Jan. 10, 1967 E. HENDERSON 3,297,213

LEAK ARRESTING CLOSURE

Filed April 7, 1965 2 Sheets-Sheet 1

Fig 1

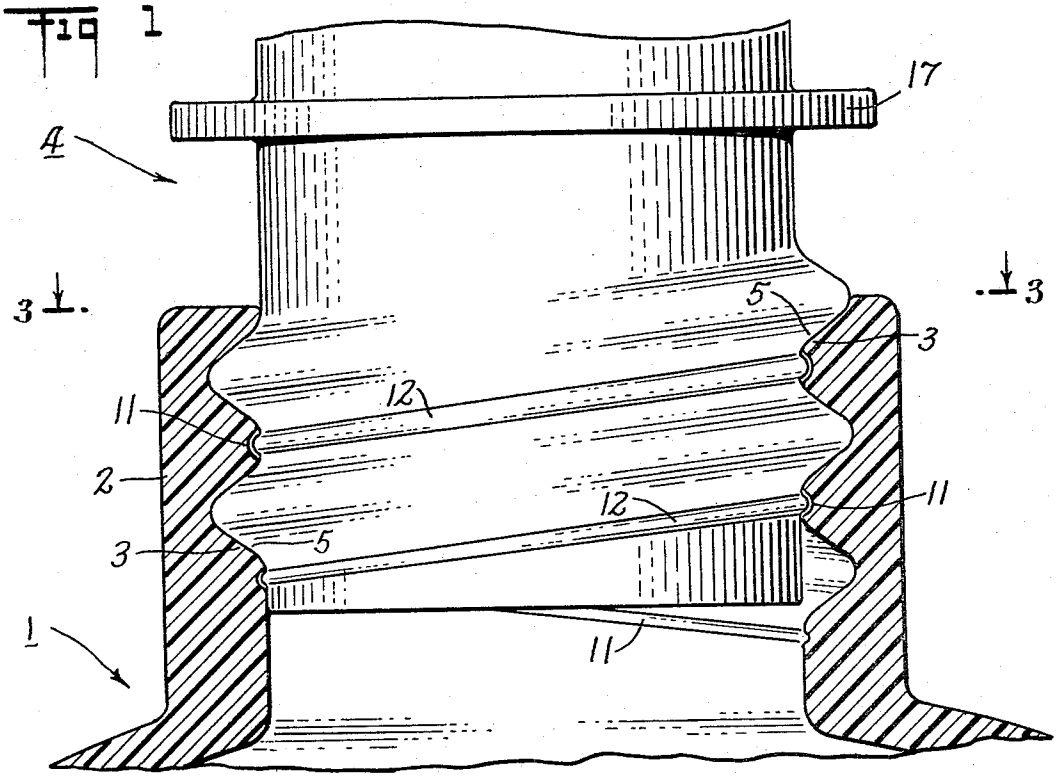
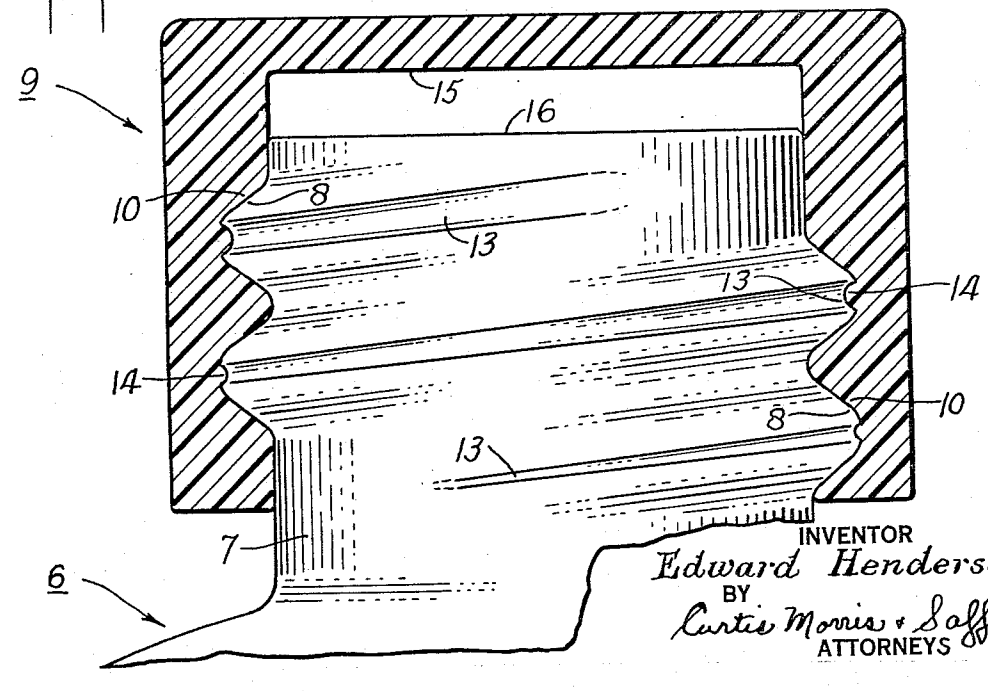


