March 14, 1961 J. RAVN 2,974,455

APPLYING CAPS TO BOTTLES

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FIG. 1.

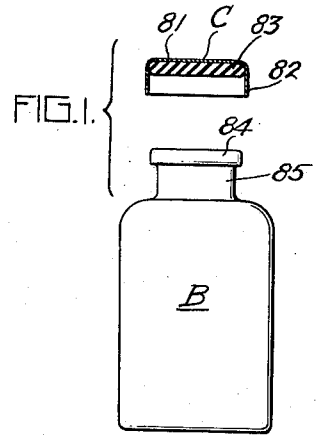


FIG. 2.

FIG. 3.

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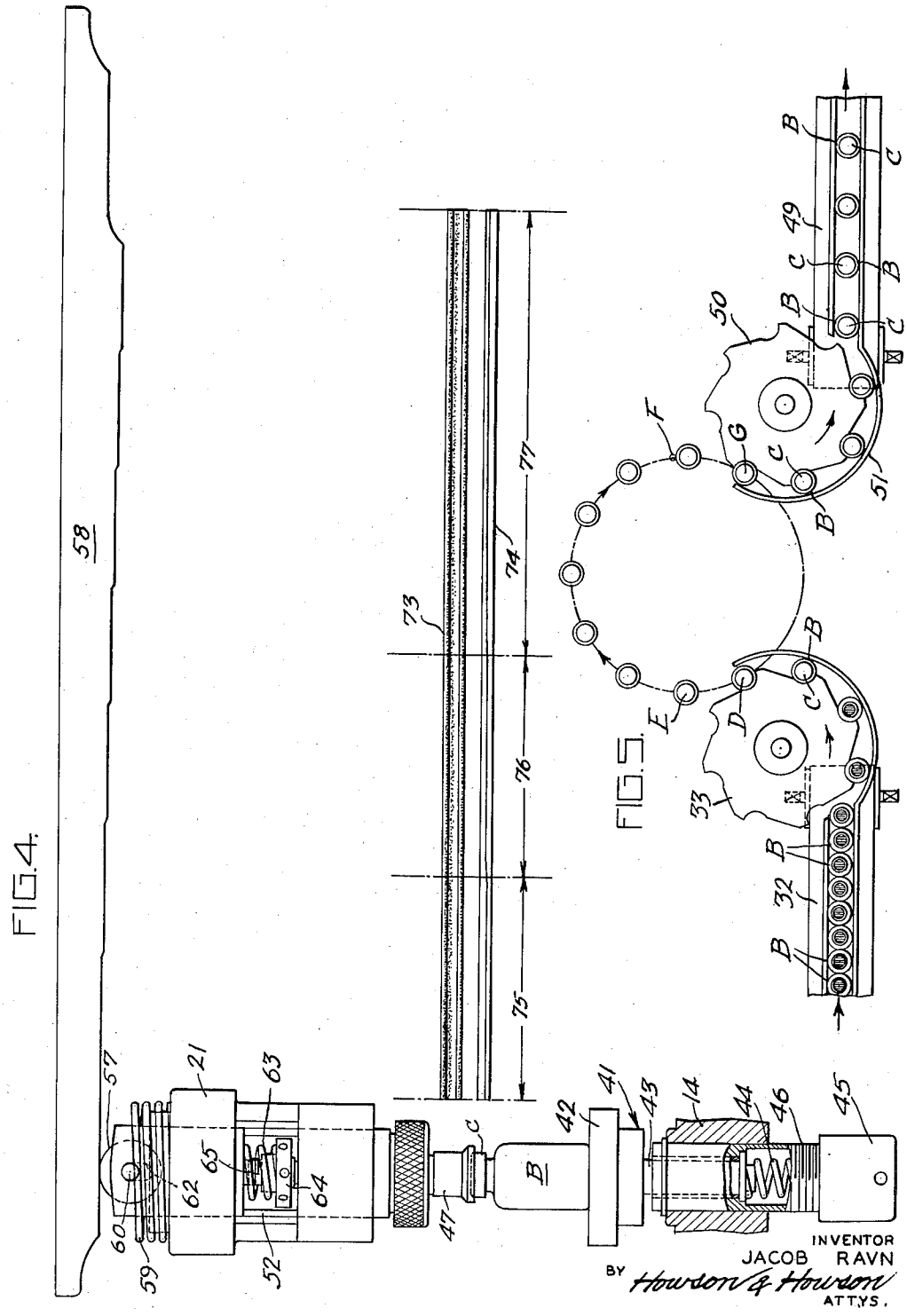
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FIG. 10.

