United States Patent

[11] **3,549,038**

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[33] **Germany**
[31] **1,607,857**

[54] **CAP WITH FRANGIBLE PORTIONS**
10 Claims, 5 Drawing Figs.

[52] **U.S. Cl.** **215/41,** 215/42, 215/56, 215/99
[51] **Int. Cl.** **B65d 41/22,** B65d 41/20, B65d 41/24
[50] **Field of Search** 220/66, 44; 215/41, 56, 42, 99, 40

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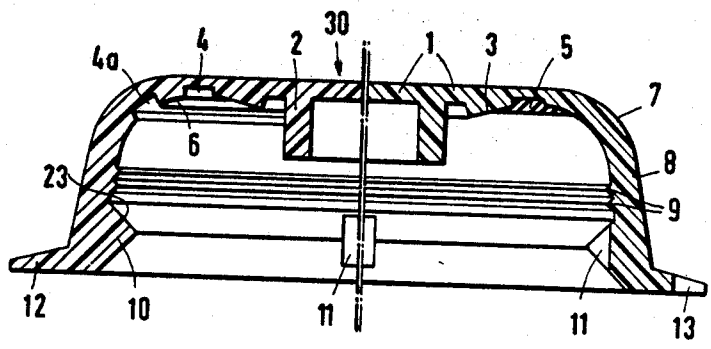
ABSTRACT: A dish-shaped bottle cap of an elastic material and having an internal peripheral retaining bead for fitting underneath the lip of a bottle mouth to form a closure on the bottle, the bead being provided with a recess to permit the bead to stretch under excess pressure applied to the cap from within the bottle and form an escape path for release of the pressure.



