

Dec. 21, 1965

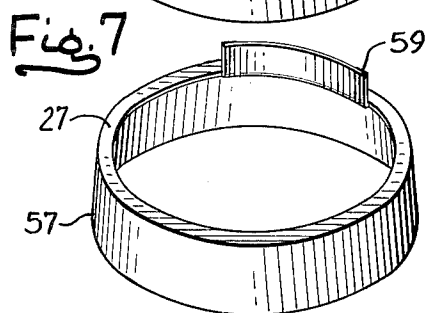
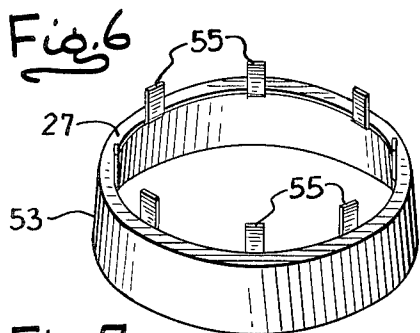
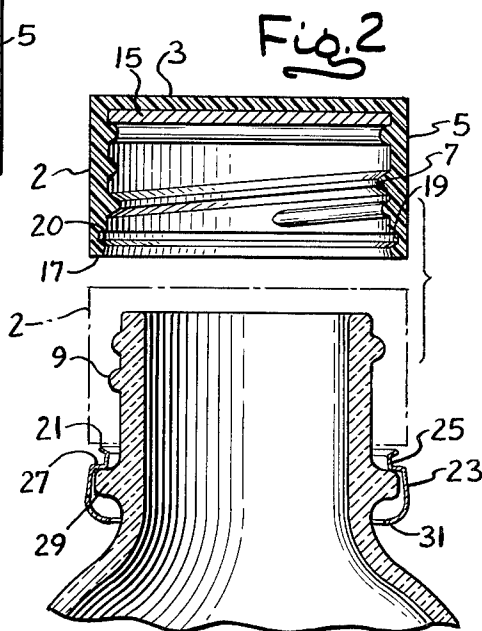
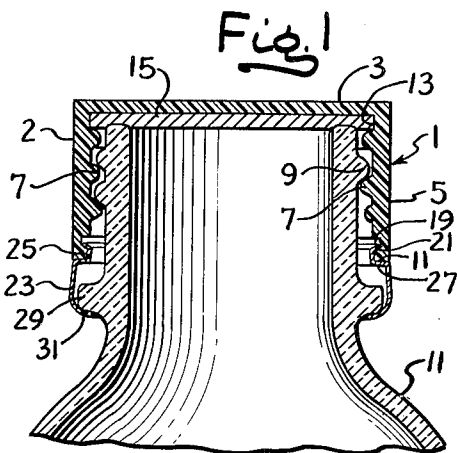
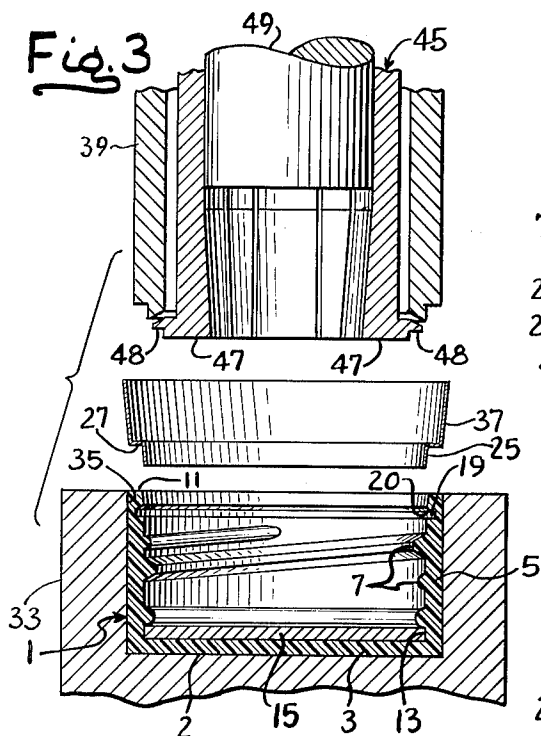
M. R. FIELDS

