

June 20, 1961

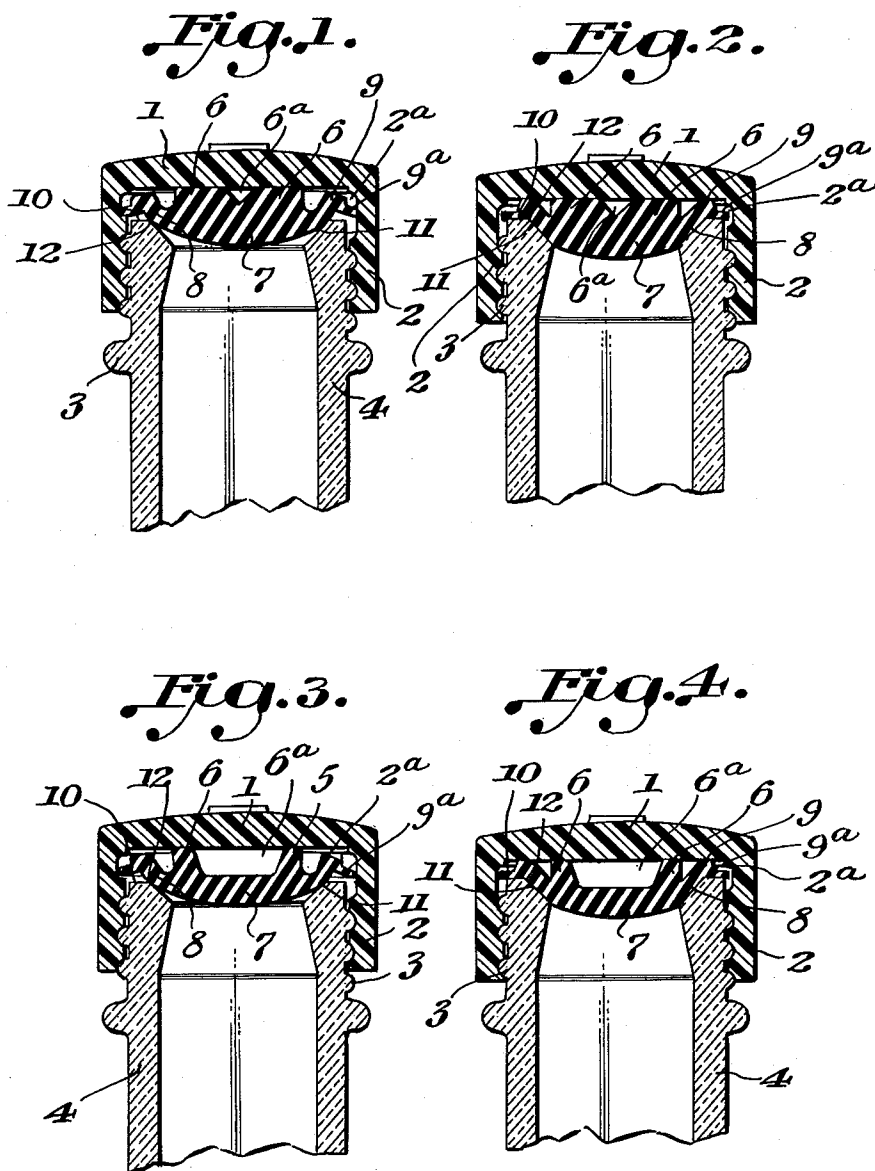
F. MARX ET AL

2,989,204

CONTAINERS HAVING REMOVABLE CLOSURE CAPS

Filed May 22, 1957

3 Sheets-Sheet 1



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Fig. 5.

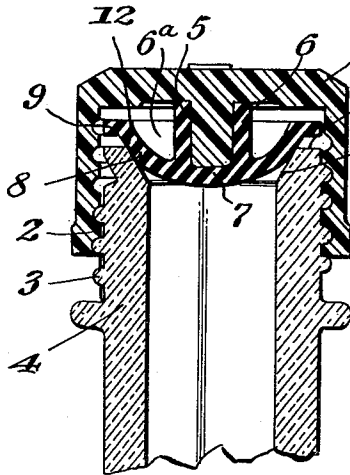


Fig. 6.