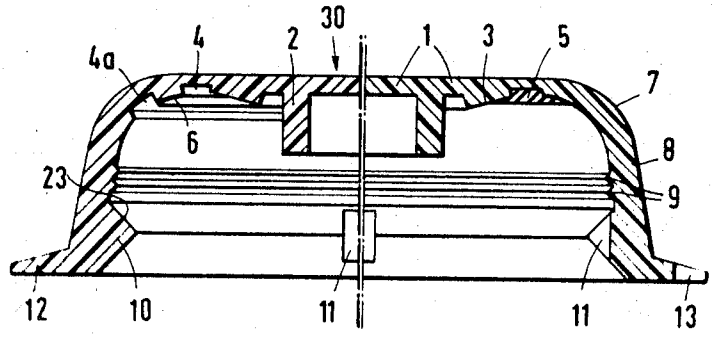


FIG. 1

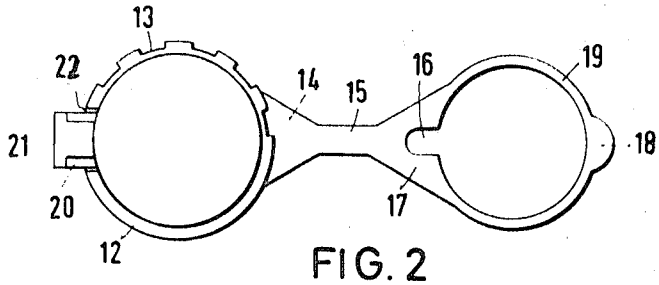


FIG. 2

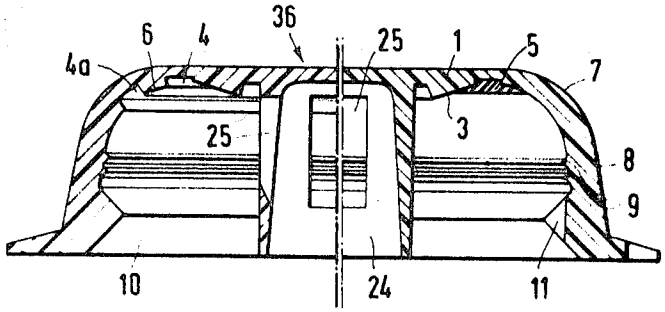


FIG. 3

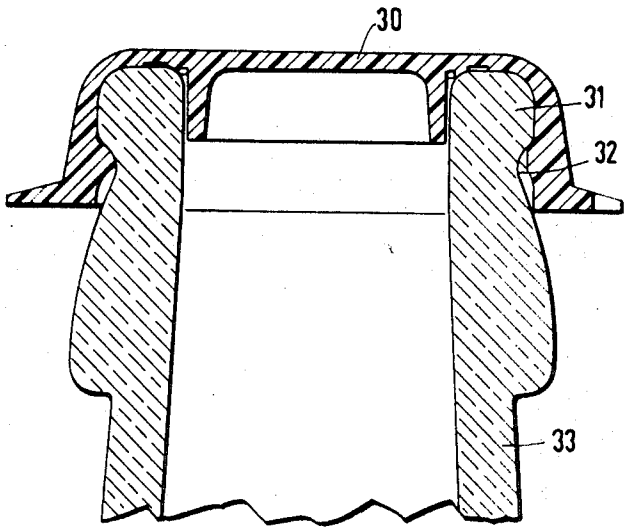


FIG. 4

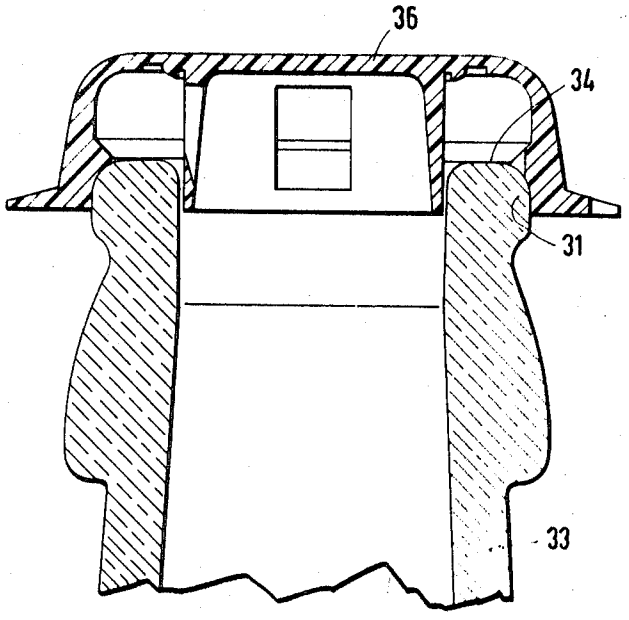


FIG. 5

CAP WITH FRANGIBLE PORTIONS

BRIEF SUMMARY OF THE INVENTION

The invention relates to a dish-shaped bottle cap made of an elastic and preferably thermoplastic synthetic material and provided with a peripheral retaining bead which engages underneath the lip of the bottle mouth and bears against said lip to form a tight seal. More particularly, the invention relates to bottle caps for sealing bottles containing liquids under pressure, i.e. bottles containing beverages charged with carbon dioxide dioxide such as beer and the like.

A major drawback of conventional closures for bottles of the above-described kind is that they are incapable of sealing more than a small pressure inside the bottle. The pressures that usually arise in soda bottles, beer bottles and in bottles containing other beverages charged with carbon dioxide, frequently cause such bottle caps to blow off. When bottles closed with such caps are shaken during transportation or when they are stored in a warm place the majority of the caps tend to blow off.

In order to overcome this difficulty, stoppers which have an externally bulbous shape and which are forced into the bottle mouth under compression have already been used for closing such bottles. However, the hollow cylindrical part of such stoppers, which extends into the bottle mouth, prevents the bottles from being afterwards easily opened. Moreover, the stoppers are also 2 difficult to replace on the bottles because their sharp-edged plug portions are readily deformed or squashed when an attempt is made to force them back and the stoppers then become useless. Furthermore, even when this type of stopper is used, the percentage of stoppers that blow off during transportation and in unfavorable conditions of storage is still impermissibly high.

It is therefore an object of the present invention to provide a bottle cap of the above specified kind which furnishes a satisfactory permanent closure even for bottles containing effervescent drinks, and which can also be used for reclosing such a bottle and to reestablish a tight seal.

Although a conventional dish-shaped closure can also be placed on a bottle after it has been opened, its shortcoming is that it fails to keep the bottle reliably closed against the internal pressure existing before the bottle is opened for the first time.

Naturally the cap could be prevented from being blown off by the internal pressure by making it sufficiently large and strong. However, in practice this involves considerable difficulties.

In order to overcome the troubles that have been described, the present invention is based on the fundamental concept that the cap be constructed so that it will limit the internal pressure to a desired level.