3,224,616

CLOSURE AND METHOD OF MAKING SAME

Filed Nov. 20, 1963

3 Sheets-Sheet 1



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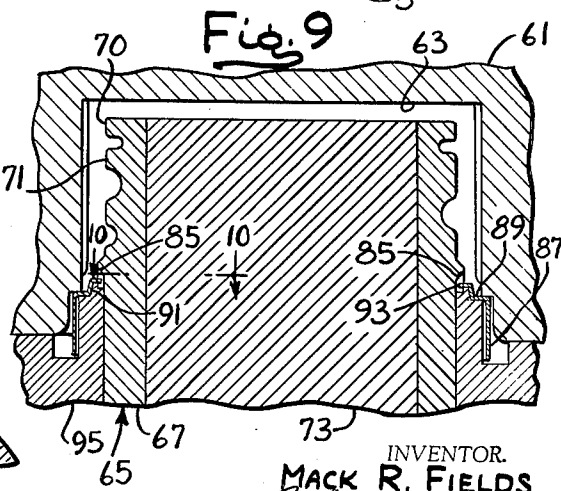
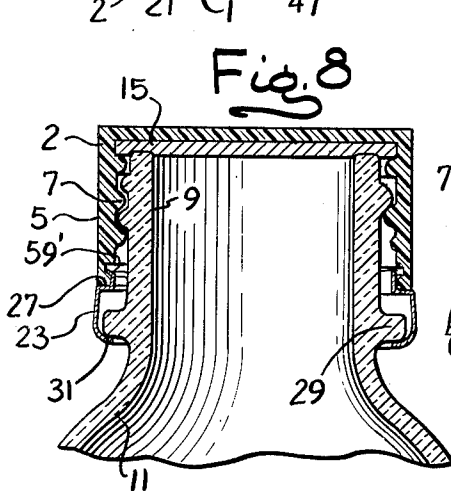
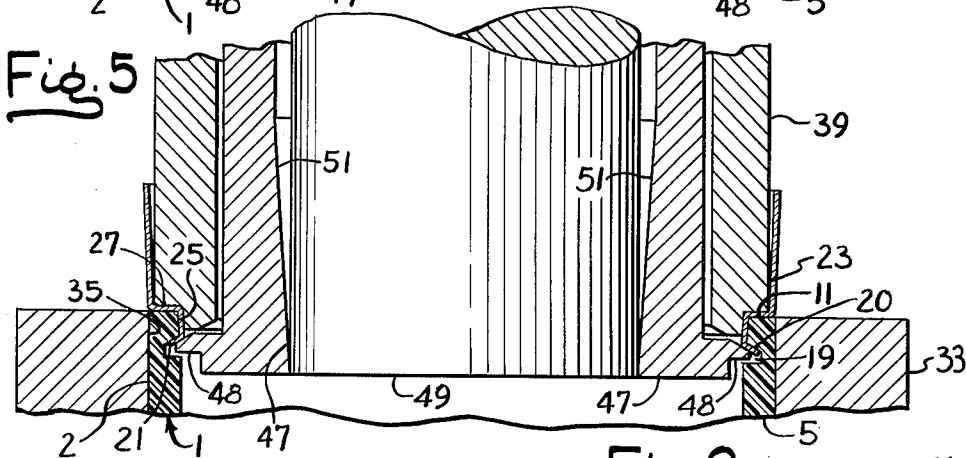
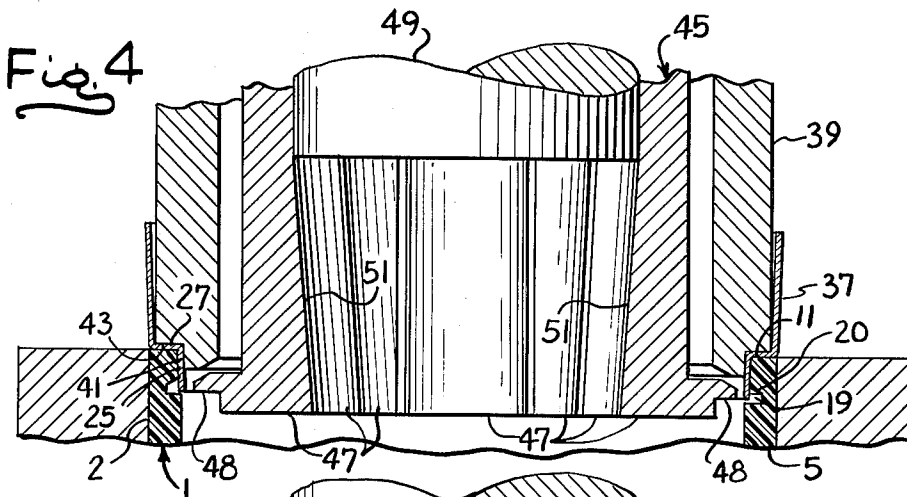
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3,224,616

