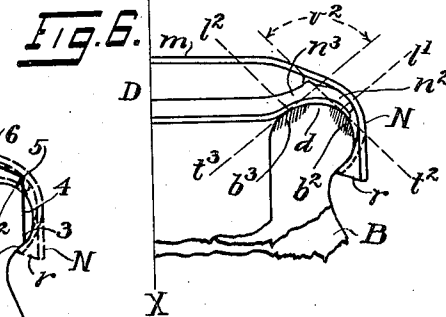
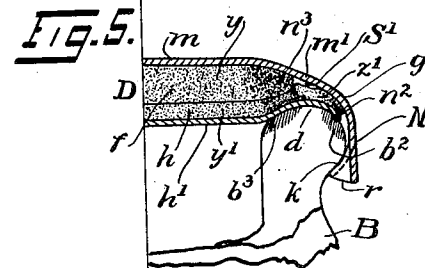
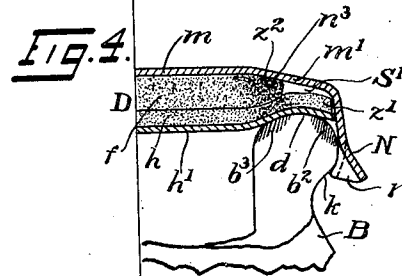
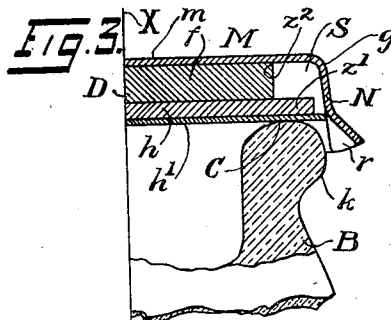
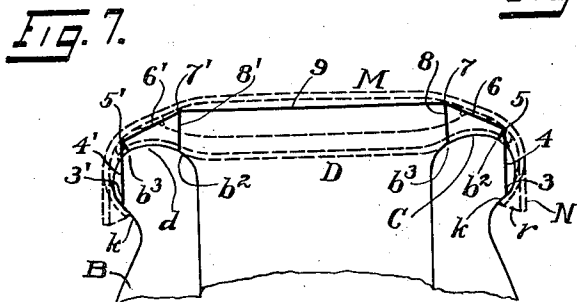
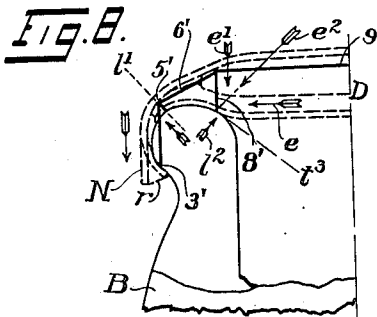
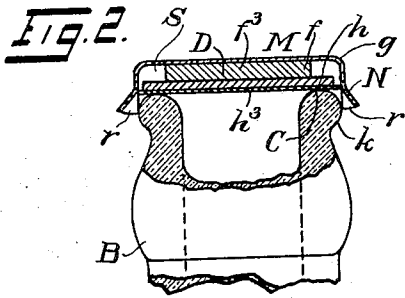
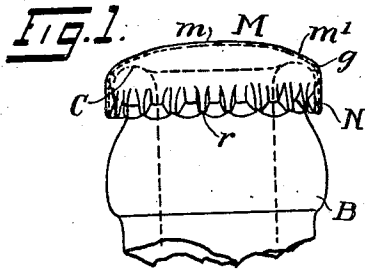


W. E. GASTON.
BOTTLE CLOSURE.
APPLICATION FILED DEC. 20, 1912.

Patented Dec. 29, 1914.

1,123,206.



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UNITED STATES PATENT OFFICE.

WILLIAM E. GASTON, OF WATERBURY, CONNECTICUT.

BOTTLE-CLOSURE.

1,123,206.

Specification of Letters Patent.

Patented Dec. 29, 1914.

Application filed December 20, 1912. Serial No. 737,779.

To all whom it may concern:

Be it known that I, WILLIAM E. GASTON, a citizen of the United States, residing in Waterbury, in the county of New Haven and State of Connecticut, have invented certain new and useful Improvements in Bottle-Closures, of which the following is a specification.

This invention relates more particularly to that class of bottle-closures which is especially designed for use in bottling mineral waters, beer and other liquids requiring the bottles to be sealed against leakage of either liquids or gases under considerable pressure, and with a high degree of security.