Consequently a bottle cap according to the present invention is characterized by the provision in the retaining bead of the cap of at least one recess which permits the cap to function as a relief valve for any excess pressure existing inside the bottle. If the pressure inside a bottle closed by a cap according to the present invention is raised excessively, for instance by shaking the bottle in a warm environment, then the pressure buildup will cause arching of the elastic material forming the top of the cap and simultaneously slightly lift the entire cap off the top of the bottle mouth. At the same time the cap will be slightly expanded radially at the level of the lip of the bottle so that the space containing the internal gas pressure is extended as far as the sealing bead on the inside of the sidewall of the cap. When the cap has been lifted by the pressure as has been described, the retaining bead is slightly stretched and participates in the upward motion. This brings the recess in the retaining bead into communication with the interior of the bottle and allows gas to escape to the outside until the undesired excess pressure has been reduced by the valve like action of the cap. When this is achieved, the cap will resume its former position in which it completely seals the bottle interior.

Contamination of the bottle interior is precluded since the valve action of the cap prevents gas or liquid from entering the bottle from the outside.

A suitable material for such a cap according to the invention is polypropylene or the like.

Although the provision of a single recess in the retaining bead would be sufficient, it is nevertheless preferred to provide several recesses equidistantly spaced around the entire periphery of the retaining bead. This insures that the loads will be completely symmetrically distributed in the cap. Moreover, when the valve action begins, the cap will lift by the same amount all around its periphery.

Preferably, the cap makes sealing contact with the top of the lip on the bottle, as is conventional. The above-described construction of the retaining bead provides means for adjusting the lifting effect so that this will take place when the internal pressure in the bottle reaches a desired level. Furthermore, the seams in a glass bottle which are formed by the divided mold are least pronounced on the upper surfaces of the lip of the bottle mouth, so that the desired sealing effect is here most easily achieved. Naturally, in principle, it would also be possible to locate the seal in the region of the sidewalls of the cap instead of facing the top of the lip of the bottle mouth. However, it is preferred, as above stated, to locate the seal in the latter position. If desired, additional annular sealing ribs may also be provided on the inside of the sidewall of the cap, said seals making tight contact with the lip of the bottle mouth. Such sealing ribs will then also operate to keep the path to the recesses in the retaining bead closed until the cap has also been radially expanded by a given amount. They therefore are rather thin.

In order to is insure that the loads are distributed as symmetrically as possible in the cap, the top of the cap is preferably formed with a concentric stiffening reinforcement. Conveniently, this may have the form of a hollow cylindrical flange projecting from the interior of the top of the cap and having an external diameter that is less than the internal diameter of the bottle mouth.

For strengthening the retaining bead, the sidewall of the cap is preferably provided on the outside, at the same level as the retaining bead, with a peripheral supporting flange. In order to insure that the elastic elongations which occur when the valve action of the cap begins, are within the prescribed limits of deformation, the supporting flange is conveniently slightly offset in the axial direction from the retaining bead, namely in the direction away from the top of the cap. If, as is preferred, the cap is provided with a press-off tab, it is useful to provide the supporting flange in the vicinity of the press-off tab with at la least one weakened portion where the flange will preferentially break. If the cap is then opened by making use of the press-off tab, the weakened portion will fracture. A vendor can thus always warrant that the bottle has not been previously opened if the flange shows no signs of having been damaged. Irrespectively of whether such a press-off tab is provided, the supporting flange may be formed with a plurality of projecting peripheral projections which will likewise be damaged when attempt is made to lift off the cap with the aid of a bottle opener.

Preferably, the recesses in the retaining bead are inwardly rounded. This makes for a better distribution of the strain in the retaining bead.

With advantage, a cap according to the invention may in conventional manner be provided with a retaining ring which embraces the bottleneck.

The sealing element which bears against the top of the lip of the bottle mouth is conveniently contained in an annular recess in the top of the cap. It may be prefabricated or molded into the cap.