CLOSURE AND METHOD OF MAKING SAME

Filed Nov. 20, 1963

3 Sheets-Sheet 2



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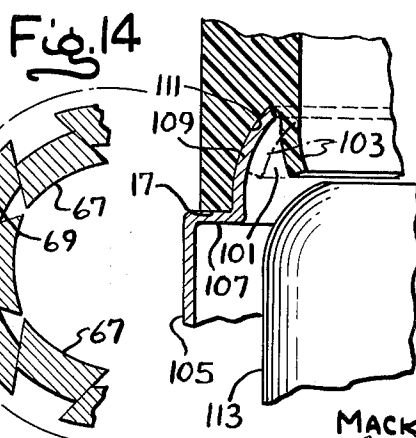
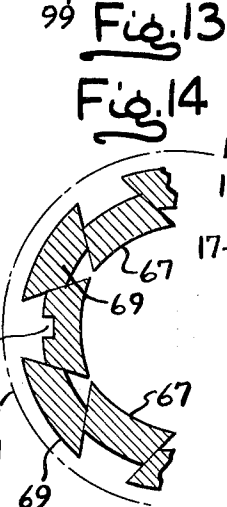
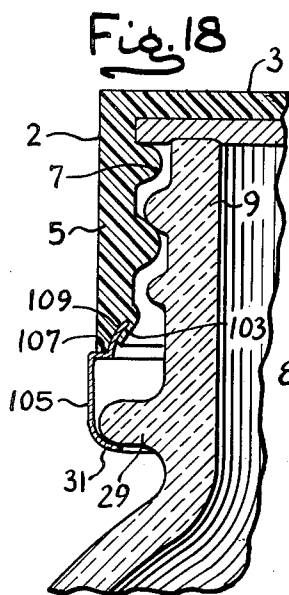
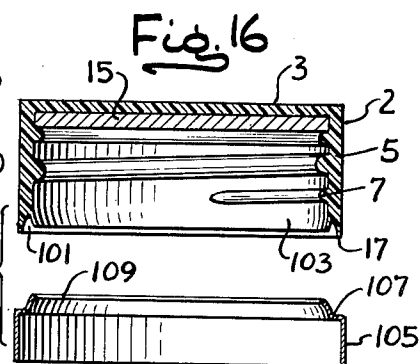
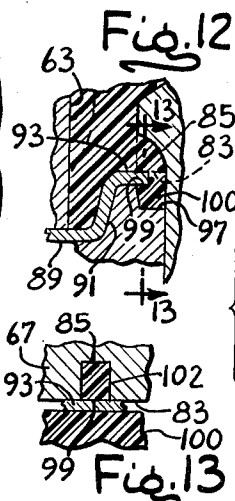
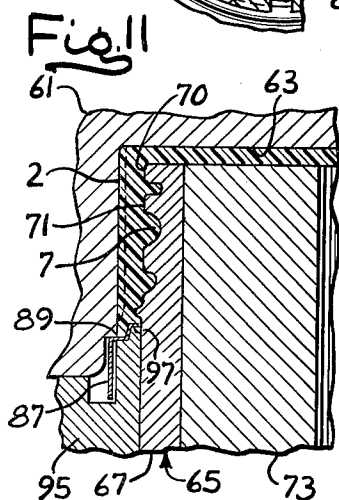
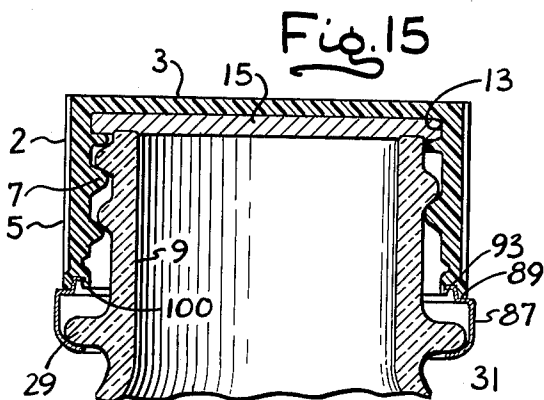
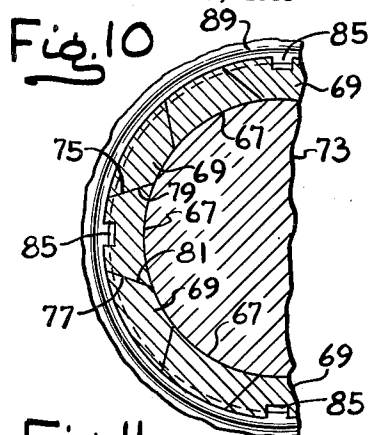
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3,224,616

CLOSURE AND METHOD OF MAKING SAME

Filed Nov. 20, 1963

3 Sheets-Sheet 3



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3,224,616

CLOSURE AND METHOD OF MAKING SAME
Mack R. Fields, Libertyville, Ill., assignor, by mesne assignments, to Roehr Metals & Plastics Company, Hillside, N.J., a limited partnership
Filed Nov. 20, 1963, Ser. No. 324,912
11 Claims. (Cl. 215—7)

This invention relates to container closures, and more particularly to a closure of the so-called "tamper-indicator" type, and to a method of making same.

