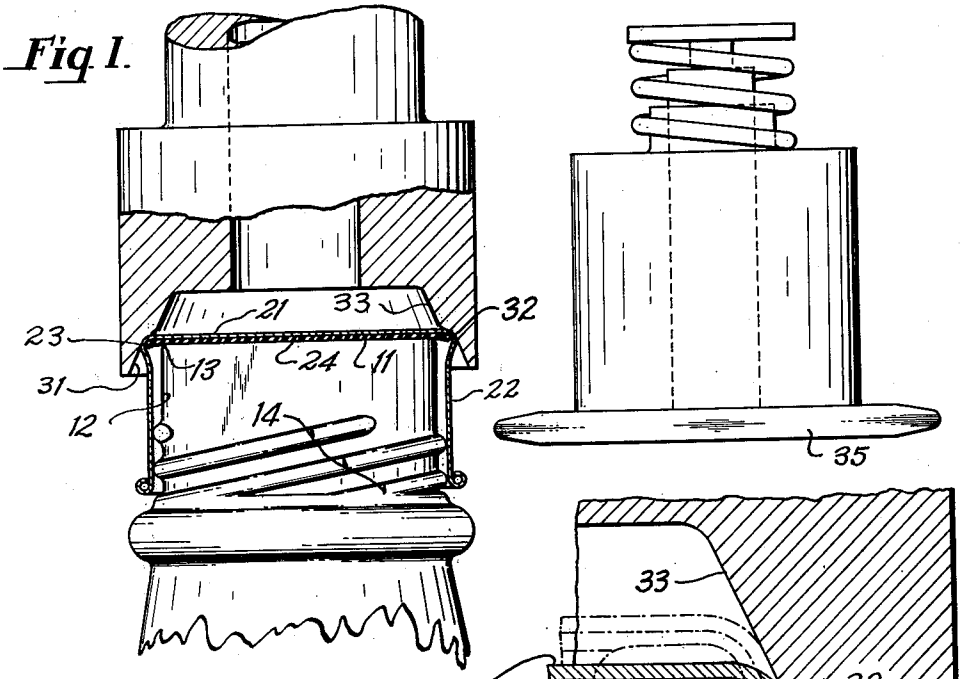
June 19, 1962 J. W. THOMAS ETAL 3,039,247

METHOD AND MEANS FOR APPLYING CLOSURES TO CONTAINERS

Filed Dec. 16, 1959

Fig. 1.



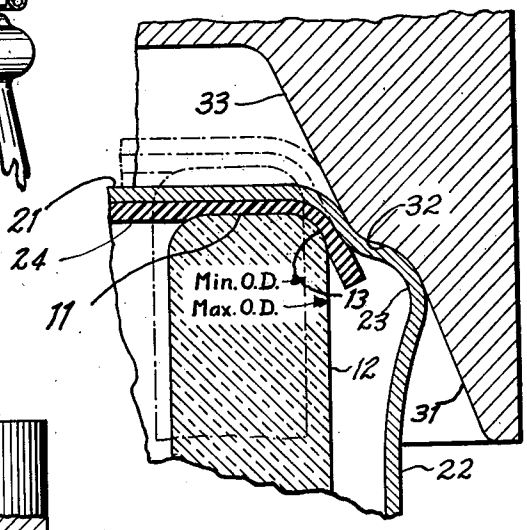


Fig. 3.