Fig 2



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Fig 3

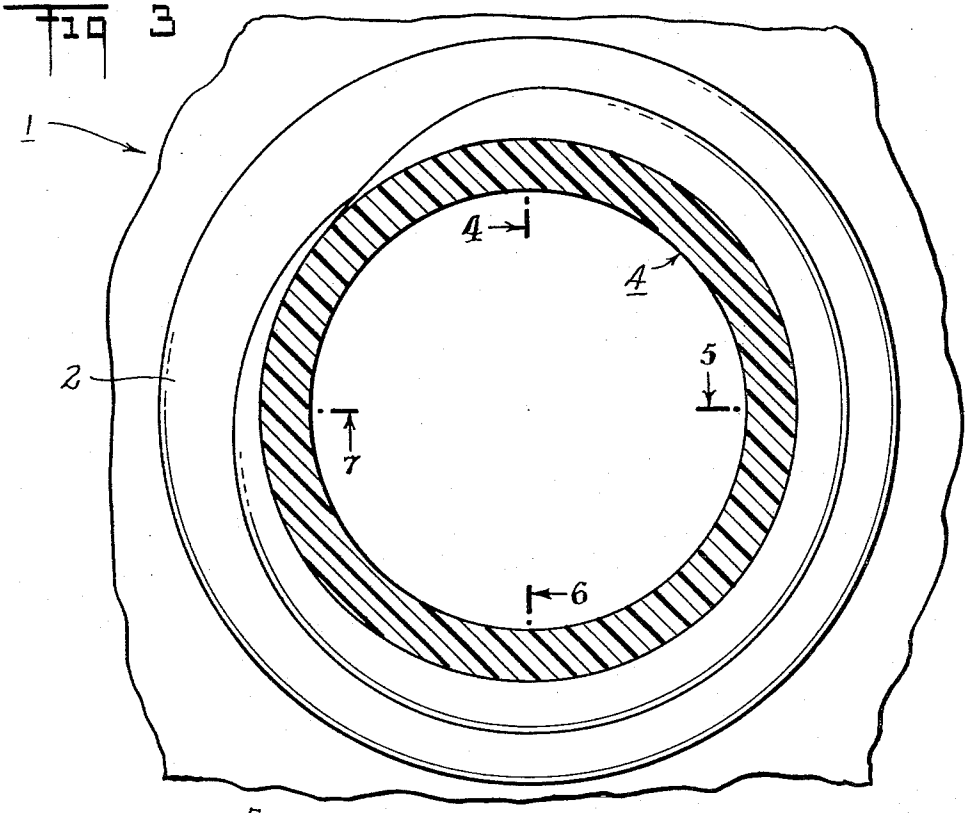


Fig 4

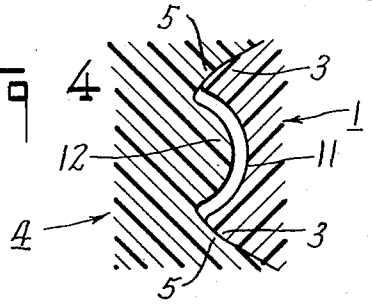


Fig 5

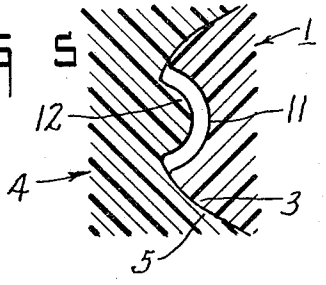


Fig 6

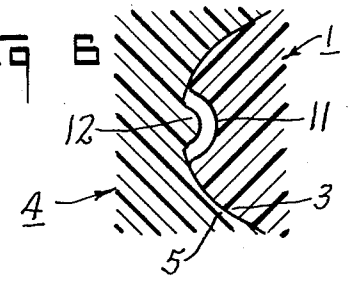
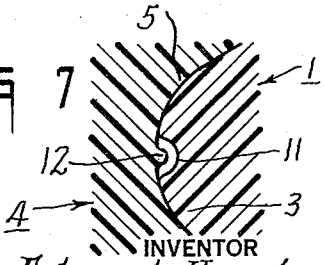


Fig 7



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LEAK ARRESTING CLOSURE

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2 Claims. (Cl. 222—542)

The present invention relates to leak arresting closures.

Leakage of the liquid or semi-solid contents from packages including containers of various types has presented a long-standing problem. Although not limited in application to any particular field of use, one object of the present invention has been to provide an effective leak-arresting closure, as one including a screw thread joint for connecting parts of containers, dispensers or the like, or for connecting applicators or the like to containers or for capping or closing containers, such as are widely employed in merchandising or dispensing drug and/or cosmetic products, among others, in fluid or semi-solid condition.

A further object of the invention has been to provide a closure or connection which can advantageously be embodied in devices made of various materials, as glass, metal, plastics, etc., for example, bottles with caps, or fitted with applicator tips or other nozzle-like applying devices.

A further object of the invention has been to provide a closure or connection which can be incorporated at relatively low cost in screw-thread connected parts and thereby permit its wide adoption and use in circumstances where the container or applicator cost of a packaged product can be of considerable and sometimes critical economic consequence.

In general, an embodiment of the subject invention includes an inner threaded part, as the neck or shoulder of a bottle, and an outer threaded part, as a cap or an applicator, mounted thereon for free axial and rotative movement between said parts. As in a conventional closure or connection, the helical main rib or thread of each part is operatively engaged in the cooperating helical main groove of the other.

To more effectively arrest leakage through such a connection in one embodiment of the invention the main rib of one part is provided with a secondary groove extending along its ridge and which is shaped and dimensioned to receive a secondary rib rising out of the trough of the main groove of the other part and co-extending with said secondary groove. Said secondary groove and secondary rib extend preferably through more than one turn of said main rib and said main groove and terminate short of the inner ends thereof. In said embodiment, the secondary groove tapers from a maximum area opening at its outer end to a narrowed inner end. Likewise, the secondary rib tapers from a maximum cross-sectional area at its outer end to its inner end in a gradient corresponding to that of said secondary groove whereby it nests snugly in said secondary groove when the inter-engaged parts are in effective leak-arresting relation.

In a variant, wherein the thread or rib of at least one part is relatively flexible, a secure closure may be effected with co-operating ribs and grooves of appropriate contour.