It is an object of the present invention to provide a tamper-indicating closure that utilizes a cap which has a threaded skirt that depends from the lower end of the cap side-wall, the skirt and cap being loosely or temporarily connected so that upon initially unscrewing the cap from the threaded neck of the container upon which the closure is mounted, the skirt will separate from the cap. This will indicate that there has been tampering with the closure or that it has been previously opened.

It is a further object of the present invention to provide a closure of the type stated in which the connection between the skirt and cap is such that it is difficult if not impossible to reconnect the two once they have been disconnected.

A preferred embodiment of the present invention is a closure of the type that is mounted on a container having a bead immediately below its threaded neck and wherein the skirt is spun under the bead after the closure has been mounted in place. It is an object of this invention to provide a closure including a cap and a skirt and wherein there is temporary connection between the cap and skirt to maintain them against separation during handling thereof and during the closure-mounting operation, particularly as the skirt is spun under the bead.

It is an additional object of the present invention to provide a closure of the type stated in which the skirt, after separation from the cap drops onto the container bead and is supported thereby. When the cap and skirt are assembled, the cap may cover a tamper-indicating indicia bearing portion of the skirt, and upon separation of the skirt from the cap the dropping of the skirt onto the container bead will expose to view the indicia to indicate tampering with the closure.

It is also an object of the present invention to provide a method of making a closure in which a plastic cap is connected to a metallic tamper-indicating skirt by interfitting flange or finger means on the skirt with groove means on the cap, more particularly, but not exclusively, by deforming the same.

It is an additional object of the present invention to provide a closure-making method in which the skirt is attached to the cap as the cap is being molded.

It is another object of the present invention to provide a closure making method in which a part of the cap is hot formed and reshaped to clinch the skirt.

The attainment of the above and further objects of the present invention will be apparent from the following specification taken in conjunction with the accompanying drawing forming a part thereof.

In the drawing:

FIGURE 1 is a vertical fragmentary sectional view showing the closure screw-threaded onto a threaded neck of a container;

FIGURE 2 is a vertical exploded sectional view of the separated cap and skirt after the closure has been initially unscrewed from the neck of the container;

FIGURE 3 is an exploded fragmentary vertical sectional view showing the cap and skirt preparatory to assembling of the two together, and also showing apparatus for carrying out the assembling process;

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FIGURES 4 and 5 are a vertical sectional view on an enlarged scale of the cap, skirt and apparatus for assembling same, and showing steps in the assembly of the cap and skirt to form the closure of FIGURES 1 and 2;

FIGURES 6 and 7 are, respectively, perspective views of two modified forms of skirts that form part of the present invention;

FIGURE 8 is a fragmentary vertical sectional view of a modified form of closure shown in position on the container neck;

FIGURE 9 is a fragmentary vertical sectional view of apparatus used to fabricate a modified form of closure wherein the skirt is secured to the cap as the latter is being molded, the apparatus and skirt being shown preparatory to molding the cap;

FIGURE 10 is a fragmentary sectional view taken along line 10—10 of FIGURE 9;

FIGURE 11 is a fragmentary sectional view similar to FIGURE 9 and showing the cap after molding thereof;

FIGURE 12 is an enlarged fragmentary sectional view of a portion of FIGURE 11;

FIGURE 13 is fragmentary sectional view taken along line 13—13 of FIGURE 12;

FIGURE 14 is a fragmentary sectional view of the thread-forming collet that forms part of the molding apparatus of FIGURES 9—12 but shown in collapsed position;

FIGURE 15 is a fragmentary sectional view of the closure of FIGURES 11 and 12 shown mounted on the container neck;

FIGURE 16 is an exploded sectional view of a modified form of cap and skirt preparatory to assembly of the two;

FIGURE 17 is an enlarged fragmentary sectional view showing the manner of assembling the cap and skirt of FIGURE 16; and

FIGURE 18 is a fragmentary sectional view of the assembled cap and skirt of FIGURES 16 and 17 shown in position on the container neck.

Like reference characters indicate like parts throughout the drawings.

Referring now to FIGURES 1 and 2, 1 designates a closure that comprises a cap 2 that has been molded of a suitable plastic, such as polystyrene. The cap 2 has a top wall 3 and a depending cylindrical sidewall 5 that is formed with an internal thread 7 for threading over the externally threaded neck 9 of a container, such as bottle 11, or the like. Adjacent to the top wall 3, the sidewall 5 has an internal cylindrical groove 13 for receiving a sealing disc 15 that bears against the rim of the bottle neck 9, as shown in FIGURE 1.