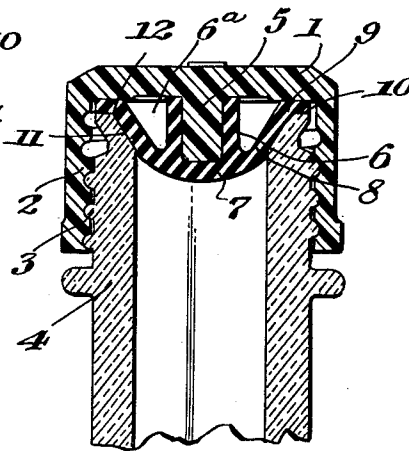


Fig. 7.

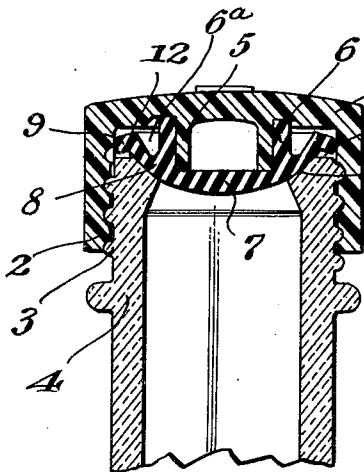
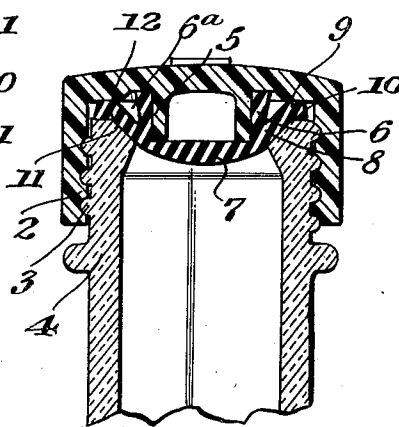


Fig. 8.



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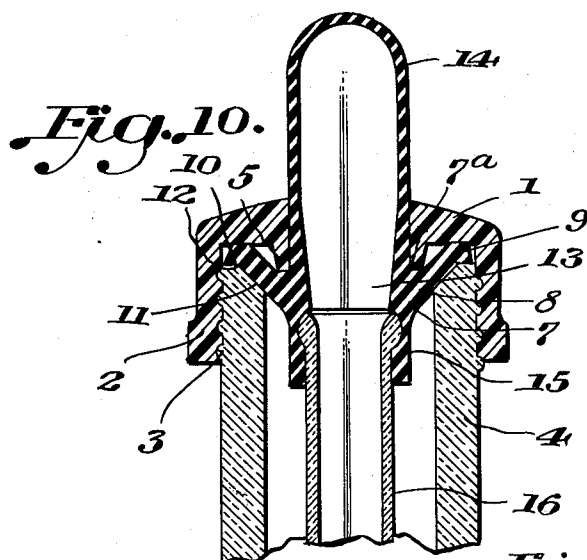
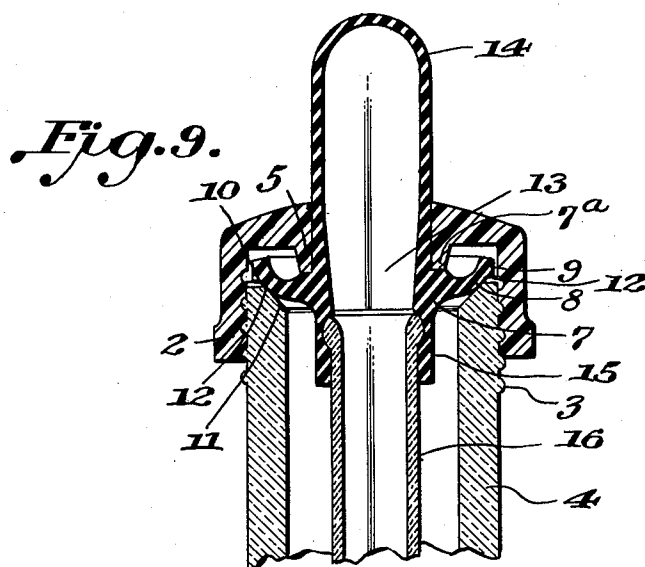
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3 Sheets-Sheet 3



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2,989,204

CONTAINERS HAVING REMOVABLE CLOSURE CAPS

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13 Claims. (Cl. 215-40)

It is known to close containers, such as bottles, with caps within which is provided an elastic packing disc, for example, of cork. In general such a packing does not afford sufficiently airtight closure of the container, such as is desired more especially for bottles containing medicaments. In order to secure more airtight packing the expedient has been adopted of inserting a packing stopper, for example, a cork treated with paraffin wax, into the mouth of the container before fixing the cap in position. This method is troublesome and cannot easily be carried out by machinery. It is also often undesirable when the container is used to be unable to remove the packing stopper at the same time as the cap.

