clearly, in particular at least a few millimeters below a horizontal plane 18 that passes through the lowermost points of the annular ring 2 according to Fig. 2. This also corresponds to the plane E2 of Fig. 3 in the example.

[0036] It is advantageous if, as is preferred, the panel itself comprises a material that is stiffened or hardened by the deep-drawing process such as aluminum or the like, or contains at least such a layer. Due to this, the preformed central portion 3b is provided with an inner shape (or dimensional) stability. This is of advantage for the entire appearance of the finished, closed and thermally treated can package.

[0037] During sterilization, if temperature and consequently pressure are generated in the interior of the filled can that was closed with the lid (cf. also Fig. 3), the preformed central portion will change, in particular change abruptly, from its "die sunk", undulation-free dome/bowl shape to a practically mirror-inverted shape that is axially outwardly bulging (sphere shaped in the case of round cans) as it is outlined in a dash-dotted fashion at 3b' in Fig. 1 and Fig. 3.

[0038] Due to the stiffening or hardening of material of the cover panel achieved during the preforming, the dilatability of the central portion 3b is accordingly practically zero so that even in the case of high pressures formed in the can during (thermal) treatment in a continuous autoclave, the outwardly bulging shape of the central portion can be determined in advance (by means of a computing).

2-D Model.

[0039] **Figure 6** is a can with domed panel (pre shaped membrane) under internal pressure and cross section in **Figure 6a** of the convex shaped panel. **Figures 6 and 6a** show the two-dimensional representation of a can with a domed panel under internal over-pressure. The two-dimensional model of the pre-shaped domed panel shows its convex shape under internal over-pressure

P. The parameters which indicate the geometry are given in the figures.

[0040] D is the diameter of the inner radius of the sealed zone, which is different from the can diameter, h is the dome deflection, y and z are the axes indicators, α is the angle of the dome with the y-axes. The volume increase, the angle and the radius of the convex dome can be calculated with the following equations:

$$\Delta V(h) = \frac{1}{6}\pi\, h^3 + \frac{1}{8}\pi\, h\, D^2 \qquad [mm^3]$$

$$\alpha(y,h) = \sin\left(\frac{8yh}{D^2 + 4h^2}\right) \qquad [rad]$$

$$\rho(h) = \frac{4h^2 + D^2}{8h} \qquad [mm]$$

3-D Model.

[0041] **Figure 7** is a convex shaped domed panel in 3-D coordinate system having x, y and z; ϕ, Θ (Theta) and p (rho). **Figure 7a** displays a force F on a randomly chosen small part (segment) of the domed panel and a part cross-section of it.

Stress in domed panel.

[0042] The tensile stress in the domed panel can be calculated rather straight forward with Figure 7a using the force known from the multiplication of the pressure and the surface segment. The force has to be divided over the length of the side (l) and the thickness (e) of the domed panel.

$$length\, l = \rho\, \Delta\varphi \sin\theta \qquad [mm]$$

$$thickness = e \qquad [mm]$$

[0043] The tensile stresses on all sides are therefore given by

$$\sigma_1 = \sigma_2 = \sigma_3 = \sigma_4 = \frac{P\rho}{2e} \qquad [N/mm^2]$$

[0044] The radius of curvature of the domed panel can be expressed in can dimension parameters. The tensile stress in the domed panel is

$$\sigma_1 = P\frac{4h^2 + D^2}{16eh} \qquad N/mm^2 \rightarrow MPa$$

[0045] In this equation ...

P is the pressure [N/mm^2]

p is the radius of the convex shaped domed panel

e is the domed panel thickness

h is the deflection of the domed panel

D is the inner radius of the sealed zone.

Slanted sealed zone (Sealing strip).