Other objects and advantages of the invention will appear from the following specification wherein an embodiment thereof is more particulaly described and from the appended drawings wherein:

FIG. 1 is a view on exaggerated scale partly in central vertical section of a portion of a bottle, or similar container, having an interiorly threaded neck with which an exteriorly threaded spout, nozzle, applicator or the like is incompletely engaged;

FIG. 2 is a similar view on exaggerated scale of a bottle, or similar container, having an exteriorly threaded neck on which is mounted an interiorly threaded cap, shown in fully engaged and in operative, closing and sealing position;

FIG. 3, a view partly in section from the line 3—3 of FIG. 1, to be considered in connection with the following described figures;

FIG. 4, a fragmentary transverse vertical section approximately at a position corresponding to that indicated at line 4—4, FIG. 3, and assumed to be approximately at the open upper end of the secondary groove in the bottle neck;

FIG. 5, a view similar to FIG. 4 but at line 5—5 of FIG. 3, and showing the smaller cross-sectional areas of the secondary groove and secondary rib, respectively, at a position 90° from the position of line 4—4;

FIGS. 6 and 7 are views similar to FIG. 5, but taken at lines 6—6 and 7—7 of FIG. 3, or at 180° and 270°, respectively, from line 4—4 of FIG. 3, and showing correspondingly reduced cross-sectional areas of said secondary groove and rib, respectively, along the length thereof which groove and rib taper from large area outer end portions to attenuated inner ends;

Referring to the drawings, the present invention may conveniently be embodied in a bottle-like container, including an outer part 1 having a neck 2, FIG. 1, which is provided with an interior main thread or helical rib 3. A spout, nozzle, dispenser, applicator, or the like, as inner part 4, of generally tubular form, adapted to cooperate with said outer part, is exteriorly threaded at its base FIG. 1, to provide a main helical groove 5. Said main rib 3 and main groove 5 are shaped, dimensioned and pitched so that the inner part 4 may be operatively assembled with outer part 1, in a conventional manner, as by rotating part 4 clockwise in relation to part 1. Thus, a conduit is provided whereby the fluid or semi-solid content of the bottle, or outer part 1, can be discharged through said spout, or inner part 4.

FIGURE 2 shows a variant wherein the container for the liquid or semi-solid is seen as an inner part 6 or bottle having a neck 7 which is provided with an exterior main thread or helical rib 8. A cap, or outer part 9, is formed with a main inner helical groove 10. Said main rib 8 and main groove 10 are shaped, dimensioned and pitched so that said parts 6 and 9 may be operatively assembled in a conventional manner by rotating the cap clockwise on neck 7.

As seen in the embodiment shown in FIG. 1, the normal defining surface or rounded ridge of main rib 3 in neck 2 of the outer part 1 is interrupted by a longitudinally tapering helical secondary groove 11 appearing as an indentation in and extending along the crest of main rib 3 from the top end thereof through one or more turns of said rib, and terminating short of the bottom end thereof. The cross-sectional contour of said secondary groove 11 is advantageously approximately semi-circular; and its cross-sectional area diminishes in a gradient from maximum at its open top end to a narrowed or reduced bottom end.

Also, as seen in FIG. 1, the normal concave surface of main groove 5 in the threaded portion of inner part 4 is interrupted by a longitudinally tapering helical secondary rib 12 appearing as a projection extending outwardly from and along the trough of main groove 5 from the open top end thereof through one or more turns of said main groove and terminating short of the bottom end thereof. The cross-sectional contour of said secondary rib 12 is advantageously approximately semi-circular; and its cross-sectional area diminishes in a gradient corresponding to

that of secondary groove **11** from maximum at its top end to an attenuated bottom end.

FIGURES 5, 6 and 7 taken with FIGS. 3 and 4 are intended to illustrate the taper form of the above described secondary groove and cooperating secondary rib, FIG. 1. Also, the dimensions and contours thereof are complementary in the sense that approximately the entire length of rib **12** nests snugly in approximately the entire length of groove **11** when the parts are brought to operative connecting position, i.e. at the end of more than one turn of one part in relation to the other.

Thus, in the assembled condition of said parts, the above-described cooperating secondary rib and groove not only tend to arrest passage of liquid, fluid or semi-solid through the connection, i.e., between the main groove and the main rib, but also provide a stop marking the completion of their effective connecting and closure effecting engagement.