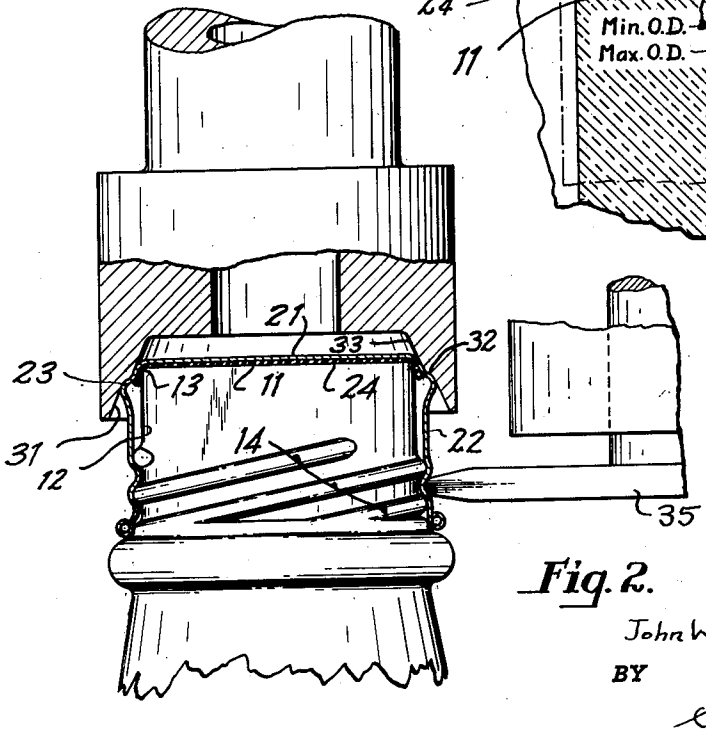


Fig. 2.

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METHOD AND MEANS FOR APPLYING CLOSURES TO CONTAINERS

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5 Claims. (Cl. 53—42)

This invention relates to the application of closures to containers. It is more particularly concerned with the application of closures of the general type disclosed in United States Letters Patent 2,409,788 to Andrew G. Osborne in which an overhanging liner is displaced and held in sealing engagement with the top and side sealing surfaces of a container finish by displacement and reforming of a deformable closure shell, such as a relatively thin metal closure shell, within which the liner is carried.

In applying closures of this general type by the means and method disclosed in the aforementioned issued patent, portions of the closure shell and liner within the same, which extend outwardly beyond and overhang the side sealing surface of the container finish, are initially bent or displaced downwardly and thereafter pressed inwardly, on introduction into a right cylindrical throat of the pressure sealing block or head of the mechanism disclosed in the issued patent, to provide a top and side seal between the liner and underlying adjacent container sealing surfaces.

Industry encountered container finish tolerances permit allowable side sealing surface variations up to .025" in diameter, and with conventional methods of inspection, the entire permissible range of diameter variation conceivably can occur in one container finish on two diameters perpendicular to each other, or nearly so, and we have adopted the term "ovality" to define this condition.

None of the aforementioned encountered variations in container finish dimensions has, in the past, been of great concern in applying side sealing type deformable closures, as taught by the previously identified Osborne issued patent, because it has been the practice to use liners of a selected thickness in excess of the industry encountered allowable container finish tolerance dimensions. The liner thickness being greater than the allowable variation in container finish diameter, the right cylindrical non-tapered throat of the issued Osborne patent pressure-applying head is conventionally selected to receive and seal maximum container finish diameters, while assuring sufficient pressure on the relatively thick liner at all points around the side sealing surface of a minimum diameter container finish to provide an acceptable seal. Moreover, when maximum diameter variations occurred in a single container finish, the greater developed pressure over areas of greater diameter would cause sufficient circumferential liner displacement, in the case of a compressible liner, to crowd the same into the areas of lesser diameter, thus compensating for varying degrees of ovality in the container finish.

It has been recognized that thinner liners are desirable because they cost less and present a reduced section thickness for transmission of gas through the same, it being known in the closure art that liners are permeable and permit penetration and transmission of oxygen into containers sealed thereby. Thinner liners are now regularly available and some packagers have adopted commercial liner stock having a thickness of .016" or less. Consideration and analysis of commercial containers, deformable closure shells and new thin compressible liner stock has revealed side sealing container surface diameter tolerances of .025", closure shell thickness tolerances of .002" and liner thickness tolerances of .003", and considering that there are two thicknesses of closure shell and liner across the side sealing surface of the container finish of a side-sealed container, a total variation in commercial packages between maximum and minimum side-sealed container exterior diameters can be as large as .035".