One object of my present improvements is to furnish a bottle-closure of the class described in which the combinations of elements therein, and their improved modes of action and co-action will be such that rubber and cork, now in general use for packing disks in such closures, may be replaced by more stable and effective materials, having a greater uniformity and of lower cost, and at the same time reduce the proportion of defective closures.

In the drawings accompanying and forming a part of this specification, Figure 1 is a side elevation of a bottle closure made in accordance with my present improvements. Fig. 2 is a central vertical, sectional view showing the several parts assembled in position ready for the setting operation. Fig. 3 is a sectional view similar to the right-hand portion of Fig. 2, but greatly enlarged, for more clearly illustrating certain features of the closure. Fig. 4 is a vertical sectional view similar to Fig. 3, and showing an intermediate state of the setting operation. Fig. 5 is a similar vertical central sectional view, showing the closure completed, at the end of the setting operation. Fig. 6 is a view similar to Fig. 5, and is a diagram for illustrating certain features of the packing member in its relations to the other parts of the closure. Fig. 7 is a diagram illustrative of the lines of force between certain points and members in the completed closure, for more fully explaining the mode of operation thereof. Fig. 8 is a diagram similar to and drawn in vertical alinement with the left-hand portion of Fig. 7, for further illustrating certain features of the invention.

For convenience of comparison, Figs. 3, 4,

5, and 6, are all drawn in similar relation to the meridian line X, X, which coincides with the axis of the closure.

Similar characters designate like parts in all of the views.

When, as in the usual practice heretofore, a moldable but resilient and resistant packing-disk is laid over the bottle-mouth and then simply pressed into place by a locked-on metal cap, the substance of the disk is subject to compression over a wide annular zone, and with only one line (and that a relatively broad one) of a relatively moderate pressure. The effect of that practice has been to so widely distribute the total pressure or sealing-force that the desired high security or sealing-effect was not satisfactorily obtained. These objections are overcome in my present improvements by the combinations in which there are two concentric bearing-zones, and by other features operating in conjunction therewith, as herein-after more fully explained.

In the mechanical co-action, or interaction, of its elements, my improved bottle closure operates in accordance with the principle of augmenting the sealing effect by reducing the area and thereby increasing the intensity of the high-pressure contact; and, also, by dividing this high-pressure area into a plurality of relatively non-contiguous and narrow concentric zones or bearing-lines; and, further, by locating these zones or surfaces in opposing inclined positions, so that the total stress or pressure exerted upon the bottle face is concentrated upon relatively a smaller area and is therefore of a relatively greater intensity and consequent higher sealing-effect, than would otherwise be the case.

The application of my improved closure to bottles of the style of formation herein illustrated, may be made by means of instrumentalities which are already well-known, and therefore I have not deemed it necessary to herein illustrate or particularly describe the same.

In the drawings, my improved closure is shown applied to a well-known form of bottle-top, B, having the curved top-face, C, and the lock-face, or lock-rim, L.

The cap is designated in a general way by M, and has a depending outer flange N which surrounds the crown disk and is pref-

erably furnished at its lower edge with some suitable retaining means,—as for instance, the lock-rim-engaging hooks at r ,—for engaging under the lock-face k , when the cap M is in its fully set position, as in Figs. 1 and 5. In practice, however, the lower edge of the flange N may, if preferred, be simply spun under the face k , in a well-known manner; this permits the use of a plainly formed or unserrated lower edge for the flange N. In some cases,—as herein illustrated,—the flange N may have the well-known indented formation, whereby the locking-on of the cap is effected in a well-known manner by closing in the lower edge of the flange N to a smaller diameter during the pressing down of the cap, by means of suitable mechanical appliances. This locked-on position is indicated in Figs. 5 and 8, in which the indents or hooks r engage directly under the rim or face k . Between the bottle face C and the cap M, a packing member D is located for coacting with those other members in a peculiar manner, which I will now, by the aid of the sectional-views and diagrams, more fully describe.

The curved top-face C, (Fig. 3) may be considered as comprising a medial or top-zone d , (Fig. 4) located between the outer, annular bearing-zone b^2 and the inner, annular bearing zone b^3 ; in Figs. 4, 5 and 6, the two bearing zones are distinguished by shaded portions. The zone b^2 inclines downwardly and outwardly, while the zone b^3 inclines downwardly and inwardly from said medial zone d . This relative and preferred disposition of said zones is indicated in Fig. 6 by the lines t^2 and t^3 , tangential to said zones b^2 and b^3 , respectively; the lines l^1 and l^2 indicate directions of pressure (see also, Figs. 7 and 8) vertically to said tangential lines b^2 and b^3 .

