Sept. 24, 1963 A. PODESTA ETAL 3,104,773

CLOSURES

Filed Dec. 16, 1960

Fig. 1.

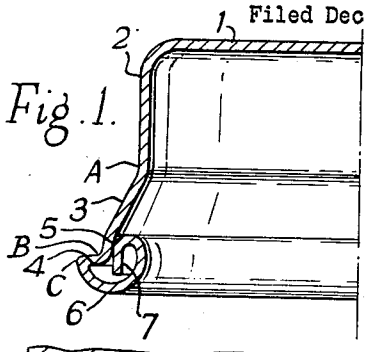


Fig. 4.

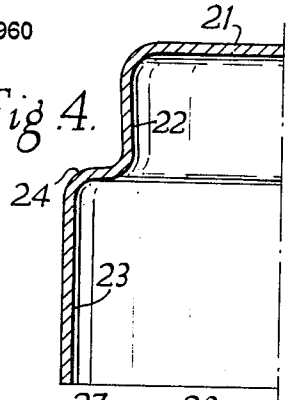


Fig. 2.

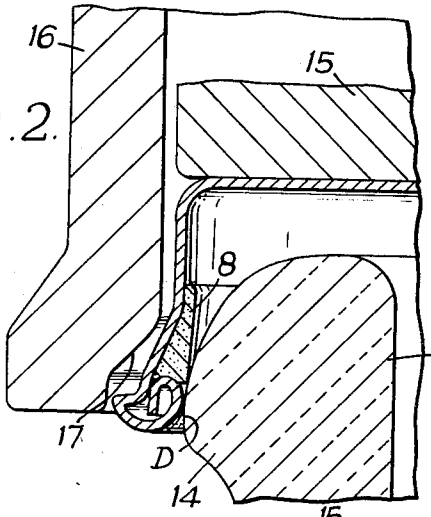


Fig. 5.

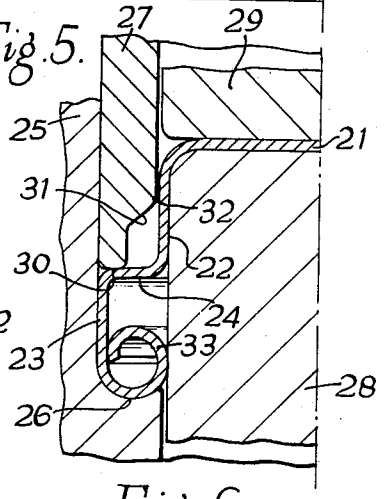


Fig. 3.

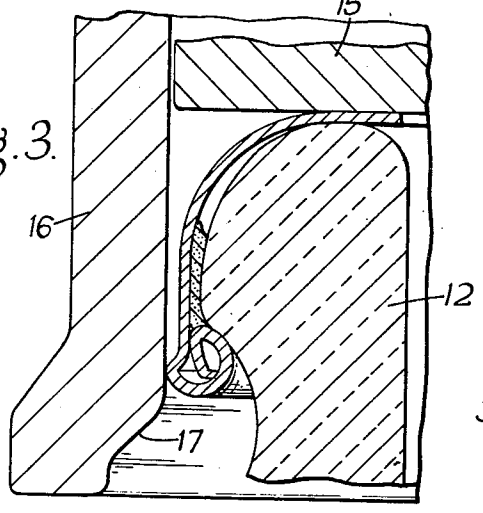
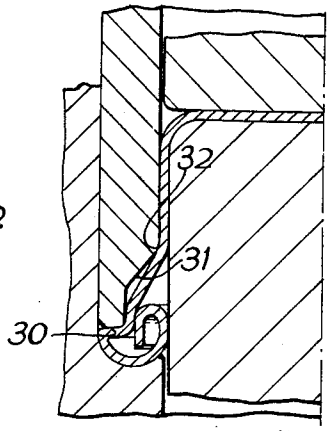


Fig. 6.



