June 27, 1961 M. B. STULL 2,990,076

CLOSURE CAP AND CONTAINER NECK CONSTRUCTION

Filed April 11, 1958 2 Sheets-Sheet 1

Fig. 1

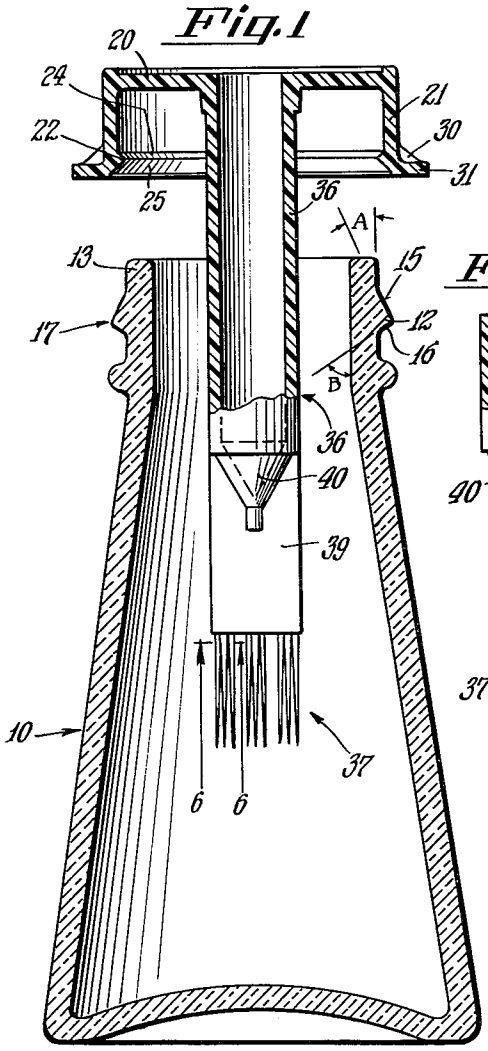


Fig. 3

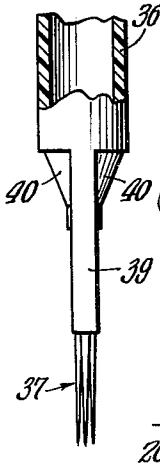


Fig. 4

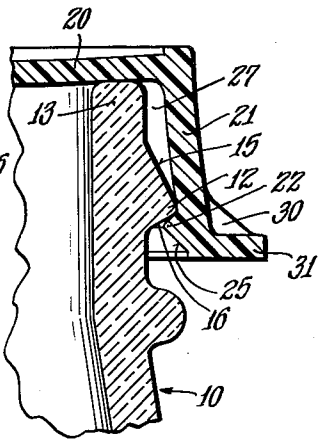


Fig. 5

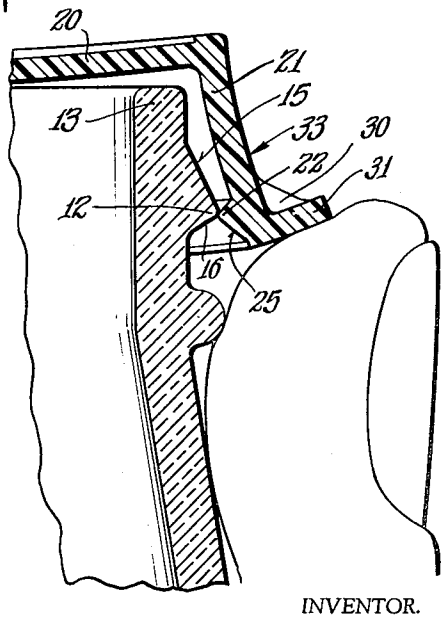
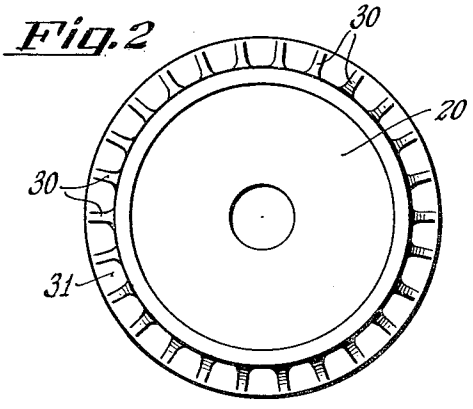