Intermediate the lower end of the thread 7 and lower end of rim 17 of the sidewall 15 is an internal inwardly opening cylindrical groove 19 that receives the radially outwardly turned cylindrical flange 21 of an annular metallic skirt 23 of soft aluminum or the like whereby the skirt 23 depends from the sidewall 13. The skirt 23 has axial wall 25 just below the flange 21 and a radially outwardly extending shoulder 27 that is covered by the rim 17. The axial interference between the skirt flange 21 and sidewall 5 is relatively small. For example, the difference between the maximum diameter of the flange 21 and the minimum diameter of the sidewall at the lower beveled wall 20 of the groove 19 may be of the order of .035 inch. The part of the skirt that is immediately below the shoulder 27 surrounds a radially projecting annular bead 29 that is integrally formed on the bottle 11 just below neck 9, the bead 29 being axially spaced from the shoulder 27 for purposes presently more fully appearing. After the bottle has been filled, the cap 1 with the attached skirt 23 is threaded onto the neck 9 and

then the lower end 31 of the skirt 23 is spun under the bead 29.

The engagement of the flange 27 in the groove 19 constitutes a temporary connection between the cap 1 and skirt 23 that prevents axial separation of the two when the closure is handled prior to and during threading onto the bottle neck 9 and also when the skirt end 31 is spun under the bottle bead 29. However, when closure 1 is initially removed from the bottle neck by unscrewing the cap, as shown in FIGURE 2, the axial movement of the skirt 23 with the cap 2 is arrested by the engagement of the skirt end 31 with the bottle bead 29 and the axial movement of the cap 2 resulting from unscrewing same pulls the latter away from the skirt 23, causing the skirt 23 to drop downwardly until the shoulder 27 abuts the bead 29.

As cap 2 is pulled away from the skirt 23, the flange 21 and adjacent portions of the skirt yield so as to contract radially and allow the flange 21 to withdraw from the groove 19. When the flange 21 passes downwardly beyond the rim 17 it will expand slightly so that its maximum diameter will be greater than the minimum diameter of the sidewall at the rim 17. This effectively prevents reassembly of the cap and skirt as by reinsertion of the flange 21 into the groove 19.

If it is observed that the skirt 23 is resting on the bead 29 it will indicate that the bottle has been opened. However, to enhance the temper-indicating effect of the skirt 23, the upper surface of the shoulder 27 may be marked with a distinctive indicia, such as by painting with a bright color. The upper surface of the shoulder 27 is concealed by the cap rim 17 so long as the cap and skirt are assembled, that is, before the closure has been initially removed from the bottle neck. But when the closure is removed and the skirt 23 drops downwardly onto the bead 29, the temper-indicating indicia will be exposed to view and indicate that the closure has been previously removed from the bottle.

After once removing the closure, the skirt 23 may be cut to remove it from the bead 29 or may be left thereon. The height of the flange 21 and wall 25 and the position of the bottle bead 29 relative to the thread on the bottle neck 9 and the length of the cap sidewall 5 may be dimensionally such that when the cap is replaced on the bottle neck 9, as shown in broken lines, FIGURE 2, the rim 17 will lie above the flange 21 so that the cap may be removed and replaced without objectionable interference from the skirt. Alternatively, and especially when the skirt is of thin gauge aluminum or similar malleable material, the foregoing dimensions may be such as to cause interference between the cap rim 17 and flange 21 so that when the cap is again threaded onto the bottle the rim 17 will crush the wall 25 and additionally increase the outer diameter of the flange 21, thereby further to inhibit reassembly of the cap and skirt.

FIGURES 3, 4 and 5 show a method of making the closure of FIGURES 1 and 2. A die 33 has a cavity 35 that is sized for snugly receiving and supporting the previously molded plastic cap 2. An annular skirt blank 37 is placed against the cap 2 so that the shoulder 27 (which may have been previously painted with temper-indicating indicia) abuts the rim 17 and with the wall 25 telescoped within the cap and terminating adjacent to the cap groove 19. A clamping ring 39 has an axial shoulder 41 that bears against the wall 25 and a radial shoulder 43 that seats against the blank shoulder 27. Telescoped within the clamping ring 39 is an expansible collet 45 that is formed with a plurality of circumferentially spaced, longitudinally extending sections 47. A collet of this general type is disclosed in my copending application Serial No. 106,790, filed May 1, 1961, and to which reference may be had. Suffice it to say, however, that the sections 47 may be resiliently movable radially and are normally in the contracted positions as shown in FIGS. 3 and 4. The sections 47 may extend from a

suitable common base (not shown). An axially shiftable center pin 49 is located within the collet.