The outer high-pressure bearing-line or zone, b^2 , is shown located so far down on the outer side of the curve C, and the inner bearing-line, b^3 , so far down on the inner side of said curve C, that these respective tangential lines t^2 and t^3 form an angle v^2 which preferably approaches or approximates a right-angle, with the result that the two high-pressures or high-compression bearing rings of areas, n^2 and n^3 , respectively, of the fully applied packing member D, may be said to have a wedging action downwardly upon those opposing annular bearing surfaces b^2 and b^3 . (See Figs. 5 and 6).

The cap and packing member being first assembled on the bottle top as in Figs. 2 and 3, and pressure being then suitably applied over the cap and the flange N thereof, the said closure members are gradually forced downward and reshaped from their initial positions in Fig. 3, to the successive

positions illustrated in Figs. 4 and 5. During this progressive operation, the compression applied to the upper edge-zone z^2 of the member D, begins the formation of a pressure-ring, n^3 , in and of the substance of this member and directly above the bearing zone b^3 , as indicated in Fig. 4, and afterward an outer pressure-ring, n^2 , but of less depth, is similarly formed.

The cap M has its rim-gripping flange N of a depth sufficient for engaging under the bottle-rim at k , and for then extending upwardly and over the relatively thin packing-zone z^1 , of the packing-member D, and there forming the sectionally curved flange-grip at g , while the crown disk or top m of the cap is adapted to be drawn down or reformed by the settling-pressure into an elevated annular bearing-disk m^1 and thus impart to the inner annular sealing-seat b^3 , an amount of pressure corresponding to that required for so re-forming said cap, and by reason of this organization of these members and during the subjection of said packing-flange z^1 to its final pressure, the said inner annular seat b^3 is also normally subjected to a constantly increasing pressure.

The top-disk m of the cap M is shown in Figs. 2 and 3, of a preferred form in which the disk, throughout the entire diameter thereof, closely approximates a plane, while in Fig. 5 the outer zone m^1 of this disk is shown drawn downwardly to a line or angle coinciding with the upper surface of the completed pressure-rings n^2 and n^3 of the packing member D. This construction provides a considerable initial space at S, Fig. 3, which space is progressively reduced in the succeeding stages of the setting-operation, as indicated at S¹, in Figs. 4 and 5. Thus the initial provision of a crown or top-disk zone at m^1 adapted to be re-formed substantially as set forth during and by the setting operation, provides for beginning the formation of the pressure-ring n^3 well in advance of the formation of the pressure ring n^2 , as indicated in Fig. 4.

The packing member D comprises a plurality of parts arranged and adapted, respectively, for several distinct uses and modes of operation, and whether of integral or composite formation, may be considered as consisting of two zones, layers or disks, as f and h , one applied or formed upon the other. The lower and larger zone or layer h also, preferably, has a composite formation, being provided with the surface member h^1 , which I term the sealing-disk or sealing-sheet. This part h^1 should be made of a material or substance adapted for contacting with the contents of the bottle without injury thereto, chemically or otherwise, and in practice this result may be obtained in some cases by treating to a substantial depth the said inner or lower

surface h^1 with a suitable gum or other resistant layer or adhesive, but I prefer to use for this purpose a relatively separate layer having the required resistant quality and also adapted to serve as a strain-sheet for resisting the deformation, which might otherwise become excessive, of the packing-members f and h . This arrangement of the several component layers or zones, f , h and h^1 of the member D, has the further advantage of permitting the use therein of a material of cheaper but more desirable quality,—such as fiber-stock, paper-board or card-board,—and which is more readily and properly moldable while affording sufficient resistance during the setting operation.