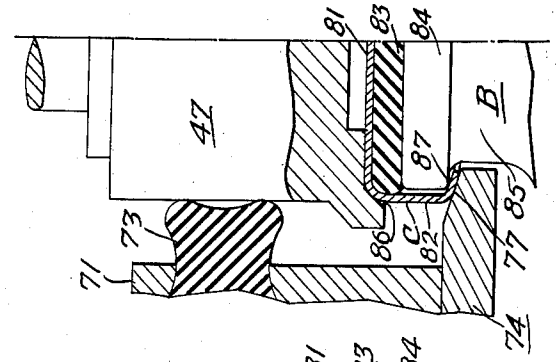


FIG. 9.

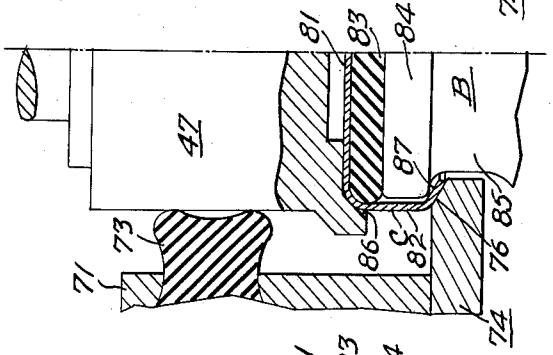


FIG. 8.

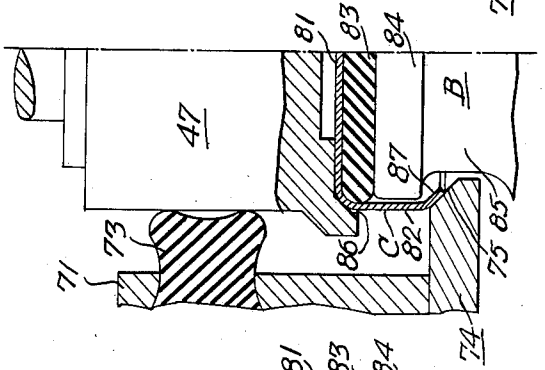


FIG. 7.

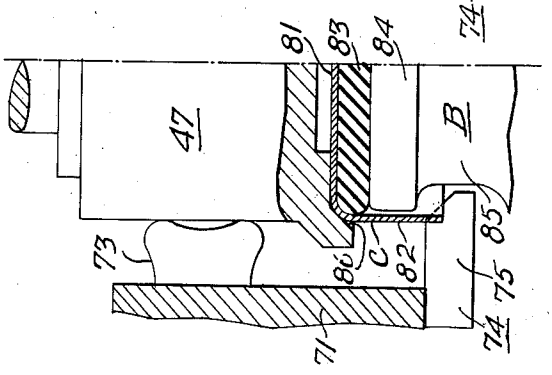
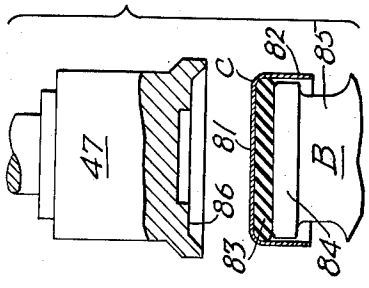


FIG. 6.



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APPLYING CAPS TO BOTTLES

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10 Claims. (Cl. 53—42)

This invention relates to apparatus for applying caps to bottles and has particular application to a device for sealing the side walls of a generally flat cylindrical cap under the finish of a bottle.

Prior to the present invention, the conventional apparatus for applying caps consisted of an element which crimped or deflected the lower portion of the cap under the finish of the bottle by lateral inward movement of the element relative to the bottle.