Based on the previous analysis, it simply means that the right cylindrical interior throat diameter of the pressure sealing head of the issued Osborne patent, sufficiently large to receive a container finish supporting a closure shell with one of the new thin liners therewithin, and in which the closure thickness and container finish are of maximum commercial encountered dimensions, would not, when the closure shell thickness and container finish dimensions are minimum exert sufficient, if any, side-sealing pressure on the now-accepted thin liners to compress the same into satisfactory side sealing relationship on the side sealing surface of the container finish. On the other hand, a right cylindrical fixed diameter interior throat pressure head small enough to compress the thin liner under minimum container finish and closure shell dimensions might not engage properly, or might even shear, the thin liner material at or slightly below maximum container finish and closure shell dimensions.

Accordingly, it is an object of the present invention to provide method and means for applying deformable closures that are effectively side-sealed at the extremes and over the range of dimensional tolerances encountered in commercial container finishes, closure and liner thicknesses. It is also an object to provide such a method and means whereby such effective seals will be obtained with relatively thin liners. A further object is to provide a method whereby a single pressure sealing head will serve at the extremes and over the range of allowable commercial dimensional tolerances in container finishes, closure shells and liner materials to provide effectively top- and side-sealed containers. It is another object to assure an effective side seal when the full range of diameter variation or tolerance is found in a single container finish. Other further objects and advantages of the invention will appear from the following description, reference being had to the accompanying illustrations, in which:

FIG. 1 is an elevational view, partly in cross section, showing a container finish, with a closure loosely supported thereon, as presented to the pressure sealing head of the invention at the beginning of the closure sealing operation;

FIG. 2 is a similar view showing the parts at the completion of the closure sealing operation; and

FIG. 3 is a sectional view to enlarged scale showing in full lines the tapered sealing head of the invention in cooperative relationship with a container finish, closure shell and thin compressible liner at maximum tolerance values on completion of a closure sealing operation, and showing in dotted lines the cooperative relationship between the tapered sealing head and container finish, closure shell and thin liner under minimum tolerance values.

The container finish adapted for the application of top and side sealing closures, in accordance with the concepts of the invention, preferably has a substantially flat top surface 11 and a cylindrical outer surface 12, joined by a downwardly and outwardly curved contiguous surface 13, and closure retaining formations, such as the multiple threads 14, therebelow.

A closure blank or shell for application to such a container finish preferably comprises a cup-shaped metal shell having a top panel 21 and a depending cylindrical skirt 22, with an annular connecting bulge 23 in the skirt adjacent the top panel, and a liner 24 within the shell. The liner may or may not be adhered to the top panel, but in any case its outer marginal edge extends

into and is retained within the interior groove corresponding to the outwardly extending bulge 23.

The pressure sealing head of the invention preferably has an upwardly converging entrance 31, an inwardly directed shoulder 32 and a tapered throat 33, and is incorporated in known manner in a conventional vertical stroke sealing apparatus, such as described and illustrated in United States Letters Patent 1,674,266 to John E. Sharp.

With the closure shell or blank loosely applied and supported on the upper surface 11 of the container finish, relative approaching movement of the sealing head and container will bring the shoulder 32 into bearing contact on the overhanging marginal rim of the top panel 21 and exert downward pressure thereon, and liner 24 underlying the same, to displace the overhanging closure shell rim and underlying liner below the substantially flat top surface 11 of the container finish to thereby bring the liner 24 towards and preferably into engagement with the curved side sealing surface 13 of the container finish. The aforesaid downward displacement of the closure shell rim and underlying liner 24 places the top panel 21 under tension and draws the same across the mouth of the container in the plane of the substantially flat sealing surface 11, with the result that the compressible liner 24 is compressed thereagainst in top-sealed relationship thereon. Simultaneously with the downward displacement of the overhanging marginal rim of the closure shell, the bulge 23 thereof is also displaced downwardly to provide an annular re-enforcement giving lateral support to the closure shell retaining the liner 24 in its displaced and reformed position.