An object of the present invention is to provide a container having a mouth, such as a bottle, phial, jar or the like, and especially a bottle for medicaments, and a cap which can be fixed over the mouth of the container and has a packing member within it, and which enables the container to be closed by machine in an airtight manner, and permits the packing to be removed at the same time as the cap when the container is opened.

This invention provides a container of the above kind, wherein the mouth of the container has adjoining its rim a conical inner surface that narrows towards the interior of the container, the closure cap has within it an elastically deformable bowl-shaped packing member having a convex surface that bulges outwards towards the interior of the container and, when placed on the mouth of the container in the non-deformed condition, makes contact near its periphery with the conical inner surface along a closed line that substantially coincides with the boundary between the conical inner surface and rim of the mouth, and the cap and the packing member are so constructed that upon movement of the cap into its closing position pressure is exerted within the central portion of the packing member in the direction of the interior of the container to cause elastic deformation of the packing member in such manner that the peripheral portion of the convex surface is pressed into full contact with the conical inner surface of the mouth.

Advantageously the conical inner surface of the mouth of the container has an angle within the range of 60° to 120°, and preferably 80° to 100°.

The packing member or the cap may have within it a central projection that by abutting against the underside of the cap or the inner side of the packing, respectively, exerts the aforesaid pressure upon movement of the cap into its closed position. The packing is then so guided within the cap that the inner side of the peripheral portion of the packing member is spaced away from the underside of the cap when the said member is in the non-deformed condition, so that during the closing movement of the cap pressure is first exerted on the central portion of the packing member in the direction of the interior of the container.

The projection within the packing or cap may take the form of a simple pin. In order to reduce the amount of material required the pin may have a recess in its free end or the projection may take the form of an open ended tube directed against the underside of the cap.

The packing member may be held and guided within the cap in any desired manner. Thus, for example, the

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projection within the packing member or cap, which serves in the present invention to transmit pressure from the underside of the cap to the packing member, may also serve as a means for holding the packing member.

The projection within the packing member or cap may then be formed as a simple pin the free end of which is either rigidly fixed to the opposing underside of the cap or inner side of the packing member, or is inserted within a closely fitting tubular guide portion on the opposing underside of the cap or inner side of the packing. In the latter case also the free end of the pin must abut against the opposing underside of the cap or inner side of the packing member, in order that during the closing movement of the cap the latter shall transmit pressure to the packing member. As an alternative to a simple pin and a co-operating tubular guide portion, the pin may be provided, for example, with longitudinal grooves and the co-operation guide portion may be provided with corresponding longitudinal grooves or longitudinal ribs, respectively. Furthermore, the pin may have at its free end a recess into which enters a pin projecting from the closed end of the tubular guide portion.

In a preferred form of container and closure cap in accordance with this invention the projection within the packing member or cap serves only for transmitting pressure from the underside of the cap to the inner side of the packing, and the bowl-shaped packing member is provided at at least a part of its outer edge with a protruding portion or portions, which serve to hold and guide the packing member within the cap.

The aforesaid protruding portions may consist of teeth which are advantageously distributed round the entire circumference of the edge of the packing member. Instead of providing a plurality of protruding portions, a simple and effective arrangement is to provide a single protruding portion in the form on an annular flange projecting from the outer edge of the bowl-shaped packing member. In this form of the invention the cap is advantageously constructed as a screw-threaded cap, and the aforesaid protruding portion or portions for holding and guiding the packing member within the cap engage the last turn of the screw thread adjacent to the underside of the cap.