The present invention provides apparatus for sealing caps which displaces the cap downwardly relative to a fixed sealing rail which, in turn, deflects the side wall of the cap under the finish of the bottle. In the final stage of the sealing operation the cap and bottle are displaced axially to firmly compress the sealing element within the cap and to engage the lower portion of the side walls of the cap firmly under the finish of the bottle.

The invention provides an apparatus of relatively simple construction which is fully effective in operation and use.

All of the objects of the invention and the various features and details of the construction and operation thereof are more fully set forth hereinafter with reference to the accompanying drawings, wherein:

Fig. 1 is a view of a bottle and cap prior to assembly of the cap to the bottle;

Fig. 2 is a fragmentary sectional view of the apparatus adjacent the feed end thereof;

Fig. 3 is an enlarged fragmentary sectional view of the sealing means of the apparatus at an intermediate position with the bottle and cap removed;

Fig. 4 is a development of the operating elements of the apparatus;

Fig. 5 is a diagrammatic plan view showing the travel of the bottle through the apparatus; and

Figs. 6 to 10, inclusive, are detached fragmentary sectional views showing operating elements of the apparatus relative to the cap and bottle at successive positions in the apparatus.

Referring now to the drawings, and more particularly to Fig. 2, the apparatus comprises a framework 11 having an upstanding central post 12 adjustable vertically therein to accommodate bottles of varying height. A lower turntable 14 is rotatably mounted on the framework 11, for example, by a bearing 13, and is provided with an integrally-formed gear element 15 which meshes with a driving pinion (not shown). An upper turntable 21 is rotatably mounted on the post 12 for vertical adjustment with the post. The upper turntable 21 has splines 22 which slidably engage a connector 23 secured to the lower turntable, so that rotation of the lower turntable 14 effects corresponding rotation of the upper turntable 21 about the bottle-height adjusting post 12. A housing 24 is mounted on the post 12 and encloses the upper turntable 21 which is rotatable within the housing.

Adjacent the feed end of the machine the frame 11 mounts a feed table 31 which receives bottles B from the in-feed conveyor 32, the bottles B being transferred from

the in-feed conveyor 32 to the lower turntable 14 across the feed table 31 by means of a star wheel 33. Suitable guide rails 34 (see Fig. 5) direct the bottles B in their travel, and as the bottles approach the lower turntable 14, a cap C is applied, as indicated in Fig. 5. The lower turntable 14 is provided with a plurality of bottle rests 41 which are freely rotatable and are resiliently supported for downward displacement from their upper limit position coplanar with the feed table 31. In the present instance, there are twelve bottle rests spaced equally circumferentially of the lower turntable 14 and the rotation of the turntable 14 is timed relative to the rotation of the star wheel 33 to cause the star wheel to deposit one bottle centrally on each bottle rest 41 of the lower turntable 14.

Each bottle rest 41 comprises a circular flanged plate 42 rotatably mounted on a supporting shaft 43 which is vertically slidable in a tubular element 46 on the lower turntable 14. A supporting spring 44 bears against a collar mounted on the lower end of the shaft 43 and biases the shaft to its upper limit position shown in Fig. 2. At its lower end the spring 44 is seated in an adjusting nut 45 threadably engaged with the tubular element 46 of the turntable 14. Thus by adjusting the nut 45, the upward bias on the bottle rest 41 is regulated.

With reference to Fig. 5, the star wheel 33 deposits the bottle on the bottle rest 41 when it is at the position D. Rotation of the turntable 14 thereafter carries the bottle to the starting position E as a cylindrical pressure block 47 is displaced downwardly ino engagement with the cap to firmly retain the bottle between the pressure block 47 and the supporting plate 42 of the bottle rest 41. At the position E, the pressure block 47 and the cap C come into engagement with a sealing rail assembly 48 mounted in registry therewith about the periphery of the housing 24, in the present instance for a distance of a half-revolution of the turntable. During its travel in engagement with the assembly 48, for example to the position F, as described more fully hereinafter, the cap is sealed securely to the bottle and further rotation of the turntable 14 carries the bottle to the position G wherein the pressure block is released from the cap and the bottle is free to be displaced onto the outfeed conveyor 49 by a star wheel 50 and guides 51 which are similar to the star wheel 33 and guides 34.