In the preferred construction illustrated, the member D may be considered, as to certain features of the combinations, as consisting of a three-layer packing-member comprising a thin, flexible and high-resistance sealing-sheet, h^1 , forming the lower layer and of a diameter covering the three zones, b^2 , d and b^3 of the bottle-face C; a second layer, h , consisting of a relatively low-resistance packing-disk of moldable fiber applied on said sealing-sheet and having its outer molding-zone, z^1 , of a diameter substantially equal to said sealing-sheet or disk; and a third layer consisting of a relatively low-resistance forcing-disk, f , on said second layer and of a diameter for only extending over an inner zone, b^3 , which is preferably substantially one-third of the total radial width of the three bottle-face zones. Thus, when arranged substantially as described, there will be formed in the fully-applied packing-member, two pressure-rings of which one is a relatively thin outer-ring and the other is a relatively-deep inner ring, and between those two pressure-rings, a space-zone, or zone of low-compression, located over the middle zone d of the bottle face, whereby the sealing-action is concentrated on the bottle-face upon non-contiguous concentric zones.

During the formation of the inner pressure ring n^3 , Fig. 4, and until this ring is well advanced, the upper disk f operates as a forcing member or disk for driving downwardly the central portion of the sealing-layers, h , h^1 , while the outer zone z^1 (Fig. 4) of these layers is still free of any substantial compressive force, and is therefore readily conformable to the conditions produced by that forcing action. But later, after said inner ring n^3 is nearly formed, the cap-flange N draws down upon the outer edge of said zone z^1 , and by a sliding and compressive action thereon forces said packing zone or flange against the bearing-line b^2 , and thus draws and forms said zone or flange z^1 outwardly and downwardly, in opposition to the forces operating to form said inner ring n^3 . This peculiar action has

the effect of first seating the packing disk firmly against the inner bearing b^3 , then drawing or wrapping that disk over the medial zone d of the curved face C, and finally seating the outer edge z^1 firmly against said outer bearing-line b^2 . Thus the said pressure-rings, n^3 and n^2 , are begun in succession but are completed substantially simultaneously. In this operation the disk h is subjected simultaneously to the sealing-pressure and to a diametrical contraction from a larger initial dimension; this tends to produce an inwardly sliding action between the contacting surfaces of the sealing-disk and the bottle face C in both the outer and the inner sealing or high pressure zones b^2 and b^3 , and thus tends to draw the sealing sheet, while under an increasing pressure, into a perfect fit or contact over the whole area of the contacting surfaces.

The diameter desirable for the lower disk h , in order that its outer zone z^1 may properly wrap down over the bearing b^3 , is such as naturally to make this disk edge impinge within the flange N of the cap M, when the parts are assembled ready for setting, as illustrated in Fig. 2. This initial excess-diameter of the zone z^1 over the inside diameter of the flange N, provides for a prior assembling of the caps M and disks D, so the closure may be handled by the bottling operators, and in machines, as a single article. Also, this pre-assembling in that manner of the parts M and D, especially when under an engagement forcible enough to normally hold them together while large numbers are handled in bulk, provides for supplying the closures to the trade as a complete article of manufacture, and in condition ready for use. In practice, the caps M and packing disks D may be thus pre-assembled by hand, but they are also adapted to be assembled together by automatic machines at an extremely low cost. When the disk h has the lower part thereof formed of the strain-sheet, or specially prepared sealing-sheet, h^1 , only this part of said lower disk need have the described retaining engagement with the cap M; this feature is illustrated in Fig. 3. In this preferred construction, I preferably use for the layer h^1 , a sheet of fiber stock of the kind now usually known as "vulcanized-fiber", combined (by an adhesive or otherwise) with the upper layer h (Fig. 3) of unvulcanized fiber stock or "paper", of a consistency suitable for being molded and reduced under the setting-pressure to about one-half its initial thickness, and thus be transformed into the outer pressure-ring, n^2 , Fig. 5.

During the process of formation of the inner pressure-ring (see Fig. 4) by the gradual descent of the cap M from the position shown in Fig. 3 to the position shown in Fig. 5, the annular zone m^1 of the cap-