A pipette may be combined with the packing member by constructing the central portion of the packing member, preferably as a pressure bulb, of which the outer closed end projects in known manner outwardly through a central opening of suitable size in the upper wall of the cap, and of which the inner open end serves to hold the pipette within the container in the position it is to occupy when immersed in a liquid within the container. The container may be made of glass, an artificial plastic or other suitable material. The cap serving as outer closure member is advantageously a screw-threaded cap which can be secured over the mouth of the container, for which purpose the mouth of the container is itself provided with a corresponding screw thread. The screw-threaded cap may be made of a material which is the same or different from that of the container, for example, artificial resin, porcelain or metal. The cap may be attachable to the container by other known means, for example, it may be a closure cap of the kind having flaps around its edge which, when the cap is placed over the mouth of the container, are drawn together about the mouth of the container by turning a lever.

The packing member must be made of an elastically deformable material, for example, a natural or synthetic rubber material or an elastic artificial resin, such as plasticised polyvinyl chloride. There are preferably used materials which, in addition to their elasticity, are strongly resistant to chemical agents, such as acid bases.

and organic solvents, and which impart no odour or taste to the substances to be kept in the container. Such materials are, for example, polyethylene and especially mixtures of polyethylene and polyisobutylene, for example, a mixture of 70 parts of polyethylene and 30 parts of polyisobutylene.

Examples of containers having closures in accordance with the invention are described with references to the accompanying drawings, in which the same reference numerals are used for similar parts, and in which

FIG. 1 is a cross-section of a closure in accordance with the invention having means for holding the packing member at its outer edge within the cap, the packing member being shown in the non-deformed condition,

FIG. 2 is a cross-section of the closure shown in FIG. 1 with the packing member in the elastically deformed condition,

FIG. 3 is a cross-section of a modification of the closure shown in FIGS. 1 and 2, before deformation of the packing member,

FIG. 4 is a cross-section of the closure shown in FIG. 3 after deformation of the packing member,

FIG. 5 is a cross-section of another form of closure having central holding means for the packing member before the latter is deformed,

FIG. 6 is a cross-section of the closure shown in FIG. 5 after deformation of the packing member,

FIG. 7 is a cross section of yet another form of closure having central holding means for the packing member before the latter is deformed,

FIG. 8 is a cross-section of the closure shown in FIG. 7 after deformation of the packing member,

FIG. 9 is a cross-section of a closure combined with a dropping pipette with the packing member in the non-deformed condition,

FIG. 10 is a cross-section of the closure shown in FIG. 9 after deformation of the packing member.

As shown in FIGS. 1 and 2 the closure has a cap 1, for example, of artificial plastic, which is provided with a screw thread 2. The screw thread 2 is engageable with a screw thread 3 on the mouth 4 of a container, for example, a glass bottle.

The bowl-shaped packing member 7 is of elastic material, for example, a mixture of polyethylene and polyisobutylene, and has a central plug-like projection 6 having a central recess 6a. The free end of the projection 6 abuts against the underside of the cap 1.

The peripheral portion 8 and the packing member 7 is formed at its outer edge with an annular flange 9. The flange 9 has extending from its lower side a projecting portion 9a, which engages in the final turn 2a of the screw thread 2 on the cap 1 and serves to hold and guide the packing member in the cap 1. The projecting portion 9a, may be a continuous or discontinuous annular flange or it may be formed of teeth. In order to counteract any tendency of the packing member to stick to the mouth of the container, the flange 9 of the packing member 7 in the non-deformed condition of the latter is inclined in an upward direction. The projection 6 is so dimensioned that when its free end abuts against the underside of the cap 1 a space remains between the underside of the cap and the upper side of the flange 9, when the packing member is not elastically deformed.

When the cap 1 is screwed down on the mouth 4 of the bottle, first of all the packing member 7 moves downwardly on to the rim 10 of the bottle until it reaches the position shown in FIG. 1. A conical inner surface 11 of the mouth 4 adjoins the rim 10 and has an angle such that in the non-deformed condition the bowl-shaped packing member 7 makes contact substantially only along the edge 12, which constitutes the boundary between the conical surface 11 and the rim 10. Furthermore, in this position of the packing member 7 its annular flange 9 is not only spaced from the underside of the cap 1, but is also spaced from the rim 10.