[0046] The sealed zone can be "bended up" in such a way that the sealed zone is slanted upwards (axially outward, or upwards) and parallel to the domed panel. In this situation there is only a shear stress in the sealed zone and no longer a peel stress. The following relation between the tensile stress in the panel and the shear stress in the sealed zone applies

$$\sigma e = \sigma_S w \quad \Rightarrow \quad \sigma_S = \frac{e}{w}\sigma \quad MPa$$

[0047] In this case the shear stress can be calculated by

$$\sigma_S = \frac{F}{w} = \frac{P\rho}{2w} = P\frac{D^2 + 4h^2}{16wh} \quad MPa$$

[0048] As outlined in **Figure 1**, the depth 10a of the bowl shape and the depth 10b of the bulging are practically equal. Referred to the plane 15, the volume in the depth portion (defined by 10a) is equal to the volume in the depth portion (defined by 10b). The depths/distances of the centers of the deformed lid panel represent the volume formed vis-à-vis the central plane 15 or E3. Upon the closing of a can body with the lid 1, the headspace H of the can is reduced by the dome/bowl volume (between 15 and 3b) and, upon heating during sterilization, the volume of the headspace is enlarged by the total volume 12 (from depths 10a and 10b).

[0049] Both contribute to a clear reduction of the maximally occurring pressure and secure the closed cans against damage upon their passage through the autoclave. Pressures of less than 1 bar (0.1 MPa) can be achieved, which, without the preforming of the panel would be clearly above this value, e.g. at 1.5 bar (0.15 MPa). This amount of the achieved lowering of the pressure depends in general on the temperature of the foodstuff filled in. At hot filling of food the differential pressure that occurs as a maximum on the panel is lower than the differential pressure when using cold filling such as for pet food as "foodstuff".

[0050] The stability as to shape/form, i.e. the avoided permanent deformation (as a missing plastic deformation or - at most - a residual elastic deformation by means of the modulus of elasticity) of the central portion 3b contributes to the fact that, upon the cooling of the finished sterilized can, this preformed portion 3b practically exactly re-adopts the original dome/bowl shape. In both conditions or positions or according to panel shape 3b and 3b' no undulations are contained in the panel. The bowls or domes are smooth (also called bulged, but with a plane surface in the bulging).

[0051] The fact that the central portion retains its area (in an envelope) permits the advance calculation of the measure of its bulging in the case of the pressures to be expected as a maximum during sterilization so that the angle of inclination 11 of the flat web 6 of the annular ring 2 for seaming to the can body can be adjusted to this right from the beginning. By no means is the angle smaller than the angle of a tangent at the bulging of the central portion 3b (next to the slanted web). The angle 11 is rather selected larger with preference so that that - in the case of the maximum internal pressures formed in the continuous autoclaves - practically exclusively shear forces and no peeling forces are active as resultant forces in the ring band 3a of the panel 3 that is affixed to the flat web.

[0052] The angle 11 is set to more than 20°. The radius or the transverse dimension (in the case of a deviation from the circular shape) of the central portion is shown as 9. Reference 16 in **Figure 2** emphasizes that the portion 3b in its bowl shape projects down to clearly below the plane 18 which passes through the lowermost portions (or points) of the annular ring 2.

[0053] The dimensions of the preforming and that of the angle of inclination depend upon the volume and the radial dimensions of the can and thus also on the size of the lid. The smaller the radius of the bulging in a pressure-loaded condition is, the smaller is the mechanical stress in the lid panel.

[0054] A suitable material of the lid panel 3 is a thin metal, preferably an aluminum, which is used for the body diameter of 83 mm. Other diameters may be used in the following manner, in a range of diameters between substantially 50 mm and 100 mm (for Europe), in particular with especially customary diameters: 73 mm, 99 mm, 65 mm, 83 mm; similar for containers (bodies) made of steel sheet.

[0055] The can body may be made of aluminum or steel sheet that are covered with a varnish.

[0056] The annular ring 2 is preferably made from an aluminum covered with varnish, the outer varnish layer being a hot sealable sealing layer, which is sealingly connected with the annular ring in the sealing portion 13. Instead of metal the ring material may also be plastic material or a plastic/metal composite, e.g. produced by means of an injection process with or without an insert or with a previous inserting of the lid panel in the shaped opening for the ring. Annular rings made of steel can likewise be used.