INVENTORS
ARMANDO PODESTA and CARLO VIGNATI

BY
Nemerovski, Lind & Ponack
ATTORNEYS

United States Patent Office 3,104,773 Patented Sept. 24, 1963

3,104,773

CLOSURES

Armando Podesta and Carlo Vignati, Milan, Italy, assignors to Metal Closures Limited, West Bromwich, England

Filed Dec. 16, 1960, Ser. No. 76,304
Claims priority, application Italy Dec. 17, 1959
7 Claims. (Cl. 215—38)

The present invention relates to closures for bottles and other containers and in particular to closures intended to be used for retaining high internal pressure whilst in service and capable of easy removal when pried off by suitable openers of the known patterns.

The closure of the present invention is intended to be used on glassware of a known pattern which comprises a contoured rib on the external surface of its neck, the underside of which rib provides an abutment for the anchorage of the closure whilst the upper surface serves as a pouring lip. Such glassware is in common usage and is by way of a universal standard.

Glassware having this known lip pattern has up to the present been almost exclusively sealed by the "crown" type closure, which has a characteristic fluted and corrugated skirt, having a raw, cut, edge. In a crown closure, sealing contact is made between the closure and the top face of the bottle lip on the area around its mouth by means of a liner formed from known resilient materials, as for example, a wad of cork.

When a sealed bottle is subjected to internal pressure the resultant load produces a tendency for the top of the closure to bend and lift. In the case of top sealed bottles it is necessary for the closure to be formed of a relatively rigid material, such as tin-coated steel of .012" thickness, to restrict the flexure of the top and at the same time provide a firm anchorage under the bottle lip in order that the available resiliency of the liner may be sufficient in range to respond and check any escape of pressure.

The performance of some other known closures, which have been proposed for glassware of this type, is seriously affected by the dimensions of the contoured rib in relationship to the diameter and length of the closure shell and in relationship to the thickness and composition of the sealing wad. In practice a fair degree of dimensional tolerance has to be expected in the manufacture of glass bottles under commercial bulk production conditions. For example, a commonly used standard for glassware of this type specifies a permissible variation of 0.032" in the contoured rib diameter and upon examination of bottles in circulation it is found that even wider variations exist, due mainly to ovality and other deviations. In addition, the rib abutment is variable in height from the top of the bottle and the specified value of its corner radius is often exceeded.

The performance of the hitherto known closures is not equally satisfactory over the wide range of bottle rib or lip conditions aforementioned, since in service the adequacy of the seal must be maintained for considerable periods under variable storage conditions and although an apparent adequate pressure-retaining seal is obtained at the initial application of the conventional closure, many bottles are found to have lost pressure after a period of time.

It is an object of the present invention to provide a fully efficient closure in which the use of a corrugated skirt having an exposed raw edge is avoided with consequent improvement to the user.

It is a further object of the invention to provide a closure which may be constructed from a light gauge aluminium sheet of commercial quality, for example, light gauge sheet of the quality generally known as "Container sheet." This quality material will hold pressure up

to 200 lbs. per square inch when a thickness of .007" to .008" is used for the closure constructed in the manner of this invention.

Other materials can be used for the invention by suitable choice of thickness in relationship to the strength and ductility and by varying the proportions of the relative elements comprised in the closure structure.

The top of closures made of such light gauge materials will deform more readily when subjected to the quite high internal pressures which arise with some products after bottling, for instance, with carbonated drinks and with beer during pasteurisation, and it follows that, if a closure made of such material is adapted to seal against the bottle on the side of and under the rib, upward deformation of the closure improves the seal because such deformation pulls the light gauge material of the shell together around the rib and thus improves the co-operation of the closure and the glassware. This increased efficiency under pressure would not occur if the seal is made against the ordinary top sealing surface around the orifice of the bottle, as is the case with known "crown" type closures.