When the cap 1 is screwed down further the underside 1 of the cap exerts through the projection 6 a deforming pressure at the central portion of the packing member 7 in such manner that the packing member is forced downwardly into the mouth of the bottle and the convex surface of the peripheral portion 8 of the packing member is pressed into full contact with the conical inner surface 11 and assumes the shape of that surface, as shown in FIG. 2. In this manner the bottle is closed airtight. Simultaneously the flange 9 is firmly clamped between the underside of the cap 1 and the rim 10 of the container, whereby additional packing is attained.

When, in opening the bottle, the cap is unscrewed to the position shown in FIG. 1 the packing member 7 due to its inherent elasticity, automatically tends to return from the deformed condition shown in FIG. 2 to its original non-deformed condition shown in FIG. 1. Due to the consequent retractive force the packing member is released from the conical inner surface 11 and the rim 10. The retractive force is supplemented by the uppermost turn of the screw thread 2, which, when the cap is unscrewed, lifts the projecting portion 9a of the packing member off the rim 10.

In the modified form of closure shown in FIGS. 3 and 4 the projection 6 is wider and has a central cavity 6a.

In the closure shown in FIGS. 5 and 6 the annular flange 9 of the packing member 7 has no projecting portion 9a for holding the packing member by means of the screw thread of the cap 1. For holding the packing member within the cap the latter has a central pin 5 which is inserted in a tubular central projection 6 of the bowl-shaped packing member 7 in such manner that the free end of the pin abuts against the upper side of the packing member. In order to provide stiffening the projection 6 is connected to the spherical curved peripheral portion 8 of the packing member 7 by means of radial ribs 6a. The pin 5 and the projection 6 are so dimensioned that when the free end of the pin abuts against the upper side of the packing member there is a space between the underside of the cap 1 and the upper side of the flange 9, when the packing member 7 is not elastically deformed.

In FIGS. 7 and 8 a further example of a closure is shown having central holding means for the packing member 7. In this case the tubular projection 6 and the pin 5 that fits into it are wider, and in the non-deformed condition of the packing member 7 the flange 9 is inclined in an upward direction. In this construction any tendency for the packing member to stick to the mouth of the container is effectively counteracted.

In the construction shown in FIGS. 9 and 10 the packing member 7 has a central bore 13 and its upper side takes the form of a pressure bulb 14 and its lower side is formed with a tubular extension 15 to receive a dropping pipette 16. The pressure bulb 14 projects through a suitably dimensioned opening in the upper wall of the cap 1 and also serves to hold the packing member 7 in the cap.

The cap also has a central annular projection 5, the free end of which bears against an annular central portion 7a on the upper side of the packing member 7. The projection 5 is so dimensioned that when its free end abuts against the portion 7a of the packing member there is a space between the underside of the cap 1 and the upper side of the flange 9, when the packing member is not elastically deformed.

When the cap 1 is screwed down the projection 5 exerts a deforming pressure on the central portion 7a of the packing member in such manner that a tight closure is produced in the manner described with reference to FIGS. 1 and 2, the finally deformed condition of the packing member being shown in FIG. 10.

If the dropping pipette 16 is not made of a brittle material such as glass, but is also made of an artificial plastic, such as polyethylene, the construction shown in FIGS. 9

and 10 may be modified by providing the pipette with an enlargement and pushing it over the tubular extension 15, instead of inserting the pipette within the extension 15.

The closures described above afford a reliable and efficient sealing of the container which is as good as that afforded by the much more cumbersome method of closing the mouth of a container with a waxed stopper before the cap is secured in position, and, as compared with this known method, the closures of this invention have the great advantage that the charged containers, for example, bottles charged with medicaments, can be closed on a moving conveyor by machinery.

What is claimed is:

1. A receptacle comprising a container with an opening therein and a closure cap having an elastically deformable packing member held thereon and being securely fastenable to said container, the container at a position adjacent to and surrounding the opening having a bevelled surface, the packing member having a convex surface projecting away from the cap, said convex surface being the one which is furthest removed from said cap, the angle of the bevelled surface with respect to a plane perpendicular to the axis of said opening being larger than the angle of a tangent to the convex surface of the packing member at a line of contact between them, whereby said packing member in the undeformed condition is prevented from entering into the bevelled opening and said bevelled surface has only line contact with said convex surface, means between the cap and the convex surface of the packing member acting upon the central portion only of the rear surface of the packing member and serving for urging said convex surface into the bevelled opening when the cap is securely fastened to the container, thereby deforming the convex surface so that it is in surface contact with said bevelled surface.