During the aforesaid displacement of the closure shell, relative to the container finish supporting the same, the container finish and closure shell enter the tapered throat 33 of the sealing head so that the tapered surface thereof exerts an additional downward and inward pressure on the displaced closure shell opposite the curved side sealing surface 13 of the container finish to force the liner 24 downwardly and inwardly into compressed condition against the curved side sealing surface 13, and preferably a contiguous portion of the cylindrical side sealing surface 12 immediately coextensive therewith, to provide a tight circumferential side seal over substantially the entire depth of the side sealing surfaces underlying the liner 24 in its compressed condition.

As best illustrated in FIG. 3, the major diameter of the tapered throat 33 must be sufficiently large in diameter to admit the maximum allowable industry encountered diameter of side sealing surface of a container to be sealed plus twice the allowable maximum industry encountered closure shell and uncompressed liner thicknesses adjacent the maximum side sealing surface of the container. It is also essential that the tapered throat 33 be extended sufficiently far in axial length to assure that it will exert downward and inward sealing pressure and develop a side-sealed closure when the container finish, closure shell and liner are at industry encountered minimum allowable tolerance values. In this connection, the degree of taper in the throat 33 is important. It must be such that it will develop a downward and inward compressing action on the liner over the full range of allowable industry encountered tolerance, and we have found that a 25° taper from the vertical has performed satisfactorily over the tolerance range of .035" encountered in commercial practice of the invention.

In further explanation of the closure sealing method of the invention, the tapered surface or throat 33 of the pressure sealing head performs a downward wiping action on the displaced closure shell in contact therewith to displace the closure shell in the region opposite the curved side sealing surface 13 of the container finish to compress the liner 24 and thus permit further relative axial travel of the sealing head, in respect of the container and closure shell, to present a narrower part of the tapered throat 33 in pressure bearing relationship over a full exterior circumference of the closure shell in contact therewith as established by the particular maximum diameter side sealing surface of the container finish underlying the displaced closure shell and contained liner 24. This wiping action and displacement of the closure shell and underlying liner compresses or pinches the liner to a maximum extent in the areas or zones of maximum side sealing container finish diameter, while distributing or crowding the compressible liner circumferentially into compressed or pinched relationship in the areas or zones of minimum side sealing container finish diameter. The tapered throat 33 thus functions automatically as a means for applying a downwardly and inwardly effective pressure, in addition to the bending pressure exerted by the inwardly directed shoulder 32, which is applied progressively inwardly of the first-applied bending pressure.

After the completion of the vertical sealing stroke, the lower portion 22 of the depending cylindrical skirt of the closure shell is deformed or reformed to correspond to closure retaining formations on the container finish, such as the multiple threads 14, illustrated to best advantage in FIG. 2. According to known commercial practice, spinning rollers 35, spring mounted to permit relative vertical or axial travel in respect to the container and its threads 14, and spring loaded to provide planetary movement thereof in respect of the areas of the closure shell between the threads 14, are employed as described in the aforementioned Sharp issued patent. For purposes of illustration, the threads have been completely formed in the closure shell skirt in FIG. 2, with the single roller 35 depicted in its action before completion of its thread-forming travel. As will be appreciated, three rollers 35 would be employed in the case of the triple threads 14.

It will be appreciated that the closure shell displacing and sealing pressures are maintained by the sealing head during the thread-forming operation to assure affixation of the closure in its sealed condition on the container finish.

The improved sealing head and sealing method do not require any special means to compensate for varying degree of relative vertical travel of the sealing head and container in response to maximum and minimum container finish and closure shell tolerances. Conventional vertical stroke rotary-type sealing machines incorporate a downward cam-operated sealing head, and it is customary to provide resilience in the stroke of the head, or in the container support, to minimize deformation, or breakage in the case of glass containers, because of allowable industry encountered variations in container height.