Earlier alternative closures have been proposed for this type of glasswase in which an outwardly curled bead at the edge of the skirt was provided and these closures were intended to be applied by a downward and inward force on such bead. One of the reasons why closures of such type proved unacceptable in practical commercial application arose out of the tendency for such bead to unroll under downward pressure, with the result that there was some lengthening of the closure skirt by transfer of metal from the bead to the skirt and the amount of such unrolling was not exactly predictable. This lengthening was definitely affected by variation in the rib diameter of the glassware and the more the bead was forced inwards to cope with the smallest diameter of rib, the more unrolling took place.

The present invention is partially based on the observations that if a sufficiently sharp bend is formed as a line of demarcation between a skirt and an inwardly curled bead there will be no transfer of metal from the skirt to the bead when a closure is subjected to downward and inward pressure on the skirt to bring the curled bead into locking engagement under the rib of glassware of the type already referred to. Contact of the inwardly curled bead with the glassware during its downward movement has only the effect of curling the bead more tightly and thus compressing the bead and strengthening the edge of the closure.

According to the present invention a closure for glassware of the type having a neck with an external rounded rib, is formed as a thin metal shell having a top and a skirt, at least the lowermost part of said skirt being outwardly flared, said skirt terminating in an inwardly curled bead, said skirt and said bead being joined to each other along a sharp bend forming a line of demarcation of such nature that metal cannot flow from said skirt to said bead and vice versa around said bead, the interior diameter of the curled bead being not substantially in excess of the diameter of the upper end of the closure skirt, said closure including a gasket in contact at least with the outwardly flared portion of the closure skirt.

Whilst the closure of the present invention is preferably formed of the grade and thickness of aluminium sheet previously discussed, it can, if desired, be formed of thin tin plate. It is essential for the material to have a degree of rigidity, because, it depends for its retention on a bottle on the engagement of the bead under the contoured rib on the bottle. It cannot therefore be formed of lead-based metals, for instance, such as are used for bottle seals.

It will be appreciated that the sharpness of the bend between the curled bead and the skirt will be dictated to some extent by the characteristics and thickness of the sheet metal material from which the closure is formed.

The interior diameter of the curled bead preferably lies about midway between the maximum and minimum permissible values of the contoured rib diameter of the glassware to which the closure is to be applied, whilst the skirt of the closure preferably has a cylindrical part above the outwardly flared part. The interior diameter of the cylindrical part is preferably the same as or slightly less than the diameter of the curled bead. The cylindrical part may be and preferably is slightly tapered for ease of withdrawl of the forming tools during manufacture. There is, of course, an annular recess on the inside of the skirt defined by the flared portion of the skirt and the inwardly curled bead.

This recess is preferably used to receive a "flowed-in" gasket, made, for example, of a polyvinyl chloride emulsion, having "puff" characteristics, so that the resultant gasket, after curing of the resin, is of a slightly spongy nature, with the result that it can be compressed very readily. The "flowed-in" gasket is preferably made of such thickness that its internal diameter, in its original shape, is less thn the minimum value of the contoured rib of the glassware, so that when first placed on a bottle the closure rests on the gasket, irrespective of the contoured rib diameter. The gasket contacts the rounded rib above the zone of its maximum diameter.

There is preferably a narrow substantially horizontal ledge between the bottom end of the flared part of the skirt and the sharp bend. This ledge is a result of the means used for forming the sharp bend between the skirt and the curled bead.

One form of closure made in accordance with the present invention and the method by which such closure may be manufactured are hereinafter described with reference to the accompanying drawings wherein:

FIGURE 1 is a section of a closure shell,

FIGURE 2 is a section of a closure at an initial stage of its application to a bottle,

FIGURE 3 is a section of a closure at the completion of its application to a bottle,

FIGURES 4, 5 and 6 show various stages in the manufacture of a closure in accordance with the invention.

The shell of a closure made in accordance with the present invention is shown in FIGURE 1. It comprises a top 1, a skirt having a cylindrical upper part 2 and an outwardly flared lower part 3. The upper part 2 and the lower part 3 meet at a gently rounded angle A.