2. A receptacle as claimed in claim 1, wherein the said angle is within the range of 40° to 50°.

3. A receptacle as claimed in claim 1, wherein the convex surface of the packing member is provided at its outer edge with an annular flange which, when the packing member is in the non-deformed condition, is unable to make contact with the underside of the cap and the mouth of the container, but which in the deformed condition of the packing member becomes firmly clamped between the underside of the cap and the rim of the mouth of the container.

4. A receptacle according to claim 1 wherein the stated means is a protrusion depending from the packing member.

5. A receptacle according to claim 4 wherein the protrusion is centrally located on the packing member and wherein said protrusion is adapted for centering and holding the packing member in said cap.

6. A receptacle according to claim 1 wherein the packing member is bowl-shaped, having a concave rear surface, said rear surface being in contact with the cap only at its central portion and being spaced from said cap at its circumference when said packing member is uncompressed.

7. A receptacle according to claim 1 wherein the angle of the bevelled surface is from 30° to 60°.

8. A receptacle according to claim 1 wherein the cap has an internal screw thread for securing it to the container which has a corresponding screw thread at a position surrounding the bevelled surface and wherein said packing member has an outer edge with a projecting portion which engages a turn of the screw thread of the cap adjacent the underside of the cap whereby the packing member is guided in the cap.

9. A receptacle which comprises a container with an opening therein, a closure cap securely fastenable to said container, an elastically deformable packing member held on said cap, and a pipette, the container at a position surrounding the opening having a bevelled surface, and the packing member having a convex surface which pro-

jects toward the bevelled surface when the packing member is undeformed, said convex surface being the one which is furthest removed from said cap and having a pressure bulb for the pipette, the angle of the bevelled surface with respect to a plane perpendicular to the axis of said opening being larger than the angle of a tangent to the convex surface of the packing member at a line of contact between them, whereby said convex surface of the packing member is prevented from entering into the bevelled opening when the packing member is undeformed, said pressure bulb projecting through the closure cap, the pipette being held in the packing member and extending from same in the direction in which the convex surface projects, and said closure cap having an annular projection which surrounds the pressure bulb and extends toward the opening, said projection being adapted for acting upon the central portion of the rear surface of the packing member, thereby serving for deforming the convex surface of the packing member so that it is in contact with the entire bevelled surface when the cap is securely fastened to the container.

10. In a receptacle comprising a container provided with a mouth portion with an opening therein symmetrical about a central axis, which mouth portion has a bevelled surface about the upper rim of said opening, and an outer screw threading about said mouth portion, as well as a closure cap having an inside top surface and an inner screwthreading and adapted for being screwed onto the outer threading of said mouth portion, the improvement of an elastically deformable packing member interposed between said mouth portion and the inside top surface of said closure cap, said packing member comprising a central portion projecting from the face of said packing member facing said opening, said central portion having a convex surface approximating that of a sphere segment, and having at its base a diameter larger than the diameter of the outer rim of said bevelled surface, whereby said central portion is prevented from completely entering said opening and has only the line contact with said bevelled surface, while said packing member is in undeformed condition, with the rim of said central portion extending from the wider, outer rim of said bevelled surface generally outward away from said axis and toward the inside top surface of said cap, flange means about said rim of said central portion and cap contacting means provided in the central region of the surface of said packing member facing said inside top surface of said cap and adapted for compressive engagement by the latter surface; said flange means being spaced from said mouth portion and clear of said inside top surface, when said cap contacting means are in contact with the latter surface while said packing member is in undeformed condition, with said central portion in contact with said bevelled surface; and said flange means being deformed to sealingly contact said inside top surface and the surface of said mouth portion outside said bevelled surface, when said packing means are deformed by depression of said cap contacting means toward said opening.