Fig. 2



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Fig. 6

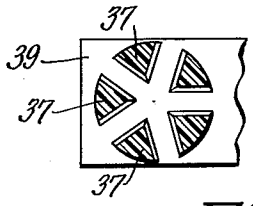


Fig. 7

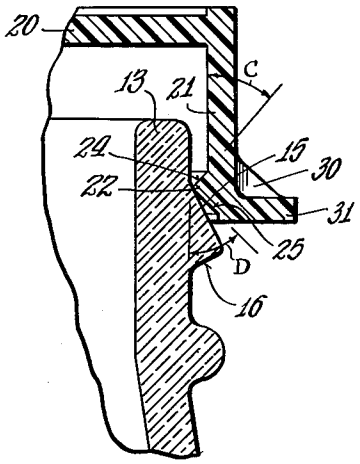


Fig. 8

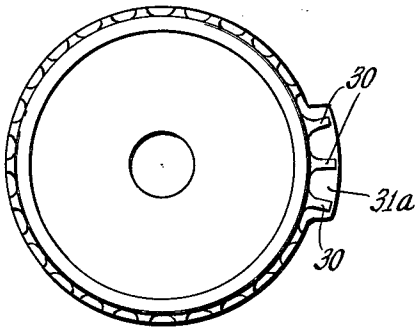


Fig. 9

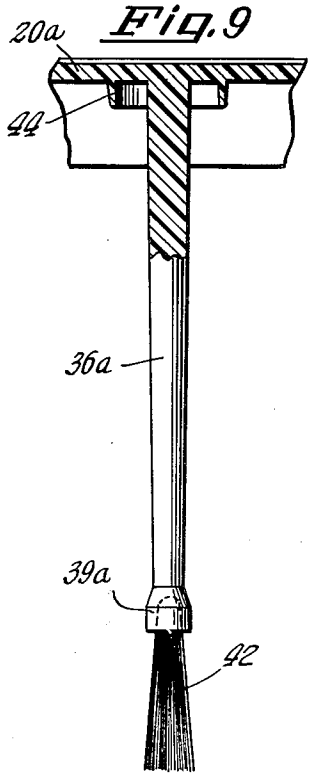
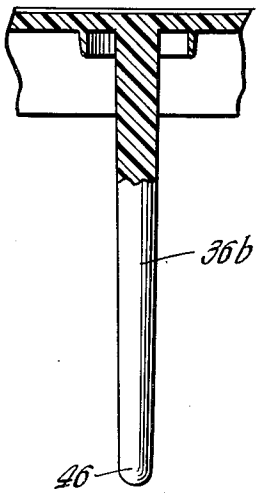


Fig. 10



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CLOSURE CAP AND CONTAINER NECK CONSTRUCTION

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1 Claim. (Cl. 215—31)

This invention relates to small cap and closure structures and to the cooperable neck portions of small containers such as glass bottles and the like on which the closure structures are used.

Over the past years screw caps in great volume have been produced for use with small bottles, vials or similar containers. Originally most of these screw caps were of metal, and in later years metal screw caps were largely replaced by those made of rigid plastic, as for example phenolic composition caps.

To obtain an effective seal it was customary to employ an inner liner in the form of a disc or washer, which rested on the lip of the bottle and formed therewith a tight joint. In cases where a dispensing type of cap was desired, in connection with mucilage, paste or other materials which required either brushing on or applying in small quantities a depending brush or rod applicator was attached to the inside of the cap, enabling the latter to act as a handle for the applicator as well as a closure for the container.

While the various types of closures above referred to operated satisfactorily, they represented a certain expense which had to be added to that of the container and the contents, which latter in the final analysis was essentially the only thing that the user wanted. The container and cap were, of course, necessary in order to provide a convenient form for packaging or handling the purchased substance, and in consequence it was always desirable to keep the cost of the container and cap at an absolute minimum.