[0057] Instead of the hot sealable layer on the ring, ring 2 may also be laminated or extruded with polymers. The lamination of the ring is done prior to the cutting out and the shaping of the annular ring.

[0058] In a preferred embodiment the lid panel that is connected with the annular ring (for seaming to the can body) preferably comprises several layers:

coating varnish layer

print layer

aluminum layer (about 70 µm, in the range of 30 µm to 100 µm)

extruded polymer layer (material with approx. 12 g/m^2 to 30 g/m^2)

[0059] The extruded polymer layer is a co-extruded layer of a tie layer and a peel layer. Other extrusions and laminations can likewise be used.

[0060] The lid panel 3 was reshaped (deep-drawn) to a convex shape in the central area 3b as it is shown in Fig. 1 at 3b. In the example, the convex shape 3b has a radius of 110 mm. The lid layer was sealingly affixed to an initially horizontal flat strip, in a connection area 13 which is at first not upwardly inclined. The flat strip 6 of the ring 2, which supports the connection area was then upwardly deformed in order to obtain the inclination position of the angle 11 of about 24°, measured with respect to a horizontal plane 18/E2. This applies to the diameter of 83 mm of can and ring.

[0061] The sealing of the ring band 3a of the lid panel 3 can be achieved more easily with a horizontal flat web 6 than with an already inclined flat web. Consequently, the lid panel 3 may still not have any preforming shape of its own, but will only be provided with a corresponding preformed shape after the sealing in the connection area 13 as sealing strip. Here, the central area 3b is preformed to a bowl shape by means of the reshaping and stiffened or hardened, in order to admit hardly any elastic deformation, but to be capable of changing to a practically mirror-inverted, outwardly bulged bowl/dome shape in the case of an inner excess pressure. The central area is lowered that much below the plane 18 that there are several millimeters between the lowermost point of the initial bowl shape 3b and this plane (in the preformed state).

[0062] After the reshaping of the central area 3b an upwardly directed reshaping of the flat strip 6 (or the web) can be carried out. This obtains its inclination of more than 20° in this connection.

[0063] In a preferred embodiment that is not depicted these two re-shapings, that of the bowl-shaped bulging of the lid panel with a hardening, stiffening character and that of providing an inclination of an annular part the annular ring for seaming to the body, may also be carried out practically at the same time.

[0064] In the example there was a sealing strip 13 as the connection area of the still not preformed lid panel 3 on the initially horizontally oriented flat strip 6 of the ring, which was produced by implementing a sealing with the following parameters

ϑ = 190°C	temperature
P = 150 kg	Pressure
t = 300 msec	Sealing time.

[0065] The inwardly bulged bowl/dome shape had - as represented above - a maximum deflection as the depth 10a after the upwardly directed inclination of the flat web 6 which depth was between 5 mm and 6 mm, with a mean value of about 5.6 mm within a probe of a plurality of tests.

[0066] **Figure 3** elucidates again the important advantages of the lid that is capable of expansion.

[0067] The lid 23 is shown in its position after firmly and tightly fixed to a can body 20, which is filled with the foodstuff 21 and then closed. A symbolic filling height is outlined at 22 or the level E1, above which the headspace H filled with air or vapor is located. The axis of the can is designated 25. The annular ring (for seaming to the can body) and the can body rim are connected with each other in customary fashion by means of a double seam 24a at the end 24 of the container (represented in a seamed fashion on the lefthand side, and in a placed fashion on the right-hand side in Fig. 3). The connection area between the flat web of the annular ring and the ring band of the lid panel is designated 26. The central portion 27a is deep-drawn in a dome/bowl-shaped fashion. Its depth 30 is represented exaggerated in order to display that it clearly reaches below the lowermost portion (plane E2) of the annular ring for seaming to the can body. The bowl volume defined by its depth 30 reduces the headspace H by the same volume, whereas the volume allocated to the double arrow 31 and limited by the central portion in its concave dome/bowl and convex bulging shapes outlines the volume enlargement of the headspace H with maximum pressure load ΔP during thermal sterilization. The broken line extension 28 of the flat web makes it clear that the angle of the flat web is larger than the angle 11 of the tangent to the bulging 27b.