top bears first downwardly upon the outer zone z^2 of the packing-layer f (see Figs. 3 and 4) and is next re-shaped by the continued descent of the cap-rim for directly coacting with the bearing zone b^3 of the bottle-face C, and thus subject the said zone z^2 of the packing member D to simultaneous vertical and diametrical compression. This feature is illustrated in Fig. 8, where the resistance to that diametrical compression is indicated by the arrow e , and the downward compressive action by the arrow e^1 , so that the arrow e^2 which thus divides the angle of said arrows e and e^1 , represents the resultant line of force by which the effective pressure is normally exerted directly upon and substantially vertical to the tangential line t^3 of the bearing-zone b^3 . Thus the pressure-ring n^3 , as finally completed by and during the setting operation, has normally an outwardly-expansive tendency which actively tends to force such pressure-ring outwardly after the manner of a wedge, between and against the angularly-disposed faces or zones m^1 and b^3 and tends to do this in such a way as to keep a relatively high-pressure on said ring n^3 , when,—as frequently happens in practice,—the cap recedes upwardly by a slight but material amount when the closure is released from the pressure of a cap-setting mechanism. That take-up action of said ring n^3 is especially favored by the location of the medial low-pressure or space zone d , located between and separating the two pressure-rings n^2 and n^3 , so that an actual diametrical enlargement under normal conditions of said inner pressure-ring n^3 does not necessarily or usually require any corresponding enlargement of the outer pressure-ring n^2 , nor involve a material amount of slipping, if any at all, of the said outer ring n^2 upon the bottle face C.

By reason of the drawing down as above described of the outer zone m^1 , it will now be evident that when an upward pressure (as from gases forming within the bottle) is applied to the lower side of the complete closure, such upward pressure, acting through the relatively uncompressed and therefore relatively mobile inner portions,—as at y , y^1 , Fig. 5, of the packing disks f and h ,—will tend, through a compression of those portions, to diametrically enlarge the same and thus tend in a measure to force outwardly the pressure zone n^3 (see Figs. 4, 5 and 8) in a manner to make this zone "wedge in" more tightly (through such tendency to outward movement) between the said inner seal-bearing b^3 and the said upper-inclined zone m^1 . In this operation, and under the conditions indicated, the said pressure zone n^3 , as will now be evident, acts after the nature of a circular, expandible wedge, and this action tends,—and tends in

a very material degree, I apprehend,—to preserve against impairment a completely effective sealing pressure on the said inner seal-bearing b^3 of the bottle face, notwithstanding there may be some tendency of the cap to slightly retract upwardly in cases where the closure is maintained for a long period of time. The peculiar wedging action to which I have referred, naturally is in opposition to, and corrective of, that peculiar action of the cap itself which results from the stress due to the completing of the formation of the cap during the setting operation, and of any resiliency in the metal of the cap resulting from the deformation (or rather the re-formation) of the cap during the setting operation.

The operation of the closure members as between each other, gives focal points or bearing points and lines-of-force ("triangulation" lines) according to a system which is illustrated in Fig. 7, and to which, I apprehend, the high practical efficiency of the closure may be largely due. From the anchorage 3 (on the face k) in the diagram, Fig. 7, the tension line, or line of force, 4, extends directly upwardly to the outer focal point 5, which is located on a line l^1 , this line being vertical to the outer bearing-line b^2 , this bearing line or surface forming the basis of resistance against the further inward movement, or downward movement, of the said focal point 5. The tension line next turns toward the upper focal point 7, as indicated at 6, the point 7 being on a line, 8, extending downwardly to the inner bearing line or zone b^3 ; from the point 7 the tension line, as 9, extends directly across the closure and connects at the point 7' with the similar system of triangulation lines on the opposite side of the closure. Thus the several opposing forces, as between the triangulations on opposite sides, respectively, of the closure, when observed in sectional view as in Fig. 7, together constitute a complete system in which the elements on one side of such a sectional plane co-act directly with and against those on the opposite side, thereby forming a complete balance of those forces, and effecting in the completed closure a co-action of all of the elements thereof in a most complete and effective manner.

In some instances, if preferred for economizing material or otherwise, the material in the central portion of the upper disk f (about one-half the diameter thereof, as at f^2 , Fig. 2,) may be removed or omitted, especially if, for some particular service, a greater diametrical contraction of this disk may be desired; and, similarly, such a central portion, as h^3 , Fig. 2, of the lower zone or disk h may be omitted, especially in cases where a strong lower sheet h^1 is employed, but for general use I prefer the disks or zones f and h to be unperforated

or at least to have one of them (preferably the zone *h* in such a case) continuous over the entire diameter thereof.

A plurality of concentric bearing zones combined with a cap having separate packing members for the respective zones, constitutes in part the subject matter of my co-pending application Serial No. 580,309 filed Sept. 3, 1910, in which a modification of my present invention is described and claimed.