The ends of each collet section 47 has an external radial flange 48 and an internal taper 51 so that when the center pin 49 is moved axially from position shown in FIGURES 3 and 4 to that shown in FIGURE 5, the sections 47 will expand radially and the flanges 48 will flare the end of the wall 25 radially outwardly into the groove 19 and form the flange 21. Upon retraction of the center pin 49 to a position shown in FIGURES 3 and 4 the spring action of the sections 47 will cause them to return to their normal or contracted positions so that the clamping ring 39 and collet 45 may be withdrawn from the closure. The closure may then be removed from the die cavity 35 for subsequent threading onto the bottle in the manner previously described.

FIGURE 6 shows a modified form of skirt 53 blank which is similar to the skirt blank 37. In the skirt blank 53, there are a plurality of circumferentially spaced tabs 55 in lieu of the continuous annular wall 25. These tabs 55 are then bent radially outwardly in accordance with the method and apparatus of FIGURES 3 and 5, to form a skirt with spaced flanges that fit into the cap groove 19.

FIGURE 7 shows a modified form of skirt and skirt blank 57 that is similar to the blank 53 except that the blank 57 has a single tab which is deformed radially outwardly to provide a relatively long arcuate flange 59 in the cap groove 19. When the closure of FIGURE 8 is initially unscrewed from the container neck, the flange 59 will withdraw from the groove 19.

FIGURE 8 shows a further modified form of the present invention which is similar to FIGS. 1 and 2 except that only a portion of the annular wall 25 is flared outwardly into the cap groove 19 to form the flange 59'. This portion may have an arcuate extent of the order of about sixty degrees. The flange 59' may be formed by providing flanges 48 on only a few adjacent collet sections 47 so that when the collet is expanded the flanges 48 will flare out only a fractional part of the wall 25.

In addition to the engagement of the flange 59' in the groove 19, the small amount of friction between the wall 25 and the part of the cap just below the groove assists in retaining the skirt temporarily onto the cap.

Due to the fact that there is a loose fit of the bottle and cap threads, there is a substantial amount of free play between the cap and bottle neck when the cap is unthreaded from the neck 9 to a point where the disk 15 clears the rim of the bottle neck. This free play permits the cap to be eccentrically cocked with respect to the axis of the bottle neck while cap is being unthreaded from the neck. This cocking, which is generally effected in the normal manipulation of the cap during unscrewing is, sufficient to allow the skirt first to drop downwardly in the regions thereof diametrically opposite to the flange 59 or 59', as the case may be, whereupon the flange 59 or 59' will, upon further unscrewing, slip out of the cap groove 19, all with little torque-producing effort on the part of the person removing the closure. With regard to the closure of FIGURE 8, the friction between the wall 25 and cap is readily overcome upon commencement of unscrewing the cap. The flange 59 or 59' may distort somewhat as it withdraws from the groove 19. Furthermore, the flange may be of such height that subsequent replacement of the cap will crush the flange, increasing its diameter further, and then making it all the more difficult to reassemble the skirt with the cap.

FIGURES 9-15 show a further modified form of the present invention in which the skirt is attached to the cap as the latter is being molded. The mold assembly comprises a mold member 61 having a mold cavity 63 that is adapted to receive a suitable radially expansible and retractable collet 65 of the type used for molding internally threaded plastic caps. This collet may be of the type shown in the copending application of my self and others,

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Serial No. 198,107, filed May 28, 1962, and to which reference may be had. A collet of that type is divided into a plurality of longitudinal sections, there being two groups of sections 67, 69, the sections of one group alternating with the sections of the other group. The outer surfaces of the sections 67, 69 are contoured to form a continuous annular rib 70 and a continuous helical thread 71 when the sections are held in their expanded or thread-forming position by an axially shiftable center pin 73. Furthermore, in the thread-forming position the adjacent collet sections are snugly abutting so as to prevent leakage of plastic therethrough. The sections 67, 69 are attached to a common base (not shown) and are resiliently expanded and thus tend to collapse by flexing radially inwardly when the center pin 73 is removed from supporting relationship with the sections. Furthermore, the longitudinal sides 75, 77 of the sections 67 converge outwardly of the sections 67 while the longitudinal sides 79, 81 of the sections 69 converge inwardly of the sections 69. Therefore, when the center pin 73 is retracted from the sections 67, 69, the sections 67 will radially contract and provide clearance to enable the sections 69 also to contract radially but an amount less than that of the sections 67. The contracted positions of the sections 67, 69 are shown in FIGURE 14. The sections 67, 69 have axially presented shoulders 83 and one or more of the sections has an axially extending radially outwardly opening slot 85 that extends across the shoulder 83, all for purposes presently more fully appearing.