11. In a receptacle comprising a container provided with a mouth portion with an opening therein symmetrical about a central axis, which mouth portion has a bevelled surface about the upper rim of said opening, and an outer screw threading about said mouth portion, as well as a closure cap having an inside top surface and inner screwthreading and adapted for being screwed onto the outer threading of said mouth portion, the improvement of an elastically deformable packing member interposed between said mouth portion and the inside top surface of said closure cap, said packing member comprising a central portion projecting from the face of said packing member facing said opening, said central portion having a convex surface approximating that of a sphere segment, and having at its base a diameter larger than the diameter of the outer rim of said bevelled surface,

whereby said central portion is prevented from completely entering said opening and has only line contact with said bevelled surface, while said packing member is in undeformed condition with the rim of said central portion extending from the wider, outer rim of said bevelled surface generally outward away from said axis and toward the inside top surface of said cap, flange means about said rim of said central portion, cap contacting means provided in the central region of the surface of said packing member facing said inside top surface of said cap and adapted for compressive engagement by the latter surface; said flange means being spaced from said mouth portion and clear of said inside top surface, when said cap contacting means are in contact with the latter surface, while said packing member is in undeformed condition, with said central portion in contact with said bevelled surface; and said flange means being deformed to sealingly contact said inside top surface and the surface of said mouth portion outside said bevelled surface, when said packing means are deformed by depression of said cap contacting means toward said opening, and guiding means protruding circumferentially from said flange means and adapted for engaging said inner screw threading of said cap, so as to guide said packing means in said cap and permitting removal of the packing means together with said cap from said container.

12. In a receptacle comprising a container provided with a mouth portion with an opening therein symmetrical about a central axis, which mouth portion has a bevelled surface about the upper rim of said opening, and an outer screw threading about said mouth portion, as well as a closure cap having an inside top surface and inner screwthreading and adapted for being screwed onto the outer threading of said mouth portion, the improvement of an elastically deformable packing member interposed between said mouth portion and the inside top surface of said closure cap, said packing member comprising a central portion projecting from the face of said packing member facing said opening, said central portion having a convex surface approximating that of a sphere segment, and having at its base a diameter larger than the diameter of the outer rim of said bevelled surface, whereby said central portion is prevented from completely entering said opening and has only line contact with said bevelled surface, while said packing member is in undeformed condition with the rim of said central portion extending from the wider, outer rim of said bevelled surface generally outward away from said axis and toward the inside top surface of said cap, flange means about said rim of said central portion, cap contacting means provided in the central region of the surface of said packing member facing said inside top surface of said cap and adapted for compressive engagement by the latter surface; said flange means being spaced from said mouth portion and clear of said inside top surface, when said cap contacting means are in contact with the latter surface, while said packing member is in undeformed condition, with said central portion in contact with said bevelled surface; and said flange means being deformed to sealingly contact said inside top surface and the surface of said mouth portion outside said bevelled surface, when said packing means are deformed by depression of said cap contacting means toward said opening; and pipette means comprising a pipette and a pressure bulb and being centrally mounted

to extend through said packing means and being surrounded by said cap contacting means, so that the open end of said pipette is adapted for extending into the opening of said container and the pressure bulb is adapted for location outside of said cap through a central opening in the latter.

13. In a receptacle comprising a container provided with a mouth portion with an opening therein symmetrical about a central axis, which mouth portion has a bevelled surface about the upper rim of said opening, and an outer screw threading about said mouth portion, as well as a closure cap having an inside top surface, centering means protruding from said inner surface, and an inner screw threading and adapted for being screwed onto the outer threading of said mouth portion, the improvement of an elastically deformable packing member interposed between said mouth portion and the inside top surface of said closure cap, said packing member comprising a central portion projecting from the face of said packing member facing said opening, said central portion having a convex surface approximating that of a sphere segment, and said central portion having at its base a diameter larger than the diameter of the outer rim of said bevelled surface, whereby said central portion is prevented from completely entering said opening and has only line contact with said bevelled surface, while said packing member is in undeformed condition, with the rim of said central portion extending from the wider outer rim of said bevelled surface generally outward away from said axis and toward the inside top surface of said cap, flange means about said rim of said central portion, and cap contacting means provided in the central region of the surface of said packing member facing said inside top surface of said cap and adapted for compressive and centering engagement by the latter surface and by said centering means, respectively; said flange means being spaced from said mouth portion and clear of said inside top surface, when said cap contacting means are in contact with the latter surface, while said packing member is in undeformed condition, with said central portion in contact with said bevelled surface; and said flange means being deformed to sealingly contact said inside top surface and the surface of said mouth portion outside said bevelled surface, when said packing means are deformed by depression of said cap contacting means toward said opening.

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