Where metal caps were provided, or rigid plastic caps, these all involved a number of different components which had to be fabricated separately and thereafter assembled. While the sealing liner or washer component of itself was not expensive, the handling and assembling of the liner contributed to the cost factor, and the same was true where applicator rods, brushes or the like were to be incorporated in the cap. Often, especially where the caps were made of metal, the cap structures themselves were composite, consisting of an inner, thread-carrying shell and an outer covering member or jacket. The inventories and tolerance control of the various pieces and their fabrication and assembly, in conjunction with the necessary container, all represented an appreciable and undesirable cost which often constituted a relatively large fraction of the cost of the product or substance which the consumer basically desired. Such inventory, multiple components, assembly costs and the like thus constituted distinct drawbacks in these prior closures or caps, and had to be coped with whenever efforts were made to reduce prices and costs of the article of merchandise.

Another important factor which had to be considered was that of reliability of the seal or closure, and the convenience of replacing the same during subsequent use. In many instances closures were so tightly screwed on the containers that it was difficult for the consumer to initially remove them without special tools, and this resulted in inconvenience and dissatisfaction, and sometimes breakage of the containers, particularly where these were of the inexpensive glass variety, while in other cases it appeared as if the cap were completely screwed down and yet a tight seal was not effected. This may be readily understood when it is considered that the height of a screw-type cap when assembled to a container, in

varying only slightly can make the difference between a perfectly sealed container and a leaky one.

There is no way of checking for such an imperfectly sealing cap using a height gauge, as the bottle height may vary to a much greater extent than the height variation between a sealing and non-sealing cap. Thus one cannot set up an automatic control or check on the container filling line, to effect a rejection of insufficiently tightened caps and defectively sealed bottles.

Upon dispensing the contents of a container it was often the case that the screw threads at the neck of the container became contaminated with the material being dispensed, and if the substance were in the nature of an adhesive or glue it would cause a cementing of the screw cap when the container was again stoppered, making subsequent removal of the cap extremely difficult. Moreover, caps which employed screw threads always required a two-hand operation to remove them, which was sometimes inconvenient if one hand was occupied with another task.

Metal screw-threaded caps were often apt to corrode or rust, and when rigid plastic was substituted for the metal the required strength was not present to enable the cap to be readily removed at a later time under adverse conditions, without breakage or destruction of the cap.

The above disadvantages and drawbacks of these prior cap and closure structures are obviated by the present invention, and one object of the invention is to provide an improved and novel cap structure, either with or without an applicator device, said structure being characterized by a one piece or unitary molded construction and representing an absolute minimum of cost.

Another object of the invention is to provide a novel and improved cap construction as above set forth, which provides an extremely secure and effective seal for the container, preventing evaporation and other loss of contents or the like during shipment and/or storage.

A further object of the invention is to provide a unique and advantageous press-fit cap construction adapted to occupy only two different positions on a container neck, a pre-assembled non-sealing position and an assembled, completely sealing position, and in this connection a feature of the invention resides in the provision of an improved cap construction which makes possible the use of automatic quality control devices on the filling or capping line, to detect and reject incompletely sealed containers.

A still further object of the invention is to provide an improved cap construction as above characterized, which permits easy and quick subsequent removal of the cap from the container regardless of contamination by the container contents, which has in the past caused great difficulty in the removal of conventional screw caps.

Yet another object of the present invention is to provide an improved side-sealing cap constructon in conjunction with a unique container neck structure which effects a tight and reliable seal regardless of contamination of the neck by the container contents, by virtue of the cap construction automatically removing and/or displacing the seal-interfering deposits each time that the cap is replaced on the container.

An important feature of the invention resides in the provision of a novel, yieldable molded plastic cap construction which may be utilized with glass containers having parting lines rendering the neck portions thereof somewhat imperfect and unsymmetrical, said cap construction nevertheless effecting a secure and reliable seal in conjunction with such imperfect or non-uniform neck portions.

An additional object of the invention is to provide an improved press-fit sealing cap construction which con-

tinually acts to remove or displace any contaminating substance on the container neck each time that the cap is replaced on the container.