[0068] A lid for a can with a diameter of 83 mm is assumed as a further practical example. The dome/bowl depth 10a/30 of the preformed lid panel is between 5 mm and 6 mm, about 5.6 mm, the lowermost point 30d of the bowl being about 3 mm below the lowermost points of the annular ring. The bulging corresponds to a sphere portion - in the case of a circular cross-section of the lid as is shown by **Figures 4 and 5**. The angle 11 is between 22° and 25°. Here, peeling forces are practically completely avoided.

[0069] The reference symbols in Figures 4 and 5 are consistent with the ones used before. Figure 4 additionally shows a tab to pulling off the panel 3 (having sealed ring band 3b and central panel 3a).

[0070] The smooth/plane dome/bowl surface is not disturbed by any undulations or grooves. The can may be at least pasteurized, in particular sterilized with the lid in practically each of the known continuous autoclaves without counter-pressure means.

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- US1162520A **[0010]**
- JP558192257U **[0011]**
- JP55428638U **[0011]**
- WO2005005277A1 **[0012]**

P A T E N T K R A V

1. Fremgangsmåde til at fremstille en låglukning til dåser indeholende levnedsmiddel, hvor låget leverer tæthed under sterilisering eller pasteurisering i en kontinuerlig autoklave, hvor dåserne lukkes med en dåselukning som låg (1), hvor

(i) dåselukningen er fremstillet fra en ringformet ring (2) tilpasset til falsning til dåselegemet og et lågpanel (3; 3a, 3b), der har et ydre ringbånd (3a) og er forseglende påsat på en indre flade bane (6) af den ringformede ring (2);

(ii) et centralt område (3b) af lågpanelet (3), begrænset af det ydre ringbånd (3a), er opstrammende omformet til en jævn skålform eller en kuppelform med en plan overflade, som oprindelig form, hvor et materiale af dette centrale område (3b), ved denne omformning størkner eller hærdes i en udstrækning således, at

- under et forøget tryk i et frirum (H) af dåsen, under en passage deraf gennem en autoclave station, ændrer det central område (3b) til en axialt udadbulet form, der er spejlvendt i forhold til den oprindelige form og, at under en efterfølgende køling af dåsen, vender det centrale område (3b) automatisk, i det væsentlige tilbage til dens oprindelige form.

2. Fremgangsmåde ifølge krav 1, hvor det central område (3b) af lågpanelet (3) er omformet forud for fastgørelsen af låget (1) til den fyldte dåse, fortrinsvist efter en forsegling af det ydre ringbånd (3a) til den indre fladebane (6) af den ringformede ring (2) eller forud for en forsegling til fladebanen (6) af den ringformede ring (2).

3. Fremgangsmåde ifølge krav 1 eller 2, hvor fladebanen (6) af den ringformede ring (2) er omformet opad efter forsegling af lågpanelet (3) til fladebanen (6) af den ringformede ring (2), hvor fladebanen stadig er plan ved et forseglingstidspunkt.

4. Fremgangsmåde ifølge krav 2 eller 3, hvor omformningen, fortrinsvist ved dybtrækning af lågpanelet, og en opadgående omformning af fladebanen (6) finder sted i det væsentlige på samme tid, eller forseglingen finder sted til en allerede hældende fladebane (6).