During the travel of the bottle from the position D to the position G, the pressure block 47 is displaced downwardly stepwise to gradually depress the bottle rest 41 against the bias of its supporting spring 44. To this end, the pressure block 47, as shown in Fig. 2, is mounted for vertical displacement in the upper turntable 21 by means of a sleeve 52. The pressure block 47 has a stub shaft 53 which is releasably mounted in a socket 54 by a snap-fastening element 55. The snap-fastener permits ready replacement of the pressure block 47 when the character of the caps is changed, as more fully described hereinafter. The socket is mounted for free rotation in the lower end of the sleeve 52.

The upper end of the sleeve 52 slidably supports a journal block 56 which carries a roller 57 mounted for rotation on an axle 60. The roller serves as a cam follower following a cam element 58, in the form of a track secured to the housing 24. The roller 57 is biased against the cam track 58 by means of a follower spring 59 compressed between the axle 60 and the upper turntable 21. The axle 60 projects through slotted openings 62 in the sleeve 52 and serves to limit the axial displacement of the journal block 56 in the sleeve. A stiff compensating spring 63 normally biases the journal block 56 upwardly to its upper limit position determined by engagement of the axle 60 with the upper end of the slots 62. The spring 63 is seated at one end against the jour-

nal block 56 and at the other end against an adjusting nut 64 threadably engaged with an adjusting shaft 65 projecting upwardly from the lower portion of the sleeve 52. The sleeve 52 is cut-away adjacent the adjusting nut to provide for adjustment thereof. As pointed out more fully hereinafter, the spring 63 is stronger than the bottle-rest-supporting spring 44 so that downward displacement of the roller 57 normally effects downward displacement of the pressure block a corresponding distance without further compression of the spring 63.

Thus, the pressure block 47 is mounted for free rotary movement relative to the turntable 21 and is displaced downwardly stepwise as it travels from the position D toward the position F. A development of the cam track 58 is shown in Fig. 4 which clearly illustrates the travel of the roller 57.

In accordance with the invention, the sealing rail assembly 48 effects rotation of the bottle and pressure block, and deflects the side wall of the cap C under the finish of the bottle to provide a sealing flange. To this end, the sealing rail assembly 48 comprises a mounting ring 71 secured to the housing 24 by suitable fasteners 72. The mounting ring, as shown in Fig. 3, mounts a friction element 73 which bears against the cylindrical surface of the pressure block 47 and rotates the same. Rotation of the pressure block 47 effects rotation of the bottle B and cap C.

Below the friction element 73, the mounting ring 71 mounts a sealing rail 74 which projects into engagement with the wall of the cap C below the finish of the bottle B. The sealing rail 74 is formed in three sections 75, 76 and 77 having a beveled upper surface disposed at respectively greater angles to the vertical. Preferably the section 75 continues for 45° of rotation of the turntable, the section 76 extends for the next 45°, and the section 77 extends for the remaining 90° (see Fig. 4). When sealing caps of different diameters, the lengths of the sections 75, 76 and 77 may be varied in accordance with the circumferential length of the caps. The cap-engaging periphery of the sealing ring 74 is of uniform radius and is concentric with the turning axis of the turntable, so that the sealing ring is not displaced laterally relative to the bottle and cap. The formation of the flange at the lower portion of the side wall of the cap is effected by the clinching effect accomplished by the downward displacement of the cap under the action of the downward displacement of the pressure block 47, the increasing angle in the successive sections of the sealing ring effecting a firm clinching of the flange under the finish of the bottle.

The operation of the composite sealing rail 74 is more clearly illustrated in Figs. 6 to 10, inclusive. As shown in these figures, the cap C comprises a top 81 having a depending cylindrical side wall 82 enclosing a sealing disc 83 which rests against the upper surface of the finish 84 at the top of the neck 85 of the bottle B.