A still further object of the invention is to provide a novel and improved container neck construction for use with the plastic cap construction of the invention, to effect a reliable and leak-proof seal despite variations and non-uniformity in the container due to glass molding techniques used which produce parting lines and other imperfections at the neck of the container.

Yet another feature of the invention resides in the provision of an improved, yieldable molded plastic cap construction containing a brush-type applicator, wherein the entire unit including the brush may be molded in a single operation, in simple and inexpensive mold equipment, the molded piece being readily removed or stripped from the mold cavity without requiring movable or retractable walls or the like. Thus, not only is there effected a substantial saving in the cost of the cap construction and a simplification thereof by the elimination of all separate components and the assembly thereof, but the tooling and mold costs for such construction are held to a minimum.

Another feature of the invention resides in the provision of a novel, molded brush construction by which there is greatly simplified the tool or mold costs.

Other features and advantages will hereinafter appear.

In the drawings accompanying this specification, similar characters of reference are used throughout the several views to designate like parts of the cap structures.

FIGURE 1 is an axial sectional view of an improved cap construction and cooperable container therefor, said container being of the type which is readily producible in glass, by known molding techniques.

FIG. 2 is a top plan view of the cap construction shown in FIG. 1.

FIG. 3 is a fragmentary view partly in side elevation and partly in axial section, of the applicator structure as seen when looking from the left the direction in FIG. 1.

FIG. 4 is an enlarged fragmentary sectional view taken through an edge portion of the cap construction and neck of the container on which the cap is applied.

FIG. 5 is a view like FIG. 4 but showing the cap in the process of being removed from the neck of the container.

FIG. 6 is a fragmentary sectional view taken on the line 6—6 of FIG. 1.

FIG. 7 is a fragmentary axial sectional view showing a portion of a container neck and cap structure as the latter is being applied to the container.

FIG. 8 is a top plan view of a cap construction made in accordance with the invention, showing a different type of actuator shoulder, for use in removing the cap from the container.

FIG. 9 is a fragmentary view partly in axial section and partly in elevation, showing another type of applicator construction.

FIG. 10 is view partly in axial section and partly in elevation, showing still another type of applicator construction.

The cap construction as provided by the invention is preferably molded of flexible and yieldable, resilient plastic substance such as polyethylene or formulations of such plastic, or equivalent or similar plastic substance. The container and neck construction thereof as provided by the invention is intended to be molded of glass or the like, or of plastic substance by a procedure wherein parting lines sometimes occur on the neck portion, as well as other imperfections such as blow holes, dimples, depressions and the like. By virtue of the present novel organization of container neck in conjunction with the improved cap construction an extremely inexpensive and yet effective and reliable closure or closure and applicator is provided, which is characterized by an effective seal of the container contents, quick removability of the cap, and extremely low initial or first cost.

Referring to FIGS. 1, 4 and 5, there is shown a small container **10** which may be in the form of a mucilage bottle or the like, the said container being of the type commonly formed of glass by a molding procedure wherein mold parting lines are evident in the neck portion. In accordance with my invention, I provide on said neck portion a novel and effective detent means and sealing bead combined in one, said bead being indicated at **12**, and being disposed in a position adjoining a short cylindrical lip portion **13** of the container. The bead **12** is annular or ring-shaped as distinguished from screw threads, and is provided with annular sloping upper and lower faces **15** and **16** which meet at a relatively sharp, very slightly rounded peripheral zone **17** having the maximum diameter of the bead **12**. The lower face **16** of the bead makes a steep angle with the axis of the neck portion **11**, such angle being preferably on the order of 60 degrees. This angle is indicated at B in FIG. 1. In distinction to the angle B which is relatively steep, the upper face **15** of the bead **12** makes a slight angle with respect to the axis of the neck, such angle being preferably on the order of 24 degrees, and being indicated by the letter A in FIG. 1. It is important, in accordance with the invention, that the peripheral portion or zone **17** of maximum diameter be relatively sharp, and that it have at most a very small radius, only sufficient to suit the material of which the container **10** is formed. For example, where such material is glass, the peripheral portion **17** may be quite sharp and devoid of any large radius. The purpose of the sharpness of the sealing bead **12** will be brought out in detail at a later point.