In the appended illustrations, the tapered surface 33 is shown as extending considerably beyond the depth necessary for sealing containers of the maximum allowable or encountered dimensional variations selected for purposes of describing the invention. It will be understood that the taper need extend only far enough to assure that it will function when the container finish, closure shell and liner dimensions are minimum. It will also be understood that any known closure retaining means, such as a single thread, interrupted threads, detents, all of which represent commercially acceptable closure retaining means, may be substituted for the multiple threads shown. These and other modifications of the invention are contemplated within the scope of the appended claims.

What is claimed is:

1. A pressure sealing head for applying a closure of the type comprising a deformable shell having a top panel, depending cylindrical skirt and compressible liner underlying the top panel, on a container having a side sealing surface with closure retaining means therebelow, the container when side-sealed exhibiting a maximum diameter right cylindrical external circumferential closure shell surface adjacent the side seal within the diametric limits established by allowable industry encountered diametrical

tolerance variations in the container side sealing surface plus allowable industry encountered tolerance variations in double thicknesses of the closure shell and compressed liner of substantially double the thickness of the uncompressed liner; said pressure sealing head comprising a cavitied rigid pressure block provided with an inwardly tapered entrance throat terminating in an inwardly directed shoulder defining a cavity complementary to and adapted to engage a marginal annular rim of the top panel of the closure shell outboard of the maximum industry encountered diameter of the side sealing surface of the container loosely supporting the closure shell, a second inwardly tapered right circular frustoconical throat in the cavitied pressure block above the inwardly directed shoulder, said second tapered throat being defined by axially spaced major and minor diameters, the major diameter being located adjacent and inwardly of the inwardly directed shoulder and contiguously and coextensively blended therewith and being substantially equal to the maximum encountered tolerance diameter of the side sealing surface of the container plus double maximum encountered tolerance thicknesses of the closure shell and uncompressed liner, the axially spaced minor diameter being substantially equal to the minimum encountered tolerance diameter of the side sealing surface of the container plus double minimum encountered tolerance thicknesses of the closure shell and compressed liner, means for establishing relative axial movement of the rigid pressure block and loosely supported closure shell on the container to bend and displace the inwardly directed shoulder-engaged outboard top panel marginal annular rim of the closure shell and liner underlying the same downwardly and inwardly towards the side sealing surface of the container and subsequently advance the displaced marginal annular rim and underlying liner within the second tapered throat to an axial depth established by a maximum diameter of the side sealing surface of the container being sealed plus double the closure and compressed liner thicknesses of the closure shell and liner supported thereon to top and side seal the closure shell and compressed underlying liner on the container while maintaining contiguous axial and circumferential contact between the outer surface of the displaced closure shell and inner contiguous circumferential surface areas of the tapered entrance throat, inwardly directed shoulder and second tapered throat, and closure shell depending skirt engaging means below and outside the pressure block actuatable to conform a lower portion of the cylindrical skirt below the top and side-sealed portions of the closure shell into closure retaining means carried by the container below the side-sealed surface thereof.