Having thus described my invention, I claim—

1. In a bottle closure of the class described, the combination with the bottle top having the curved upper face and a lock-rim for engaging the metal cap, and having in said upper face three zones comprising a medial top-zone between two oppositely inclined concentric bearing-zones, and with a metal cap having the crown disk and having the depending outer flange provided on its lower edge with lock-rim-engaging locking-on means, of a packing member comprising a lower packing disk of a diameter greater than the outer diameter of said medial top-zone, and an upper forcing member of a diameter corresponding with the inner diameter of said medial zone, whereby during the setting operation, the formation of an inner pressure-ring over said inner bearing-zone is begun in advance of the forming of the outer zone of said lower-disk into an outer pressure-zone bearing on the said outer bearing-zone.

2. In a bottle closure of the class described, the combination with the bottle top having the curved upper face and a lock-rim for engaging the metal cap, and having in said upper face three zones comprising a medial top-zone between two oppositely inclined concentric bearing-zones, and with a metal-cap having the crown disk and having the depending outer flange provided on its lower edge with lock-rim-engaging locking-on means, of a packing member comprising a lower packing disk of a diameter greater than the outer diameter of said medial top-zone, and a forcing member of a diameter corresponding with the inner diameter of said medial zone, and having said members forming a low-pressure zone located in the fully-compressed packing-member directly over the middle zone of the bottle-face and between the said two concentric high-pressure bearing zones.

3. In a bottle closure of the class described, the combination with the bottle top having the curved upper face and a lock-rim for engaging the metal cap, and having in said upper face three zones comprising a medial top-zone between two oppositely inclined concentric bearing-zones, and with a metal-cap having the crown disk and having the depending outer flange provided on its lower

edge with lock-rim-engaging locking-on means, of a packing-member comprising a flexible relatively unmoldable sealing-disk of a diameter for engaging in the unset-cap for holding these parts assembled before setting; a moldable disk having an outer molding-zone bearing on said sealing-disk and corresponding substantially in diameter therewith; and a central forcing-disk having a diameter corresponding with the inner diameter of the molding-zone of the larger moldable disk, whereby on the complete setting thereof the closure has an annular low pressure-zone located in the fully-applied packing-member between two concentric annular high-pressure zones.

4. In a bottle closure of the class described, the combination with the bottle top having the sealing-face and a locking-on rim for a metal cap, and having in said face three zones comprising a medial top-zone between an outer bearing-zone and an inner bearing zone, of a three-layer packing-member comprising a thin, flexible and high-resistance sealing-sheet forming the lower layer and of a diameter covering said three zones of the bottle-face; a second layer consisting of a relatively low-resistance packing-disk of moldable fiber and having its outer zone on said sealing-sheet, and having a diameter substantially equal thereto; and a third layer thicker than said second layer and consisting of a forcing disk having a relatively low-resistance to compression and a diameter extending over said inner bearing-zone, and a metal cap arranged for bearing down on the forcing disk and thereby also compressing the outer zone of said first and second layers into a pressure-zone against the outer zone of the bottle-face, with a low-compression zone between said bearing zones.

5. In a bottle closure of the class described, the combination with the bottle top having the curved upper face comprising a medial top-zone between two oppositely inclined annular bearing zones, of the three-layer packing member D, it comprising a thin, flexible and high-resistance sealing-sheet forming the lower layer and of a diameter covering said three zones of the bottle-face; a second layer consisting of a disk of moldable fiber on said sealing-sheet and of a diameter substantially equal thereto; and a third layer consisting of a forcing-disk located above said second layer and of a diameter extending over the inner said bearing-zone, and a metal cap bearing down on the forcing disk forming an inner high pressure-zone, and compressing the outer zone of said first and second layers into a high pressure-zone for bearing against an outer zone of the bottle-face, and with an annular low-pressure zone between said high pressure-zones.

6. In a bottle closure of the class described,

the combination with the bottle top having the curved upper face and a locking-on rim for a metal cap, and having in said upper face three zones comprising a medial top-zone between two oppositely inclined bearing-zones, and with a cap having the crown disk and a depending outer flange provided on its lower edge with locking-on-means, of a packing member comprising a lower packing disk of a diameter greater than the outer diameter of said medial top-zone, and a forcing member of a diameter corresponding with the inner diameter of said medial zone, whereby to form in the fully applied packing-member a low-compression zone directly over the medial top-zone of the bottle-face, and for forming a relatively thin and high-compression pressure-zone of the outer-zone of the packing-member against the downwardly inclined outer zone of said face and outside of the medial zone thereof; and in said packing-member forming a relatively deep pressure-zone against and directly above the downwardly inclined inner zone of said face, and inside of the medial zone.

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