For application to the neck of the container **10** I provide further, in accordance with the invention, a novel cap construction of the snap-on type, said cap construction being molded in one operation of a flexible and yieldable plastic such as polyethylene or similar formulations. The cap construction includes a flexible top wall which is generally flat, and a depending annular or cylindrical flange **21** which is secured to the periphery of the wall **20**, said flange being also flexible and yieldable and having a novel, interior annular sealing and detent bead **22** adapted to be cooperable with the exterior bead **12** of the bottle neck.

As shown, the annular detent bead **22** is disposed at the lower edge of the flange **21**, said bead having an annular sloping upper face **24** and an annular sloping lower face **25**, the said faces meeting at and forming a sharp peripheral zone of minimum diameter on said bead, the lower face **25** making a slight angle and the upper face **24** making a steep angle with respect to the axis of the cap.

For example, I have found that the upper face **24** may advantageously make an angle of 60 degrees with respect to the cap axis, and the lower face **25** may advantageously make an angle of 45 degrees with respect to the cap axis. The said angles are indicated by the letters C and D in FIG. 7, and it will be noted that with this construction a relatively small area of contact will exist between the exterior bead of the bottle neck and the interior bead **22** of the cap when the latter is being forced over the neck. This is of course due to the fact that the angle of the upper face of the bead **12** is relatively slight as compared with the angle of the lower face of the bead **22**, both being referred to the axis of the container or cap. I attribute the ease with which the cap construction may be forced onto the bottle neck, causing the interior bead **22** to ride over and pass the exterior bead **12**, to the said limited area of contact in conjunction with the relatively slight angle of the upper face **15** of the exterior bead **12**.

Referring to FIG. 4, when the cap construction is finally snapped in place on the neck of the container, the interior bead **22** thereof will be disposed below the exterior bead **12** of the container neck. Also, the lower face **16**

of the exterior bead **12** will be in engagement with the upper surface **24** of the interior bead **22**. In addition to this, the sharp peripheral portion **17** of maximum diameter of the bead **12** will tend to be embedded in the inner wall of the depending flange **21**, and I attribute the effective and reliable seal of the present improved cap and bottle construction to this fact, in conjunction with the appreciable inward force which the depending flange **21** exerts radially against the exterior bead **12**. Considering FIGS. 4 and 7 it will be observed that due to the expansion suffered by the cap flange **21** when the cap is on the container neck the angle of the upper face **24** of the flange bead **22** is no longer 60° but instead that it has changed to an appreciably lesser value and the face **24** is now mostly out of contact with the lower face **16** of the bead **12** on the bottle neck, as clearly shown in FIG. 4. Also it will be noted from an inspection of FIG. 4, that an appreciable space **27** exists between the upper portion of the depending flange **21** and the cylindrical lip portion **13** of the container neck. Additionally, it will be noted that the top flexible wall **20** of the cap construction has become bowed and concave as seen from the top. Such bowed top wall of the cap forces and holds the depending flange **21** against the exterior bead **12** of the bottle neck. Moreover, by the existence of the space **27** between the flange **21** and the bottle lip **13** the latter does not exert any outward force or pressure against the flange which might detract from the force supplied by the bowed top wall **20** of the cap. In consequence, an appreciable force exists between the exterior sealing and detent bead **12** of the bottle neck and the inside wall of the depending flange **21**, and such force provides for an extremely effective sealing of the contents of the container and also provides a strong detent action which is effective in preventing the cap from being inadvertently removed from the container, as by excessive pressures within the container or any other disruptive forces.