Fig. 6 shows the position of the pressure block 47 and bottle B and cap C at the position D in the travel of the bottle through the capping unit. In this position, the pressure block 47 is elevated above the cap C with sufficient clearance to enable the cap C and bottle B to find their proper position centrally of the bottle rest 41.

As the bottle moves from position D to position E, the pressure block 47 is displaced downwardly by the cam track 58 to firmly engage the top 81 of the cap and press the sealing disc 83 firmly against the finish 84 of the bottle, as shown in Fig. 7. The beveled recess 86 in the lower surface of the pressure block 47 insures centering of the cap and bottle on the bottle rest 41.

As the bottle and pressure block 47 move into position E, the sealing rail assembly engages the pressure block 47 and the lower terminal portion of the side wall 82 to displace the latter inwardly and form a flange 87 (see Fig. 8). As the turntables 14 and 21 cause the elements to orbit about the axis of the machine, the friction element 73 effects rotation of the pressure block 47 causing the pressure block and the cap to rotate against the first section 75 of the sealing rail. As the cap rotates, the cam track 58 displaces the pressure block 47 downwardly effecting a bending of the flange 87 under the finish 84 of the bottle. At the end of the sealing rail section 75, the bottle and cap have a position relative to the sealing rail as indicated in Fig. 8, it being noted that there is vertical clearance between the top of the sealing rail and the lower surface of the finish 84.

As the elements continue their orbit, the flange 87 passes into engagement with the beveled surface of the rail section 76 which has a greater angle relative to the vertical and effects a sharper bending of the flange. The orbiting of the cap and pressure block 47 about the axis of the machine rotates the bottle and pressure block about their common axis and effects a uniform bending of the flange 87 about its entire periphery. At the end of the rail section 76, as shown in Fig. 9, the cam track 58 has displaced the bottle by means of the pressure block 47 so that its finish 84 is slightly above the top of the rail section 76.

The assembly then passes into engagement with the rail section 77 which effects the final clinching of the flange 87. During the travel along the section 77, the downward displacement of the pressure block 47 reaches a point where the clearance between the beveled upper surface of the rail section 77 and the lower edge of the finish 84 is equal to the thickness of the flange 87. At this point, the pressure of the sealing rail section 77 against the finish 84 combines with the bias of the supporting spring 44 to overcome the bias of the compensating spring 63 and to thereby interrupt downward displacement of the pressure block 47. From this point until the bottle reaches the position F, the bottle is not further displaced downwardly, and the clinching of the flange 87 under the finish 84 is completed, as shown in Fig. 10. Just prior to entering the station F, the pressure block 47 is elevated by the cam track 58 to permit the plate 42 of the bottle rest 41 to attain its initial upper limit position. At the point F, the sealing rail assembly terminates and further travel of the turntable carries the bottles into engagement with the star wheel 50 which displaces it onto the outfeed conveyor 49.

In accordance with the invention, the diameter of the cylindrical portion of the pressure block 47 which engages the friction element 73 is substantially equal to the outside diameter of the side wall 82 of the cap. This equality in diameter insures against sliding movement of the cap on the sealing rail, and that the engagement of the cap on the sealing rail is a rolling movement. In this manner the friction between the cap and the sealing rail is minimized and possible damage to the fragile material comprising the cap is obviated.

The invention affords ready adjustment of the mechanism to accommodate different caps and bottles. When the cap diameter is changed, a different pressure block having a corresponding diameter is employed and the sealing rail assembly in its entirety is replaced to accommodate the different cap and pressure block. A change in the depth of the finish 84 below the top 81 of the cap is accommodated by changing the assembly 48 to one having the proper spacing between the elements 73 and 74. Changes in bottle height are compensated for by adjusting the upper turntable 21 on the post 12. Minor variations in the height of the finish are compensated for by the compensating spring 63 since the height of the finish determines the point at which the compensating spring 63 comes into play to arrest downward movement of the pressure block 47.

While a particular embodiment of the present invention has been herein illustrated and described, it is not intended to limit the invention to such disclosure, and changes and modifications may be made therein and thereto within the scope of the following claims.