2. A pressure sealing head for applying a closure of the type comprising a deformable shell having a top panel, depending cylindrical skirt, an annular bulge connecting the top panel and skirt, said bulge being coplanar with said top panel and extending outwardly beyond the cylindrical skirt, and a compressible liner underlying the top panel and extending into an internal groove corresponding to the annular bulge, on a container having a side sealing surface with closure retaining means therebelow, the container when side-sealed exhibiting a maximum diameter right cylindrical external circumferential closure shell surface adjacent the side seal within the diametric limits established by allowable industry encountered diametrical tolerance variations in the container side sealing surface plus allowable industry encountered tolerance variations in double thicknesses of the closure shell and compressed liner of substantially double the thickness of the uncompressed liner; said pressure sealing head comprising a cavitied rigid pressure block provided with an inwardly tapered entrance throat terminating in an inwardly directed shoulder having a profile substantially complementary to the annular bulge of the closure shell for engagement with a marginal annular rim of the top panel of the closure shell and annular bulge outboard of the maximum industry encountered diameter of the side sealing surface of the container loosely supporting the closure shell, a second inwardly tapered right circular frustoconical throat in the cavitied pressure block above the inwardly directed shoulder, said tapered throat being defined by axially spaced major and minor diameters, the major diameter being located adjacent and inwardly of the inwardly directed shoulder and contiguously and coextensively blended therewith and being substantially equal to the maximum encountered tolerance diameter of the side sealing surface of the container plus double maximum encountered tolerance thicknesses of the closure shell and uncompressed liner, the axially spaced minor diameter being substantially equal to the minimum encountered tolerance diameter of the side sealing surface of the container plus double minimum encountered tolerance thicknesses of the closure shell and compressed liner, means for establishing relative axial movement of the rigid pressure block and loosely supported closure shell on the container to bend and displace the inwardly directed shoulder-engaged outboard top panel marginal annular rim and annular bulge of the closure shell and liner therein downwardly and inwardly towards the side sealing surface of the container and subsequently advance the displaced marginal annular rim, annular bulge and underlying liner within the second tapered throat to an axial depth established by a maximum diameter of the side sealing surface of the container being sealed plus double the closure and compressed liner thicknesses of the closure shell and liner supported thereon to top and side seal the tainer while maintaining contiguous axial and circumferclosure shell and compressed underlying liner on the conential contact between the outer surface of the displaced closure shell and inner contiguous surface areas of the tapered entrance throat, inwardly directed shoulder and second tapered throat, and closure shell depending skirt engaging means below and outside the pressure block actuatable to conform a lower portion of the cylindrical skirt below the top and side-sealed portions of the closure shell into closure retaining means carried by the container below the side-sealed surface thereof.

3. In a method of sealing a container having a side sealing surface with a deformable closure shell of substantially uniform thickness having a top panel, depending cylindrical skirt and compressible liner underlying the top panel, the container when side-sealed exhibiting a maximum diameter right cylindrical external circumferential closure shell surface adjacent its side seal within the diametric limits established by allowable industry encountered diametrical tolerance variations in the container side sealing surface plus allowable industry encountered tolerance variations in double thicknesses of the closure shell and compressed liner of substantially double the thickness of the uncompressed liner, the steps comprising, loosely supporting the closure shell across the mouth of the container above the side sealing surface thereof with a marginal annular rim of the top panel and liner underlying the same overhanging the side sealing surface of the container an amount at least substantially equal to the closure shell and uncompressed liner maximum tolerance thicknesses plus substantially the depth of the container side sealing surface to be sealed, initially effecting relative downward pressure between the overhanging top panel of the closure shell and container in a zone of right cylindrical circumferential line contact concentric with the maximum diameter of the side sealing surface of the container with the pressure applied and confined radially outwardly of the maximum diameter of the side sealing surface to bend and deform the marginal rim of the overhanging top panel and liner underlying the same downwardly and circumferentially inwardly towards the maximum diameter of the side sealing surface of the container, confining the so deformed overhanging top panel and continuing circumferentially concentrically effective relative downward pressure thereon while simultaneously de-

veloping and effecting circumferentially concentrically inwardly directed pressure in progressively decreasing circumferential right cylindrical line contacting zones of applied pressure to further deform the previously deformed closure shell and compress the underlying liner in maximum amount between the inner circumferential surface of the deformed closure shell and maximum diameter of the side sealing surface of the container, and while maintaining the two aforesaid effective pressures deforming the depending closure shell skirt below the side sealing surface of the container into conformity with closure retaining formations carried by the container.

