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A. B. FOYE
CONTAINER CLOSURES

3,017,048

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2 Sheets-Sheet 1

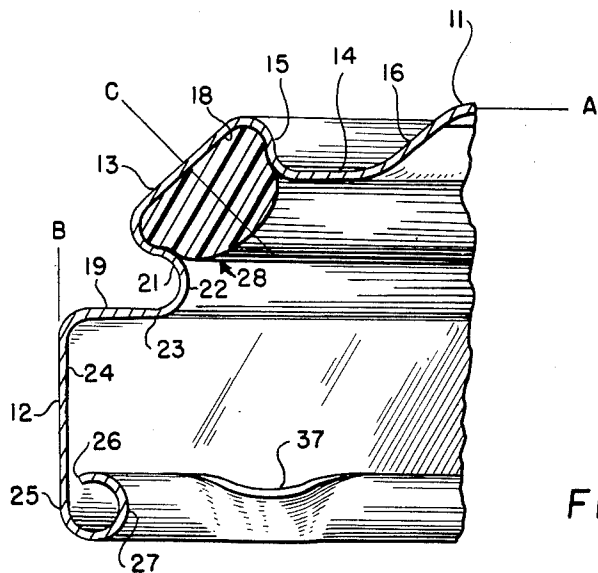


FIG. 1.

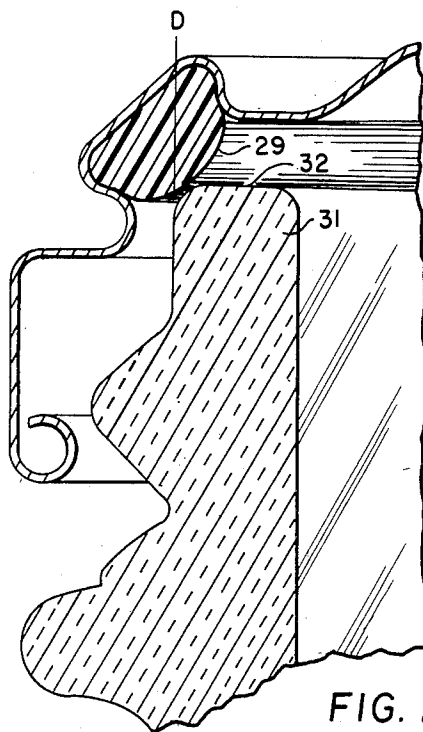


FIG. 2A.

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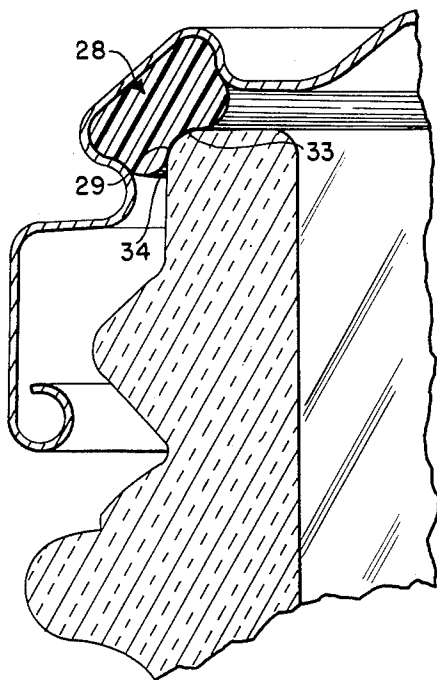


FIG. 2B.

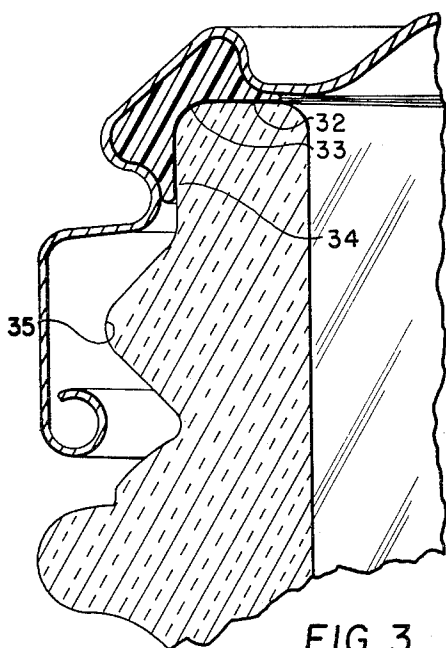


FIG. 3.