I claim:

1. Apparatus for sealing a cap having a cylindrical wall to a bottle having an outwardly projecting finish, said apparatus comprising turntable means and means to rotate said turntable means about a central vertical axis, a bottle rest mounted on said turntable for free rotation about a second vertical axis on said bottle rest, whereby said bottle rest orbits around the turntable axis and is rotatable about its own axis, said bottle rest adapted to receive a bottle and cap disposed centrally on said bottle rest, a cylindrical pressure block mounted on said turntable means in vertical registry with said bottle rest for free rotation about said second vertical axis and for vertical displacement axially thereof, whereby said pressure block orbits and is rotatable with said bottle rest, a sealing rail having an arcuate surface concentric with said axis of rotation of said turntable and mounted to engage the cylindrical wall of said bottle cap, said wall-engaging surface projecting into underlying relation with the finish of the bottle, a friction ring having an arcuate surface concentric with said sealing rail and mounted for engagement with the cylindrical surface of said pressure block whereby, upon orbiting of said pressure block and bottle rest about the turntable axis, said friction ring engages said pressure block and effects rotation thereof and of said bottle and cap and bottle rest, and means to displace said pressure block downwardly progressively as it orbits with said turntable to thereby displace said cap and bottle downwardly to cause the sealing rail to clinch the sidewall of the cap under the finish of the bottle.

2. Apparatus according to claim 1 wherein said sealing rail is beveled adjacent the upper edge of said wall-engaging surface, the bevel increasing in angularity relative to the vertical progressively in the orbit of said cap to thereby progressively clinch said side wall under the bottle finish.

3. Apparatus according to claim 2 wherein said means to displace said pressure block comprises yieldable means which interrupts downward displacement upon clamping of said side wall between said finish and the beveled edge of said sealing rail.

4. A bottle-supporting assembly for capping apparatus comprising a support table adapted to support the bottle and cap thereon and mounted for vertical movement, a supporting spring biasing said table upwardly, a pressure block in vertical registry with said table, adapted to engage the cap on top of the bottle, means for mounting said pressure block for vertical movement coaxial with said supporting table, a journal block mounted for vertical movement relative to said pressure block, a compensating spring of greater strength than said supporting spring biasing said journal block upwardly relative to said pressure block, a cam roller mounted in said journal block for movement therewith, and cam means engaging said roller to displace the same vertically upon relative movement between said roller and said cam means, the downward displacement of said roller effecting clamping movements of said pressure block against said bottle, further displacement of said roller effecting compression of said supporting spring to displace said bottle support downwardly, said compensating spring being actuated only upon application of a force having a vertical component additional to the force of said supporting spring.

5. Apparatus according to claim 4 wherein said pressure-block and said bottle-support mounting means respectively afford free rotation of the same about their common vertical axis.

6. Apparatus according to claim 4 wherein said bottle-support and pressure-block mounting means includes turntable means mounted for rotation about a vertical axis spaced from the common axis of said pressure block and said bottle rest.

7. Apparatus according to claim 6 wherein said turntable means comprises an upper turntable mounting said pressure block and a lower turntable mounting said bottle support, said upper and lower turntables being mounted for vertical adjustment relative to one another to accommodate bottles of different sizes, said cam means being mounted for vertical adjustment with said upper turntable.

8. The method of applying cylindrical caps to bottles having an outstanding finish about the upper portion of its neck, comprising the steps of positioning a cap on the bottle with its cylindrical wall surrounding and depending below said finish, rolling said cap and bottle along a sealing rail projecting under said finish to form a flange underlying said finish, and progressively depressing said cap and bottle relative to said sealing rail to diminish the clearance between the upper surface of said sealing rail and the under-surface of said finish to a point where said clearance is equal to the thickness of the flange formed by said sealing rail, whereby said flange clinches said cap under the finish of the bottle.

9. A method according to claim 8 wherein the engagement of said cap with said sealing rail at the outer perimeter of the cap is a true rolling engagement, without sliding.

10. A method according to claim 8 including the step of applying a yielding pressure on said cap and bottle to effect said downward displacement thereof, said pressure yielding only upon clamping engagement of said flange between the lower surface of said finish and the upper surface of said sealing rail.

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