The outwardly flared lower part 3 leads into a narrow substantially horizontal ledge 4 through a more steeply inclined part 5 and a rounded angle B.

The ledge 4 leads into a curled bead 6 through a sharp angle C, formed, as will be explained hereafter, by compressing a spiral curl. The bead is a spiral having at least one spire which curves downwardly and inwardly from the end of the ledge 4, and then upwardly and outwardly. It will be seen that the terminal portion 7 of the curled bead is locked behind the steeply inclined part 5 of the skirt.

The closure is completed by a gasket 8 which is preferably of the "flowed-in" type, formed in situ in the closure, although it can be preformed and inserted into the closure, if that be desired.

It will be seen that the gasket material is placed in the shallow recess formed in the angle between the curled bead and flared part 3 of the skirt. In come cases it may be advantageous for the gasket to extend up the full extent of the skirt.

The application of a closure to a bottle is shown in FIGURE 2. In FIGURE 2 there is shown a part of a bottle neck 12, having a contoured rib 14, the maximum diameter of which is at about the point D, below which point the diameter decreases rapidly so as to define a ledge under which the bottom edge of the closure can be forced into locking engagement.

In FIGURE 2 the diameter of the contoured rib is towards the minimum value permitted by the specification of the glassware for which the closure is intended.

The application of the closure to the glassware is effected by an application tool of generally conventional shape for the application of "crown" closures. The application tool is comprised of a presser member 15, which moves to press the closure down onto the top of the bottle and a throat member 16, having a conical surface 17 for engaging against the outwardly flared part 3 of the skirt, the throat member 16 being separate from the pressure member 15 and moving independently of it. During the movement of the throat member 16 the conical surface 17 slides down over the outwardly projecting lower edge of the closure and squeezes it inwardly at the same time as it draws it downwardly to bring the upper part 2 of the skirt and the peripheral part of the top 1 to the shape shown in FIGURE 3.

The action of the throat member 16 has the effect of bending the metal of the closure at the angles A, B and C and at the same time compressing the curled bead against the bottle. It will be appreciated that the contact between the bead and the gasket and the glassware provides a retarding action. In the case of the bead the resistance thus provided leads to it becoming more tightly curled by the action of the throat member. The provision of the sharp angle C prevents metal flowing from the bead into the skirt under the action of the application tool. This expedient overcomes the known difficulty of outwardly curled beads unrolling to a variable extent under the action of an application tool of the present type.

The inward squeezing action of the throat member 16 on the curled bead 6 leads to the metal being bent back at the angles A and B, whilst at the angle C a relatively sharp bend is retained. The curled bead in its final form shown in FIGURE 3 forms a strong lip as an edge reinforcement to the closure, which will not break or buckle when the closure is prised off the bottle by means of any of the conventional opening implements employed for removing crown closures.

One method of manufacturing the closure shell shown in FIGURE 1 is illustrated in FIGURES 4, 5 and 6.

The method starts with a two diameter blank made of aluminium container sheet of a thickness of about 0.007" and having a top 21 and a cylindrical or slightly conical portion 22, whose dimensions are carried over into the top 1 and part 2 of the final closure. The blank has a portion 23 of larger diameter, connected to the portion 22 by a horizontal ledge 24.

The edge of the blank is inwardly curled by means of a tubular curling tool 25, having a curved trough 26.

The curling is effected by pressing downwardly on the ledge 24 by means of an annular tool 27, whilst the blank is supported on a mandrel 28, which has substantially the diameter of the portion 22, and is clamped against the mandrel 28 by a presser member 29.

The annular tool 27 slides in the curling tool 25 and has a narrow foot 30, which presses against the top of the ledge 24 of the blank. The tool 27 has a concavely tapered recess 31 between the foot 30 and a point 32 on its inner bore. As the tool 27 bears down against the top of the ledge 24, the bottom edge of the blank is formed into a regular spiral curl, as shown at 33 in FIGURE 5. The mandrel 28 is so positioned in relation to the tubular curling tool 25 that the curling of the edge of the closure is substantially completed when the annular tool 27 reaches the position shown in FIGURE 5.