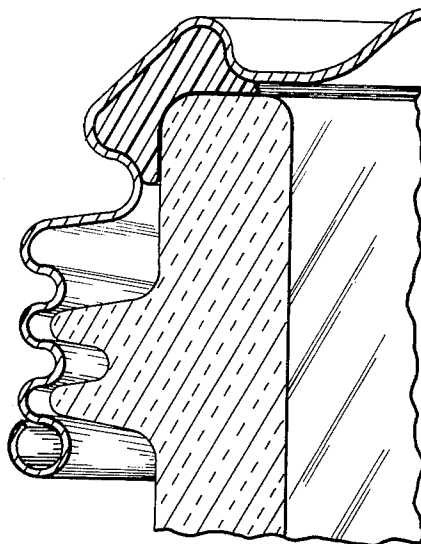


FIG. 4.

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CONTAINER CLOSURES

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This invention relates to an improved closure for hermetically sealing glass containers.

The art of hermetically sealing glass containers with closures has become well developed within the past years. The closure, which is commonly used, is in the form of a cap made from sheet metal. The top of the cap is referred to as a "panel" and is intended to overlie the end and opening of the container. The sides of the cap are called a "skirt" and surround the neck of the container when the cap is applied thereto. One of the functions of a cap is to seal the container. This is usually accomplished by means of a gasket which is carried by the cap and held in tight contact with the surface of the container.

A common type cap, used when the food pack requires sterilization after it has been capped, is called a "process cap." This type cap forms a mechanical lock with the glass container thereby holding the closure in position during processing. It is needed because pressures build up within the closure as a result of the sterilization treatment. It is apparent that the cap, in an extreme case, could be ejected from its seat on the container were it not for the fact that it was locked in position. This can easily happen because sterilization temperatures as high as 250° F. for as long as 90 minutes are not uncommon. The more modern of the "process caps" carry top seal gaskets of the "flowed-in" type. Frequently these gaskets are made from plastisols in the form of paste. They are applied to the inverted closure while in the fluid state and then are transformed in situ into a rubbery mass. The closures which are to be used in conjunction with this type gasket, however, must be provided with a compatible coating to increase the specific adhesion between the gasket and the closure. However, even this expedient is not thoroughly satisfactory, since the plasticizer in the gasket can attack the coating and reduce the adhesion of the coating to the metal. Also, on heating it softens and acts as a lubricant instead of an adhesive.

Typical kinds of process caps include the screw type, lug type and the combination band and panel type of cap. It has been found, however, that the screw and lug type closure, in many cases, are functionally inadequate for low cost glass containers. For one thing, the glass containers of the low cost type cannot be made to exact dimensions in each and every case. Gross irregularities in the finish are, of course, rejected by inspection. Even with rigid inspections, however, minor irregularities in the glass will always exist. These minor irregularities are translated into gross irregularities when they exist in the treads or lugs of a container. This is especially true when a closure is applied to such a container. The major problem is that the mounted closure, due to the fact that it is rigid, will be tilted on the rim seat of the container. If this happens, the top seal gasket will not come into full contact with the sealing surface of the rim. This condition is more pronounced in the connection with the screw cap and is particularly accentuated if the rim of the container contains a saddle finish. Industry has attempted to overcome this by applying the gasket material to the panel as a wide band of substantial thickness. The object here is to enable the lowest point in the rim to engage and form a seal with the gasket. In the case of the lug type cap, it is necessary to utilize from 750 to 850 cubic millimeters of

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material to accomplish this result. It is apparent that this is a very wasteful and expensive procedure.

The combination band and panel type cap overcomes some of the difficulties encountered with the use of the two aforesaid process caps. This is because the panel is flexible and is locked in position on the rim by a peripheral band. The application of this type cap to the container, however, is a slow procedure relative to the application of other caps. This is the case even when the application is done with automatic machinery. The basic reason is that this is a two piece operation. This factor also tends to increase the cost of the closure.