An annular metal skirt 87 has a radial shoulder 89, an annular conical wall 91, that terminates in radially inwardly projecting flange 93, the latter being against the collet-section shoulders 83. A shut off ring 95, surrounding the collet 65 is telescoped within the skirt 87 and has surfaces corresponding to the shoulder 89, wall 91 and flange 93 to clamp and support the skirt in proper position in the mold cavity 63. Formed in the end of the shut off ring 95 is an annular recess 97 that is in communication with the slots 85.

With the collet 65 in its expanded position plastic is injected into the mold cavity 63 in a conventional manner. The plastic will flow over the collet 65 and form the cap with a thread 7 and groove 13 which will be counterparts of the rib 70 and thread 71 of the collet. The plastic also will cover the flange 93, wall 91 and the portion of the shoulder 89 that is within the mold cavity. Moreover, the plastic will flow through the slots 85 and around the flange 93 to fill the recess 97, thereby no form on the cap a radially outwardly opening, circumferentially spaced grooves 99 (FIG. 12) that are defined by the ledge of plastic 100 that is below the flange 93 and the circumferentially spaced sections of plastic 102 that are the counterparts of the groove 85 and which are above the flange 93, thereby to retain the end of the flange 93 on the cap.

The collet 65 is thereafter radially collapsed an amount sufficient to clear the counterpart molded surfaces of the cap 2 whereupon the collet and other mold parts may be separated from the molded cap with its attached skirt 87. After the sealing disc 15 has been inserted in its groove 13, the closure may be placed over the bottle neck 9, as shown in FIGURE 14, and the end 31 turned under the bottle bead 29.

The retention of the flange 93 between the ledge 100 and plastic sections 102 constitute a temporary connection between the skirt 87 and cap 2 so that when the cap is radially spaced grooves 99 (FIG. 12) that are defined by the adjacent parts of the skirt will radially expand as the flange 93 withdraws from between the ledge and sections 102 and passes over the ledge 100. When the cap and skirt 37 are completely separated the flange 93 contracts toward its original position so that its maximum internal diameter is less than the minimum external diameter of the ledge 100. This prevent reassembly of the cap and skirt 87.

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After separation from the cap, the skirt 87 will drop downwardly until the shoulder 89 rests on the bottle bead 29, thereby indicating that the closure has been previously unscrewed from the bottle neck. The shoulder 89 may, of course, be painted with a suitable indicia that becomes exposed when the skirt drops downwardly onto the bottle bead 31.

FIGURES 16-18 show a further modified form of the present invention in which the plastic cap is molded with a downwardly opening V-shaped groove 101 at the rim 17. The radially inner wall of the groove 101 is formed by a thin depending lip 103 that terminates slightly above the extreme lower edge of the cap.

An annular metal skirt 105 is blanked out with a radial shoulder 107, which may have a tamper-indicating indicia thereon, and at the radially inner edge of the shoulder 107 terminates in a flange 109 that is arcuately sized and shaped to conform approximately to the groove wall 111.

When the cap 2 and skirt 105 are placed together as shown in FIGURE 16, a heated forming tool 113 is brought to bear against the lip 103 to heat same sufficient to soften it and force it radially outwardly against the flange 109 so as to clinch the flange in the groove 101. The closure may then be threaded onto the bottle neck and the skirt end 31 spun under the bead 29.

The initial removal of the closure from the bottle neck will cause the flange 109 to pull out of the groove 101 whereupon the skirt 105 will drop downwardly onto the bottle bead 29, and indicate that the closure has been removed. The lip 103 will be deformed or ruptured as the flange 109 is separated from the groove 101 so as to prevent reassembly of the cap 2 and skirt 105.

In compliance with the requirements of the patent statutes I have herein shown and described a preferred embodiment of the present invention. It is, however, to be understood that the invention is not limited to the precise construction and process shown, the same being merely illustrative of the principles of the invention. What is considered new and sought to be secured by Letters Patent is:

1. A tamper-indicating closure comprising a cap having a threaded annular sidewall for threading over the neck of a container, an annular skirt projecting below the bottom of the sidewall, flange means at the upper end of the skirt, a shoulder on the skirt below the flange means and having indicia thereon that is concealed by the sidewall, said flange means fitting into groove means on the sidewall in a manner to constitute a separable connection between the cap and skirt that inhibits reconnection of them once they have been disconnected, the flange means withdrawing from the groove means to separate axially the cap from the skirt and expose the indicia to view when the cap is unscrewed from the container with the skirt being retained against axial movement on the container.