4. In a method of sealing a container having a substantially flat top sealing surface and contiguous downwardly and outwardly extending curvilinear side sealing surface with a deformable closure shell of substantially uniform thickness having a top panel, depending cylindrical skirt and compressible liner underlying the top panel, the container when side-sealed exhibiting a maximum diameter right cylindrical external circumferential closure shell surface adjacent its side seal within the diametric limits established by allowable industry encountered diametrical tolerance variations in the container side sealing surface plus allowable industry encountered tolerance variations in double thicknesses of the closure shell and compressed liner of substantially double the thickness of the uncompressed liner, the steps comprising, loosely supporting the closure shell across the mouth of the container in the plane of the substantially flat top sealing surface above the side sealing surface thereof with a marginal annular rim of the top panel and liner underlying the same overhanging the side sealing surface of the container an amount at least substantially equal to the closure shell and uncompressed liner maximum tolerance thicknesses plus substantially the depth of the container side sealing surface to be sealed, effecting relative downward pressure between the top panel of the closure shell and container in an initial zone of right cylindrical circumferential line contact concentric with the maximum diameter of the side sealing surface of the container with the pressure applied and confined radially outwardly of the maximum diameter of the side sealing surface to bend and deform the marginal rim of the overhanging top panel and liner underlying the same downwardly and circumferentially inwardly towards the maximum diameter of the side sealing surface of the container, confining the so deformed overhanging top panel and continuing circumferentially concentrically effective relative downward pressure thereon while simultaneously developing and effecting circumferentially concentrically inwardly directed pressure in progressively decreasing circumferential right cylindrical line contacting zones of applied pressure to further deform the previously deformed closure shell and compress the underlying liner in maximum amount between the inner circumferential surface of the deformed closure shell and maximum diameter of the side sealing surface of the container, and while maintaining the two aforesaid effective pressures deforming the depending closure shell skirt below the side sealing surface of the container into conformity with closure retaining formations carried by the container.

5. In a method of sealing a container having a substantially flat top sealing surface and tangential outwardly curved and downwardly extending side sealing surface with a deformable closure shell of substantially uniform thickness having a top panel, depending cylindrical skirt, an annular bulge formed between the top panel and cylindrical skirt, and compressible liner underlying the top panel and extending outwardly into the internal groove corresponding to the annular bulge, the container when side-sealed exhibiting a maximum diameter right cylindrical external circumferential closure shell surface adjacent its side seal within the diametric limits established by allowable industry encountered diametrical tolerance variations in the container side sealing surface plus allowable industry encountered tolerance variations in double thicknesses of the closure shell and compressed liner of substantially double the thickness of the uncompressed liner, the steps comprising, loosely supporting the closure shell across the mouth of the container in the plane of the substantially flat top sealing surface above the side sealing surface thereof with a marginal annular rim of the top panel and liner underlying the same overhanging the side sealing surface of the container an amount at least substantially equal to the closure shell and uncompressed liner maximum tolerance thicknesses plus substantially the depth of the container side sealing surface to be sealed, effecting relative downward pressure between the top panel of the closure shell and container in an initial zone of right cylindrical circumferential line contact concentric with the maximum diameter of the side sealing surface of the container with the pressure applied and confined radially outwardly of the maximum diameter of the side sealing surface to bend and deform the marginal rim of the overhanging top panel and liner underlying the same downwardly and circumferentially inwardly towards the maximum diameter of the side sealing surface of the container, confining the so deformed overhanging top panel and continuing circumferentially concentrically effective relative downward pressure thereon while simultaneously developing and effecting circumferentially concentrically inwardly directed pressure in progressively decreasing circumferential right cylindrical line contacting zones of applied pressure to further deform the previously deformed closure shell and compress the underlying liner in maximum amount between the inner circumferential surface of the deformed closure shell and maximum diameter of the side sealing surface of the container, and while maintaining the two aforesaid effective pressures deforming the depending closure shell skirt below the side sealing surface of the container into conformity with closure retaining formations carried by the container.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,039,247

June 19, 1962

John W. Thomas et al.

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 6, line 32, strike out "closure shell and compressed underlying liner on the con-" and insert the same after "seal the", in line 30, same column 6.

Signed and sealed this 2nd day of October 1962.

(SEAL)
Attest:

ERNEST W. SWIDER
Attesting Officer

DAVID L. LADD
Commissioner of Patents