I have invented a novel cap which functions quite well as a "process cap." This cap is adapted to carry a conventional "flowed-in" gasket at an angle with respect to both its top panel and its skirt. There exists, however, no need to pre-treat the surface of this cap with a compatible coating prior to the application of the "flowed-in" gasket. This is due to the fact that the gasket is mechanically rather than chemically locked in position on the closure. The basic design of the cap facilitates this locking-in action. The gasket with which this cap is adapted requires less than 60% of the material that would be required to form a seal in an ordinary process cap. This is because this gasket need not be padded in order to form a seal with the rim of the container. This cap is flexible in three dimensions and therefore may be easily fitted to low cost glass containers having the usual variation in tolerances. The gasket of this cap will form a custom made seal with the rim of the individual container with which it is used when the cap is applied to the container. This is due not only to the nature of the gasket but also its relative position in the individual cap. The gasket of this cap forms an angle seal with the rim of the container rather than a top seal as is usual with other process caps. This provides a more positive seal than the top seal because it seals at three locations, i.e. the top, corner, and the side.

FIGURE 1 is a fragmentary vertical sectional view through one form of the new closure before its application. FIGURES 2A and 2B are fragmentary vertical sectional views of the closure of FIGURE 1 showing it being telescoped on the neck of a jar.

FIGURE 3 is a view partly in vertical section and partly in elevation showing the closure of FIGURE 1 applied to a container.

FIGURE 4 is a view similar to FIGURE 1 of a form of the new closure provided with screw threads.

In general, the closure of this invention as illustrated in FIGURE 1, comprises a top panel 11, a dependent skirt 12, and an inwardly facing annular anchor channel 13 intermediate therebetween and disposed at an angle with respect to both the panel and the skirt.

The top panel 11 is composed of a circular top or disc-like portion. The panel, as shown in FIGURE 1, is flat but may be corrugated. It is known that if the latter be the case, panelling of the top will be prevented. This is a condition encountered when the closure is subjected to pressure or vacuum.

An outwardly facing recess 14 is intermediate between the annular anchor channel 13 and the circular panel 11. This recess 14 is in the form of a peripheral ring around the top panel 11 of the closure. It is formed by the side 15 of the channel and the terminal end 16 of the top panel. This recess facilitates the stacking of the individual jars which have been fitted with this closure.

The closure is provided with an anchor channel 13 which is disposed annularly around the periphery of the top panel 11 and separated therefrom by the upwardly facing peripheral recess 14. This anchor channel 13 is in the form of an annular groove formed in the underside of

the cap. This groove opens inwardly around the periphery of the panel 11. The entrance and base 18 of this channel are disposed at an angle with respect to both the plane (A) of the top panel 11 and that (B) of the cylindrical skirt 12. The cross section of this channel may be diagrammatically described as a trapezoid with its shorter side, i.e. the entrance, missing. It is especially adapted to receive the conformable sealing element 28.

A shoulder or annular ledge 19 is disposed laterally from the sides 21 of the channel and separated therefrom by the annular side recess 22. This recess 22 is formed by the turned down portion of channel side 21 and the inclined terminal end 23 of the shoulder 19. The annular shoulder 19 may be in a plane parallel to that of the top panel 11 or slightly declined therefrom. The inside diameter of the annular shoulder 19 is greater in dimension than that of the outside diameter of the container with which this closure is used.

The annular skirt 12 of this closure is dependent from the annular shoulder 19, i.e. it extends downwardly from the periphery of the annular shoulder 19. The upper portion 24 of the skirt extends downwardly in a straight line at right angles to the annular shoulder 19. The lower portion of the skirt 25, however, is necked in, i.e. extends downwardly and inwardly. The interior diameter of the necked in portion 25 is larger than the exterior diameter defined by the neck of the container. This would include the diameter of the periphery defined by the ridges of the lugs. This is the distance between diametrically opposite lugs measured from peak to peak.

The terminal end 26 of the annular skirt 12 is rolled to form an in-turned circular rigid bead 27. This bead 27 would be positioned vertically below the shoulders of the cap. The interior diameter of the annular rigid bead 27 is larger than the exterior diameter of the container's neck including that defined by the ridges of the lugs. The annular bead is provided with four locking segments, one of which is illustrated at 37. It may, however, be provided with more than four. The exact number of locking segments provided would, in all cases, be determined by the number of lugs on the container to be used. The interior diameter defined by the locking segments would be greater than the diameter of the container. The diameter defined by the ridges of the container lugs, however, is larger than the interior diameter defined by the locking segments in order to provide a locking engagement therewith.