Further movement of the tool 27 crushes the upper outside portion of the spiral curl 33 and forms it into the shape shown in FIGURE 1, this crushing movement folding the metal of the closure to produce the essential sharp bend angle C and at the same time stretching and forming the ledge 24 and the upper part of the portion 23 into the form of the flared part 3 of the final closure shell. The angles A and B are respectively bent around the inner edge of the foot 30 and the upper end 32 of

the recess 31. Both the upper end 32 and the inner edge of the foot 30 are radiused to ensure that the angles A and B are gently rounded.

We claim:

1. A closure for bottles of the type having a neck with an external rounded rib surrounding the mouth of the bottle, said closure being a thin metal shell comprising a top and a skirt, at least the lowermost part of said skirt being outwardly flared, said skirt terminating in an inwardly curled spiral bead having at least one spire curving downwardly and inwardly and then upwardly and outwardly from the lower dege of said skirt, the inner diameter of said curled bead being between a diameter less than the maximum specified external diameter of the rib of the bottle and a diameter only slightly in excess of the diameter of the upper end of the closure shell skirt and the curved surface at said minimum diameter being adapted to abut against the underside of the rib on the neck of the bottle, a sharp bend in the metal shell being formed at the junction between said skirt and said curled bead, said sharp bend forming a line of demarcation between said curled bead and said skirt and being of such sharpness that metal cannot flow from said skirt to said bead and vice-versa around said sharp bend, and said closure including an annular gasket placed in said shell in contact with said skirt above said inwardly curled bead, whereby when said closure is placed on the neck of the bottle and pressed down onto the neck and said skirt is forced inwardly toward the neck of said bottle, the inside angle of said sharp bend is increased and said bead is pressed tightly against the underside of said rib.

2. A closure according to claim 1 wherein said skirt comprises an upper cylindriical part and a lower conically outwardly flared part.

3. A closure according to claim 2 wherein the interior diameter of the curled bead is substantially equal to the diameter of the upper cylindrical part of the skirt.

4. A closure according to claim 1 wherein the interior diameter of the closure skirt is selected to lie about midway between the maximum and minimum values specified for the external diameter of the contoured rib of the bottle to which the closure is to be applied.

5. A closure according to claim 1 including a narrow substantially horizontal ledge between the sharp bend and the outwardly flared part of the skirt.

6. A closure for bottles of the type having a neck with an external rounded rib surrounding the mouth of the bottle, said closure being a shell of light gauge aluminum having a top, a skirt comprising a cylindrical upper portion and an outwardly flared lower portion, and a partially compressed, inwardly curled bead at the lower edge of the said outwardly flaring lower portion of the skirt, said bead being a spiral having at least one spirt curving downwardly and inwardly and then upwardly and outwardly from the lower edge of said skirt, the inner diameter of said curled bead being between a diameter only slightly in excess of the inner diameter of said cylindrical upper portion of the skirt and a diameter less than the maximum value specified for the external diameter of said rib and the curved surface at said minimum diameter being adapted to abut against the underside of the rib on the neck of the bottle, an annular flowed-in gasket in said shell in contact with said outwardly flared portion of said skirt, said shell having a sharp bend formed therein at the junction of said bead and said outwardly flared portion, said bend being of such sharpness that metal cannot be flowed through said bend from said skirt to said bead and vice-versa, whereby when said closure is placed on the neck of the bottle and pressed down onto the neck and said skirt is forced inwardly toward the neck of said bottle, the inside angle of said sharp bend is increased and said bead is pressed tightly against the underside of said rib.

7. A closure as claimed in claim 6 wherein the outwardly flaring lower portion of the skirt comprises a substantially conical portion and a narrow, substantially radially extending portion at the lower edge of said substantially conical portion, the terminal edge portion of the curled bead being behind the lower end of said substantially conical portion.

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