5. Fremgangsmåde ifølge krav 1, hvor den opstrammende omformning er en dybtrækning.

6. Fremgangsmåde ifølge krav 4, hvor en hældningsvinkel (11) af fladebanen (6) er større end 20°.

7. Fremgangsmåde ifølge krav 4, hvor en hældningsvinkel (11) af fladebanen (6) er mindre end 30°.

8. Fremgangsmåde ifølge krav 4, hvor en hældningsvinkel (11) af fladebanen (6) er mellem 22° og 25°.

DRAWINGS

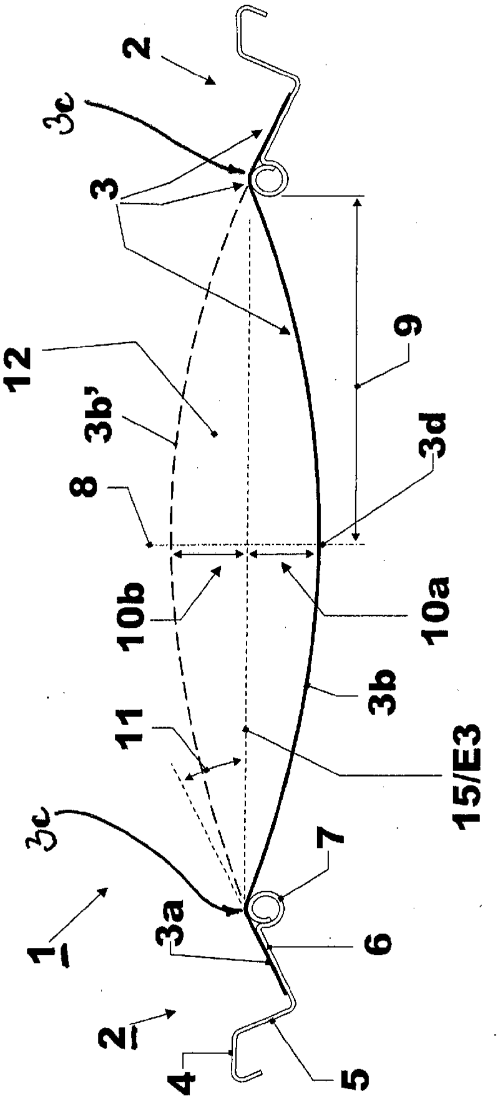


Fig. 1

Fig. 2

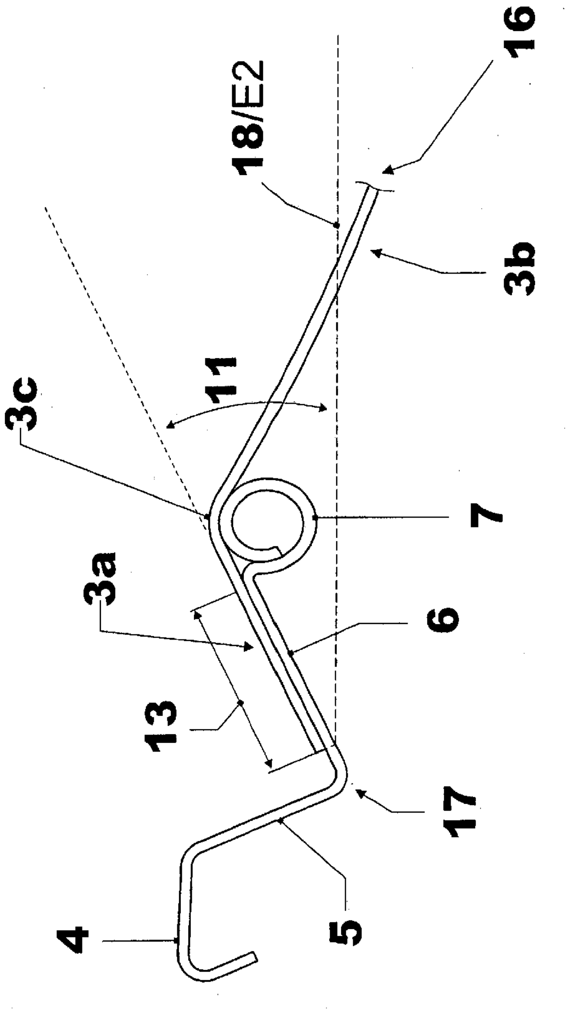
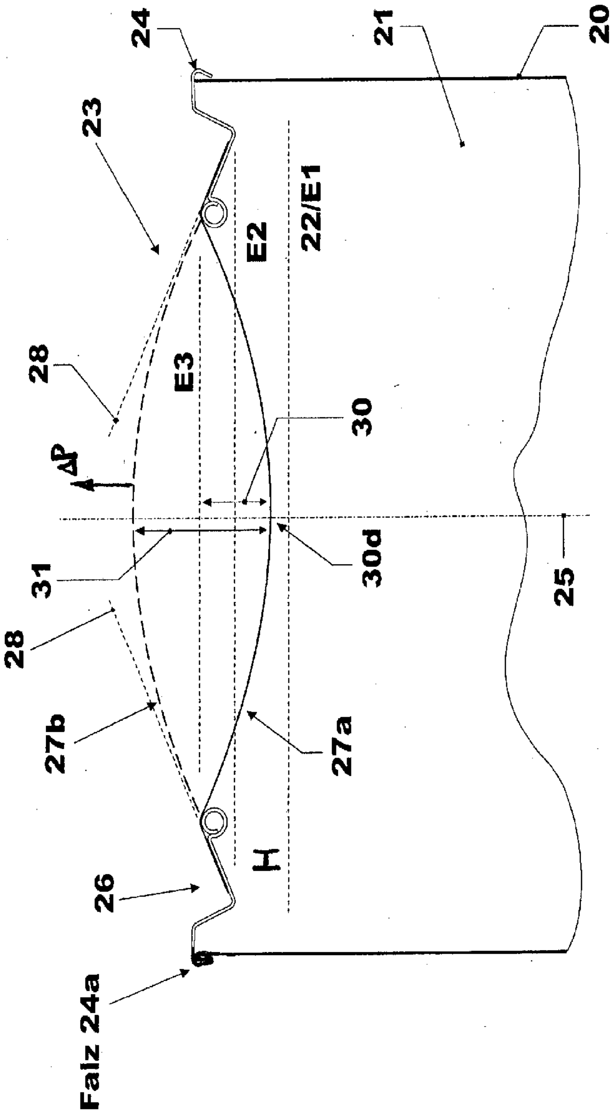