The cap is slipped onto the neck of the container and twisted into engagement therewith. The surface of the locking segments, at this point, bear against the outwardly opposing lugs on the neck's surface. The skirt, however, due to its dimensions remains out of contact with the lugs.

This improved cap is distinguishable by its annular channel 13 containing a mechanically locked-in sealing element or gasket 28. The central axis (C) of this channel 13 is disposed at an angle to both the plane (A) of the top panel and the plane (B) of the skirt. This channel 13, as stated previously, is in the shape of a trapezoid. The two non-parallel sides tapering towards an entrance. The distance across the entrance of the channel is smaller than any other distance between the sides which terminate in the entrance. This is an important factor in mechanically anchoring the sealing element in the channel. This channel, however, could be of a bulb shape and may accomplish the same result.

The closure is inverted in order to apply the gasket to the channel 13. The compound which is to form the sealing body or gasket is introduced into the channel 13 in the conventional manner known in the art. This most usually will be by means of a rotatable nozzle. Thus, the compound is introduced into the channel in a fluent condition and then is cured to a resilient rubbery mass. The body of this rubbery mass 28, at this stage, will fill the cavity formed by the sides 15, 18, 21 of the channel. The

cross section of the central portion of this rubbery mass will be larger in dimension than the distance between the sides 15, 21 at the entrance to the channel. The body of this mass will taper to a neck portion whose cross section will be equidistant to the distance across the channel's entrance. The rubbery mass will then extend through the entrance between the sides of the channel and will protrude therefrom in the shape of a convex surface 29, as illustrated in FIGURE 1. It is apparent that the rubbery mass, at this point, is mechanically locked-in the channel. The gasket formed by this mass, as a result of this action, will remain in position throughout processing. There exists no need, therefore, to precoat the surface of the channel with a compatible coating in order to increase adhesion. Since the gasket is locked-in mechanically, there is no possibility that the gasket will become separated from the closure even under extreme processing conditions.

Any of the compounds which are conventionally used in the art to form a sealing body or gasket may be used in this closure. These include plastisols in the form of pastes or fluid dispersions of resins or elastomers in water. The films formed from these compounds are tough, rubbery and can be modified for desired sealing characteristics by formulation. The baked films of these compounds have been found to conform to the irregularities in the finish of the rim of the glass container. This is due to the thermoplasticity which these compounds exhibit under the conditions encountered in commercial food packing. These gaskets, due to their nature and relative position in the closure, will form a custom made fit with the rim of the individual container used. The sealing body of the present cap, in the 48 mm. size, would require about 500 to 550 cubic millimeters of material. This is at least 40% less than the amount required by an ordinary process cap in the same size. The size of the cap is determined, in each case, as the distance diametrically across the inside of the closure from skirt to skirt.

When the present closure is to be applied to a jar, it will be slipped over the neck 31 thereof, as illustrated in FIGURE 2A. It is to be noticed that the gap between the top finish 32 and the interior of the outwardly facing recess 14 narrows rapidly as the closure comes to its final seal. These two sections, however, never come in contact with each other. This is because, as illustrated in FIGURE 2B, the exterior corner 33 of the top finish 32 will first come in contact with the convex peripheral surface 29 of the rubbery mass 28. The exterior corner 33 functions as a non-yielding body as the closure is forced down upon the neck of the jar. This non-yielding body protrudes into the compressible body of the sealing element 28 forcing it into the annular anchor channel 13. It is known in the art that sealing materials possess both elastic and viscous properties at the temperatures and pressures of sealing. This sealing material, therefore, can transmit thrust and the major thrust developed by the exterior corner 33 will be directed towards the area of least resistance. Two gaps exist, at this point in the procedure, which offer no resistance to the compressed sealing material. One gap is between the top finish 32 and the interior side of the outwardly facing recess 14, and the other is between the side finish 34 of the jar and the interior side of the annular side recess 22. The sealing material will move into these gaps, as illustrated in FIGURE 3. Therefore, as the closure is further forced down on the neck of the jar, the compound will be packed into these gaps rather than displaced from them. The inside surface of the locking segments, at this point, should clear the surface of the outwardly opposing lugs 35 on the neck of the container. The cap is then twisted and these locking segments come into locking engagement with the lugs. When the jar is closed, the sealing element 28 forms a composite angle seal with the rim of the container, as illustrated in FIGURE 3. This composite is made of three seals, i.e. one with a partial section of the