An important feature of the improved cap and container neck construction of the present invention resides in the fact that the cap will occupy only either of two positions on the container neck, an initial pre-assembled position wherein it rests loosely on the neck, as illustrated in FIG. 7, and an assembled position wherein it completely seals the container, as illustrated in FIG. 4. The angle A of the camming surface **15** of the bead **12** plays an important part in effecting the above action wherein the cap has only two positions; also, in conjunction with the angle A, the angle B plays a part, inasmuch as the two faces **15** and **16** defining such angles enable the sealing bead **12** to function as a camming element. In conjunction with the internal bead **22** the bead **12** causes the cap construction to occupy either the sealing position of FIG. 4 or else the raised, pre-assembled non-sealing position of FIG. 7. This is of distinct advantage in that it enables an automatic quality control device to be utilized on the filling and capping line. For example, a microswitch or electric eye device may be set at a height slightly above the maximum height tolerance of the bottle with the assembled cap as seen in FIG. 4, and whenever a bottle with a cap which is set higher than such maximum height passes by the quality control station, such bottle and cap will be rejected on the basis that the cap does not properly seal the bottle. It may be readily understood that such arrangement could not be employed in the case of screw caps where the cap may occupy any of a large number of different positions on the container neck, and wherein only a slight change in the height of the cap could mean the difference between a perfect seal and an imperfect seal.

It will be readily seen from an inspection of FIG. 4 that in addition to the side seal as effected by the annular bead **12** on the container neck and the side wall or flange **21** on the cap, there further exists a secondary or supplementary seal between the top edge or lip of the container neck and the top transverse wall **20** of

the cap construction. However, reliance is not placed on the said supplementary or secondary sealing action, but instead as provided by the invention the main sealing action is between the annular bead **12** of the container and the side wall or flange **21** of the cap. However, in the case where the contents of the container are not of a nature where they harden or build up, the secondary seal between the top edge or lip of the container neck and the transverse wall **20** of the cap remains effective, and supplements the side seal of the cap construction.

I provide a plurality of thin or slender, triangular fillets **30** and an outwardly extending shoulder **31** about the bottom edge of the flange **21**, the fillets **30** extending between the said shoulder and the exterior wall of the flange. By such construction it is possible to easily and quickly remove the cap structure whenever this should be desired, as illustrated clearly in FIG. 5. The user need merely apply an upward pressure by the thumb or forefinger against the underside of the annular shoulder **31**. This pressure will result in the depending flange **21** flexing at a point as indicated by the arrow **33** in FIG. 5. Such flexure results in the interior detent bead **22** of the flange riding up over the exterior detent bead **12** of the bottle neck. The cap is thus easily removed whenever it is desired to dispense the contents of the container, and such removal may be effected regardless of contamination of the container neck by the contents of the container, even if such contents are of a cementitious nature.

It is important to note that with the cap construction as above set forth and provided by the invention, an effective seal of the container is had at all times subsequent to the initial opening of the container and use of the contents thereof. This is true regardless of the number of times that the container is opened even though the contents thereof are in the nature of cement, glue or the like. It will be understood that when the contents are dispensed from the container, invariably some is deposited on the top of the neck thereof. Heretofore, where a screw cap was provided, the replacing of such cap did not effectively, completely wipe the said top edge or lip of the container, and in consequence there was a build-up of the substance on the lip, which because of its unevenness as it became greater, greatly impaired the seal. Finally all semblance of the original seal would be lost, and in addition the deposit of the said substance on the screw threads made each subsequent removal of the cap more difficult than the preceding one.

With the cap and neck construction of the present invention, and particularly where the annular sealing bead **12** is made to have a sharp ridge or crest, the mere act of replacing the cap on the container results in the side flange of the cap continually wiping clean the sealing bead **12** of the container neck. This occurs each time that the cap is replaced, and in consequence it is not possible for the substance to build up on the outside of the container neck, particularly on the sealing bead **12**. Especially, the sharpness of the sealing bead **12** is of advantage in that relatively little substance stays on the bead, and what little does remain will be effectively wiped off and removed when the cap is replaced into its sealing position. This is true even though the cap construction be of resilient and yieldable polyethylene or similar soft plastic, since I have found that such material is still effective in chipping or breaking off any build-up of contaminating substance which would extend radially from the annular bead **12** sufficiently to adversely effect the seal.