Fig. 3



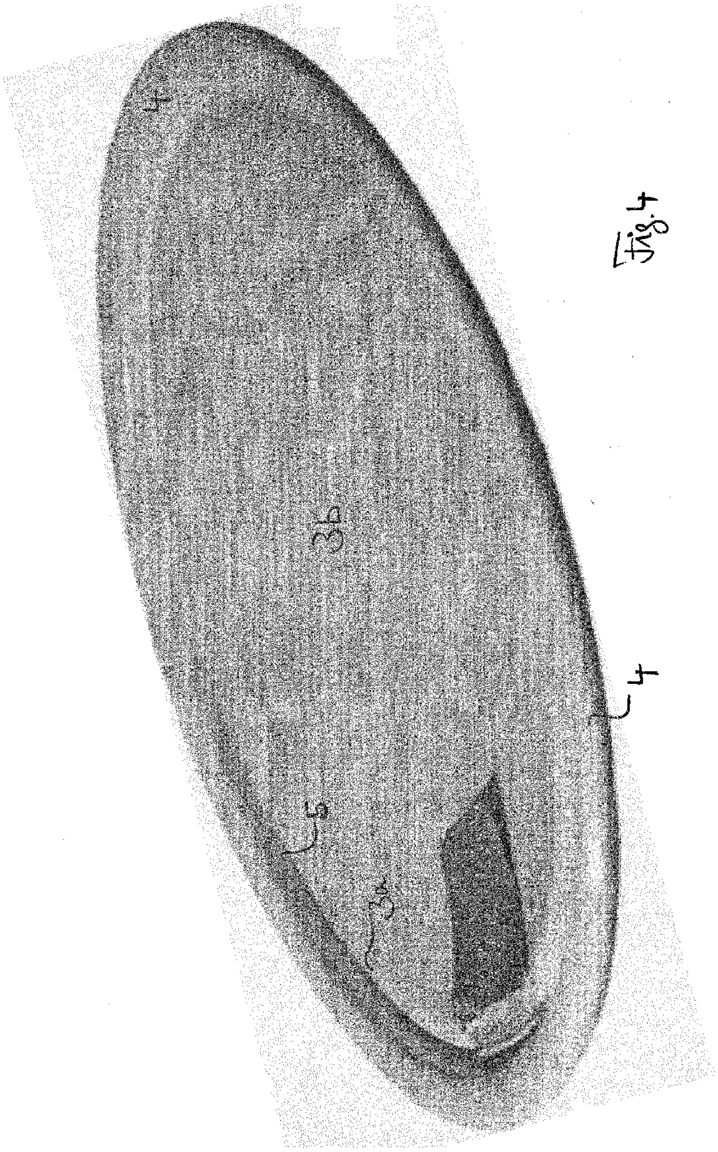


Fig. 4

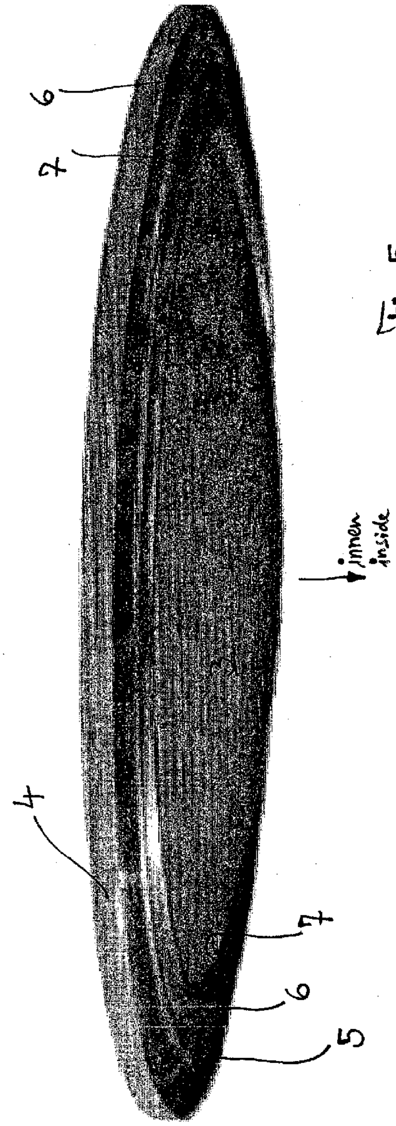


Fig. 5

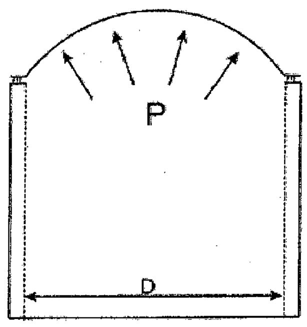


Fig. 6

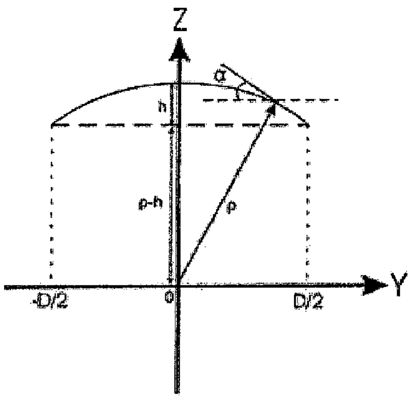


Fig. 6a

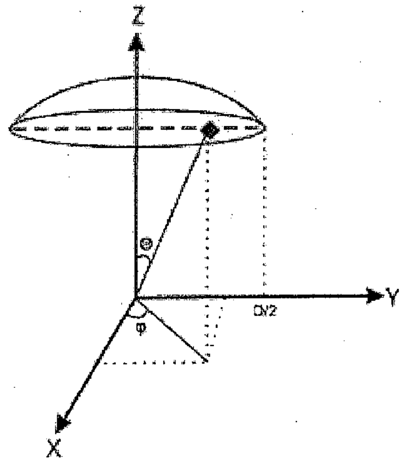


Fig. 7

Fig. 7a