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top finish 32, one with the exterior corner 33, and the last with the side finish 34. It is apparent that this composite seal is a more positive seal than an ordinary top seal. In the latter case, the only effective seal is made with the top finish of the container. The present closure, in common with other process closures, is a resealable closure. This means that it may be removed from the container and reapplied to seal the jar tightly. This is accomplished by merely slipping it over the neck of the container and twisting it into locking engagement with the lugs or threads thereon. This is a relatively easy procedure in comparison to that encountered with the conventional band and panel type closure because this is a one piece operation.

It is apparent, from the foregoing description and drawings, that the sealing element will invariably engage the exterior periphery of the rim and will form a seal therewith. This presupposes, of course, that the cap is slipped over the neck of a suitable container. The engagement of the surfaces will take place even though the sealing element contains less material than the ordinary top seal variety. One of the reasons for this invariable action lies in the inherent flexibility of the cap. This is a result of its design. Another reason for this action is that the sealing element, which is mechanically locked in the anchor channel, is disposed at an angle to both the plane of the top panel and that of the skirt, as illustrated in FIGURE 2A. The axis of the sealing element, due to this arrangement, transverses the plane (D) of the exterior wall of the container. A section of the periphery of the sealing element, as a result of these factors, is spacially located at a comparatively low point within the closure. This comparison is being made against the conventional process cap adapted with a top seal and commercially available on the market. The point of contact, therefore, between the rim of the entering neck of the container and the periphery of the sealing element will be made spacially at a much lower point within the closure. This point of contact is much lower than that ordinarily encountered in commercially available process closures. The engagement between the surfaces, therefore, will be invariably made without padding the sealing element in any manner. As the neck progresses into the closure, an effective top seal and side seal will progressively form until the final seal is made as heretofore described. This is the case even though the rim may contain a saddle finish or the cap may be tilted on the container. The latter usually occurs because the interlocking threads on the glass container possess irregularities. The former, however, is a defect commonly encountered in jars which may be described as a shallow area.

There are many modifications which may be made in the present closure without departing from the inventive

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concept embodied therein. In one case the skirt may be modified while in another it may be the panel. One such modification is illustrated in FIGURE 1 where the skirt is designed to interlock with a lug equipped jar. Another modification, however, is illustrated in FIGURE 4 where, if desired, the skirt may be designed to interlock with a jar whose exterior is thread equipped. Another skirt modification which may be used, but which is not shown, is the conventional "snap on" type skirt. In any case, with or without these modifications, the present closure is unique. There exists no fear that the gasket will become separated from my cap during the normal processing of the food pack. This has always been the case with other process type closures. The tendency of the food pack to deteriorate as a result of leakage of such gasket is therefore reduced if the container is equipped with the present closure. This closure may be made in a large variety of sizes to accommodate a correspondingly large variety of containers. It may be applied to a container by hand or at a relatively rapid rate with the automatic equipment which is conventionally used by industry.

I claim:

1. In a closure of the resealable type having a panel portion and an independent cylindrical skirt portion adapted to be removably mechanically attached to the rim of a container, the improvement comprising an annular, inclined, inwardly opening channel intermediate said panel and skirt portions and falling below the plane of said panel and within the confines of the cylinder in which the outer surface of the cylindrical skirt is situated, the base of said channel defining a frusto-conical surface, the sides of said channel converging toward each other and confining therein a resilient sealing element with an exposed normally convexly arcuate sealing surface, and outwardly opening annular recesses on the top and side of said channel, said sealing element being so positioned that when the closure is attached to a container, said sealing element engages the top and outside edges of said rim and said annular recesses serve in conjunction with said edges to confine said sealing element.

2. The closure of claim 1 when said closure is adapted to rotatably engage said rim.

3. The closure of claim 1 having an annular shoulder between the side annular recess and said skirt portion, said shoulder being substantially parallel to the plane of said panel.

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