2. In combination with a container having a threaded neck constituting a pour-out opening, said container having an annular bead below the threaded portion of the neck, a tamper-indicating closure for the opening, said closure comprising a cap having a threaded sidewall surrounding the neck and with the thread of the sidewall in engagement with the thread of the neck, a skirt at the lower end of the sidewall and projecting downwardly therefrom, means forming a temporary connection between the skirt and sidewall that prevents axial retraction of one from the other until the cap is unscrewed from the neck, said means constituting flange means at the upper end of the skirt fitting into groove means at the lower end of the sidewall, a portion of the skirt between the cap and bead forming a radial shoulder that is spaced from the bead and a portion of the skirt being turned inwardly to underlie said bead so that upon unscrewing the cap from said neck, the skirt is retained against axial movement with the cap by the bead and the axial movement of the cap causes the flanges means to

withdraw from the groove means to separate the cap and skirt at said connection whereupon the skirt will drop downwardly until the shoulder abuts the bead.

3. The combination according to claim 2 in which the groove means is on the inside of said sidewall and the flange means contracts an amount sufficient to clear the part of the cap between the groove means and the adjacent end of the sidewall.

4. The combination according to claim 2 in which the flange means extends partially around the upper end of the skirt.

5. The combination according to claim 4 in which part of the skirt axially between the flange means and shoulder frictionally engages the sidewall.

6. The combination according to claim 2 in which the groove means is on the outside of the sidewall and the flange means outwardly expands an amount sufficient to clear the part of the cap between the groove means and the adjacent end of the sidewall.

7. The combination according to claim 2 in which the groove means is shaped by pressing part of the cap against the flange means after the same has been inserted therein.

8. A tamper-indicating closure comprising a cap having a threaded annular sidewall for threading over the threaded neck of a container, an annular skirt projecting below the bottom of the sidewall, flange means on the skirt fitting into groove means on the sidewall in a manner to constitute a temporary connection between the cap and skirt that prevents axial retraction of one member from the other until the cap is unscrewed from the container neck, the flange means withdrawing from the groove means to separate the cap from the skirt as the cap is unscrewed from the container neck with the skirt being retained against axial movement on the container, the flange means projecting radially outwardly at the upper end of the skirt and the groove means being on the inside of the sidewall below the thread thereof and opening radially inwardly, the flange means, upon withdrawal from the groove means, radially contracting an amount sufficient to clear the minimum internal diameter of the skirt between the groove means and the bottom of the skirt and then radially expanding an amount greater than said minimum diameter to inhibit reassembly of the separated cap and skirt.

9. A tamper-indicating closure comprising a cap having a threaded annular sidewall for threading over the threaded neck of a container, an annular skirt projecting below the bottom of the sidewall, flange means on the skirt fitting into groove means on the sidewall in a manner to constitute a temporary connection between the cap and skirt that prevents axial retraction of one member from the other until the cap is unscrewed from the container neck, the flange means withdrawing from the groove means to separate the cap from the skirt as the cap is unscrewed from the container neck with the skirt being retained against axial movement on the container, the flange and groove means thereafter being such as to inhibit reconnection of the skirt and cap thereat, the flange

means being a single radially outwardly projecting element on the upper end of the skirt and the groove means being on the inside of the side wall below the thread and opening radially inwardly, the element being of such size as to withdraw from the groove upon radially cocking the cap while unscrewing same from the container neck.

10. A tamper-indicating closure comprising a cap having a threaded annular sidewall for threading over the threaded neck of a container, an annular skirt projecting below the bottom of the sidewall, flange means on the skirt fitting into groove means on the sidewall in a manner to constitute a temporary connection between the cap and skirt that prevents axial retraction of one member from the other until the cap is unscrewed from the container neck, the flange means withdrawing from the groove means to separate the cap from the skirt as the cap is unscrewed from the container neck with the skirt being retained against axial movement on the container, the flange means projecting radially inwardly at the upper end of the skirt, and the groove means being on the outside of the skirt, the flange means, upon withdrawal from the groove means, radially expanding an amount sufficient to clear the maximum external diameter of the skirt between the groove means and the bottom of the skirt and then radially contracting an amount less than said maximum diameter to inhibit reassembly of the separated cap and skirt.

11. A tamper-indicating closure comprising a cap having a threaded annular sidewall for threading over the threaded neck of a container, an annular skirt projecting below the bottom of the sidewall, flange means on the skirt fitting into groove means on the sidewall in a manner to constitute a temporary connection between the cap and skirt that prevents axial retraction of one member from the other until the cap is unscrewed from the container neck, the flange means withdrawing from the groove means to separate the cap from the skirt as the cap is unscrewed from the container neck with the skirt being retained against axial movement on the container, the flange and groove means thereafter being such as to inhibit reconnection of the skirt and cap thereat, the groove means opening downwardly from the lower end of the sidewall, the flange means projecting upwardly at the upper end of the skirt, and the groove means being shaped by hot pressing a part of the sidewall against the flange means after the same has been inserted into the groove means.

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