The flexibility of the cap structure, in conjunction with the nature of the polyethylene plastic or similar formulation, prevents the depending flange **21** from being adhered very strongly to the bottle neck, and in consequence the cap-removing pressure as applied by the finger shown in FIG. 5 will be sufficient to readily separate the flange from the bottle neck, so as to effect removal of the cap structure.

Where the cap construction is to include an applicator, I provide in accordance with the invention a flexible depending shank portion **36** having at its lower extremity bristles **37**, both said shank and bristles being molded as an integral part of the top wall **20** of the cap construction. As seen in FIG. 1, the depending shank **36** may be of tubular construction with a relatively large outer diameter, and may further comprise a flat lower extremity **39** from which depend a plurality of integral bristles **37**. As seen in FIG. 3, the flat portion **39** may be relatively thin, and may be joined to the tubular portion **36** by tapered fillets **40**.

Referring to FIG. 6, the bristles **37** may be advantageously formed in three groups, each group of bristles comprising five individual bristles disposed in a circle and having roughly a triangular cross-section, the said bristles being also tapered to sharp points, as shown.

Referring to FIG. 8, in accordance with the invention a modification is shown, wherein the shoulder **31** disposed on the lower edge of the flexible flange **21** of the cap may be in the form of a short tab **31***a*, rather than in the form of an annulus or ring. In such case, there will still be provided the plurality of fillets **30**, by which a strengthening of the tab is effected, thereby to cause a flexure of the depending flange **21** at the point indicated at **33** in FIG. 5. By the provision of the short tab **31***a* a saving of material is effected, which in some circumstances might be an important consideration.

Another type of applicator construction is illustrated in FIG. 9, wherein the top wall **20***a* of a cap structure is provided with a solid depending shank **36***a* having a hollow lower extremity **39***a* provided with natural hair bristles **42**. A drain-back well may be provided in the form of an annular dependent flange **44**, to catch the excess substance on the applicator should the cap be placed in inverted position. Such excess substance will then be prevented from reaching the depending flange **21** of the cap structure.

In FIG. 10 another form of applicator is provided, such applicator being constituted of a solid depending shank **36***b* having at its lower extremity a rounded end surface **46**. For certain substances this type of applicator is preferable to the brush type.

It will be understood from the foregoing that I have provided a novel combination container neck and molded flexible cap construction which is characterized by extreme simplicity and low cost while at the same time providing a remarkably effective seal, and enabling the contents of the container to be used from time to time without difficulty being experienced in removing the cap. Moreover, in conjunction with such cap construction, I provide an integral applicator including a brush having integral bristles, the entire piece being molded in a single operation, at a very low and attractive cost.

Variations and modifications may be made within the scope of the claim, and portions of the improvements may be used without others.

I claim:

The combination of a molded glass container having an annular neck provided with a short cylindrical lip portion at its edge and an exterior annular sealing and retaining bead adjoining said lip portion, said bead having annular, sloping upper and lower faces meeting at a relatively sharp, slightly rounded periphery of maximum diameter, the lower face making a steep angle and the upper face making a slight angle with respect to the axis of the neck, said neck, lip portion and bead having mold-parting lines and lacking a perfect circular configuration by virtue of said lines; and a resilient plastic snap cap having a yieldable depending flange extending around said annular neck of the container, said flange having an interior annular bead disposed at its lower edge, said interior bead having annular, sloping upper and lower faces meeting at and forming a sharp inner periphery of minimum diameter, the lower face making a slight angle and the upper face making a steep angle with respect to the axis of the cap, the said steep angle of the container-bead face being appreciably greater than the said steep angle of the cap-bead face whereby said upper annular face of the interior cap bead engages the lower annular face of the exterior bead of the container neck along a narrow circular zone constituting a small fractional part of the area of said upper face to releasably retain the cap thereon and said relatively sharp periphery of the bead of the container neck as a consequence bearing most of the force exerted by the cap flange and being partially imbedded therein whereby irregularities in the bead of the container neck do not render ineffective the seal with the cap flange, those portions of the upper and lower faces of the container bead which are immediately adjacent the said sharp periphery being engaged under pressure with the said cap flange.

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