What has been noted above in regard to the FIG. 1 embodiment applies, in general, to that shown in FIG. 2 where the closure cap **9** is shown in completely engaged relation to neck **7** of container **6**. As seen in this figure the main rib **8** of the threaded neck **7** of container **6** is provided with a longitudinally tapered secondary groove **13** which cooperates with a similarly tapered secondary rib **14** in a main groove **10** of cap **9**. Accordingly, as in FIG. 1, the opposed surfaces of said secondary rib **14** and its complementary secondary groove **13** do not come into operative meshing or nesting relation until relative rotation of the parts has been effected through approximately a sufficient number of turns, as two or more for some purposes, or until secondary rib **14** comes into effective stop position in relation to secondary groove **13**. Stated differently, for approximately the required number of turns, the secondary rib **14** rides in substantially free spaced relation to said secondary groove **13** during both engaging and disengaging operation of cap **9** so that they have no impeding effect on normal rotation and axial movement between the parts. The same is true in regard to operation of the parts shown in FIG. 1.

Where, as in FIG. 2, a device according to the invention includes a closure, as cap **9**, there is no need to provide a liner, or gasket commonly required in known closures, at the under side of top wall **15** of the cap to sealingly engage the upper edge **16** of neck **7**; indeed engagement of surface **15** with edge **16** could limit relative axial movement of the parts and prevent complete meshing of secondary rib **14** with secondary groove **13**, thus defeating one of the advantages supplied by the present invention. It is noted that a major economy is effected where the need for a sealing liner in cap **9** is eliminated.

It is contemplated that the parts identified herein as "inner" and "outer" may include wall portions made of materials varying from rigid, as glass or metal, to flexible or pliable, as different thickenesses or types of plastics such as polyethylene or other material having appropriate chemical and physical characteristics. Thus, where wall portions of the inner part 4, FIG. 1, as related to neck 2 are made relatively thin or of relatively flexible or non-rigid material which may be required for its ultimate use, they can be protected against tearing or impairment in handling and can be rendered more readily usable by providing thereon a relatively rigid peripheral flange **17** serving conveniently as a finger hold. It is also contemplated that in connection with parts involving only moderately close tolerances, where the wall of at least one of the interengaging parts is flexible or pliable, it may contribute to attaining as effective conforming engagement of the secondary rib in the secondary groove as if the parts were formed to more exacting tolerances.

In the FIG. 1 and FIG. 2 embodiments, if one of the interengaging threads is flexible, or if both are flexible, the complementary parts can be brought into and will remain in effective leak-arresting engagement. Thus, for example, where groove **5** of the inner part and/or rib **3** of the outer part is flexible and the thread contour angle is appropriate, closure will be effected by compressive engagement between portions of the thread in one part and opposed portions of the thread in the other part.

I claim:

1. A leak arresting connection and closure for fluid containers of the type wherein two generally cylindrical screw threaded parts, one including a helical main groove and the other including a helical main rib, are rotatably interengaged to effect relative axial movement between them, said main rib having a secondary groove extending along its ridge and said main groove having a secondary rib complementary to said secondary groove extending along and rising out of the trough of said main groove and being arranged in non-interfering cooperative relation to said main rib, said connection and closure being characterized in that said secondary groove and rib terminate at their inner ends short of the inner ends of said main rib and main groove respectively, said secondary groove being gradually tapered in the direction toward its inner end and said secondary rib being correspondingly tapered in the direction toward its inner end and being of a shape and dimensions whereby inner end portions of said secondary rib substantially occupy inner end portions of said secondary groove thereby to maintain effective leak resisting nesting contact with opposed conforming surface portions of said secondary groove.

2. Connection and closure according to claim **1** and wherein, when said parts are in operatively assembled condition, inner end portions of said secondary rib are pressed into said nested relation with opposed inner end portions of said secondary groove thereby providing a spirally disposed leak-arresting closure extending the effective length of said nesting contact between said secondary rib and said secondary groove.

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