Care is indicated when bottle bottles are closed with caps according to the invention, in order to assure that the caps, after having been applied to the bottle and before being pressed home, that is to say before the retaining bead snaps into engagement underneath the lip of the bottle mouth, do

not tip over to one side or the other or fall off completely. If importance is attached to the possibility of the caps being affixable with less care, then this requirement can be met by extending the hollow cylindrical flange on the underside of the top of the cap at least approximately down to the level of the plane defined by the bottom edge of the cap, and by providing the cylinder with at least one window adjacent its junction with the underside of the top of the cap. The hollow cylindrical flange will then serve as a guide means for the cap during its application onto the mouth of the bottle, the cylindrical flange pulling the cap into central alignment when it has been inaccurately applied, and preventing the cap from tipping over to one side. The window in the cylindrical flange permits air trapped inside the cylinder to escape when the cap is pressed home over the mouth of the bottle. This facility avoids an undesirably large volume of air from being occluded in the interior of the bottle when the cap is closed. The occlusion of air would usually adversely affect the quality of the contents of the bottle, normally a beverage.

Another substantial advantage of this form of construction is that subsequent pasteurization of the bottle contents can be dispensed with, provided the bottle (and naturally this applies also to the cap and contents of the bottle) are sterile before the bottle is closed. By making the liquid foam slightly, all of the air above the surface of the liquid can be expelled from the bottle during the affixiation of a cap according to the invention. This is a matter of some importance, particularly in the bottling of beer.

The invention also relates to a bottle that has been closed with a cap as proposed.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a sectional view of a bottle cap according to the invention, the type of seal so shown on the left-hand side of the drawing differing from that shown on the right;

FIG. 2 is a plan view of a different embodiment of the bottle cap;

FIG. 3 is a sectional view similar to FIG. 1 of another embodiment of a bottle cap according to the invention;

FIG. 4 is a longitudinal sectional view of a bottle which is closed with a cap according to FIG. 1; and

FIG. 5 is a longitudinal section of a bottle on which a cap according to FIG. 3 has been applied but not yet installed in closing position.

DETAILED DESCRIPTION

The bottle cap **30** in FIG. **1** has a thin-walled top **1** which in the region of the inside of the bottle mouth is formed with a cylindrical flange **2** that serves as a strain regulator. The thin-walled part of the top merges into an annular sealing ring **3** which has an inner diameter that is less than the lower limit of tolerance for the internal diameter of the bottle mouth. The sealing ring **3** is thickest adjacent its inside edge and diminishes in thickness radially outwards.

The outer periphery of the outwardly tapering cross section of the sealing ring **3** may adjoin a peripheral dovetail-shaped groove **4** for the reception of a sealing compound **5** tightly pressed into the same, as shown in FIG. **1** on the right side thereof.

In an alternative arrangement, shown in FIG. **1** on the left, two concentric dovetail-shaped grooves **4***a* may be provided, the outer edge of the inner groove and the inner edge of the outer groove descending further downwards and thus defining an additional sealing face **6** between the two grooves. The top **1** of the bottle cap merges through a rounded transition **7** of a radius exceeding that of the bottle mouth into the sidewall **8** of the cap which defines an obtuse angle with the top **1**. Inside the sidewall, one or more thin peripheral ribs **9** are provided below the rounded transition **7**.

The bottom part of the sidewall **8** is formed on the inside with a retaining bead **10** which engages the underside of the lip **31** of the bottle as shown in FIG. **4**, and which has a profile defined by a straight side projecting at an angle of 45° away from the sidewall **8** of the cap and by a second straight side extending from roughly the center of the bead back again at an angle of about 45° to the sidewall of the cap, thereby to locate the cap centrally when it is applied to the top of the bottle. The retaining bead **10** is provided at equidistant intervals around its periphery with a number of recesses **11**. The outside of the sidewall **8** of the cap is provided with a peripheral supporting flange **12** which extends horizontally from the bottom edge and which may be formed with radially projecting teeth or projections **13**.

In the embodiment according to FIG. **2** the peripheral supporting flange **12** has a delta-shaped extension **14** which, by means of a narrow elastic central band-shaped web **15** merging into a delta-shaped member **17** with a slot **16**, connects the bottle cap with a retaining ring **19** formed with a tab **18**.

In this latter embodiment, it is preferred to provide on the side of the cap which is diametrically opposite the delta-shaped extension **14**, a press-off tab **21** formed with two reinforcing ribs **20**.

The underside of this press-off tab may be connected on both sides by a thin filmlike web **22** with the supporting flange **12** so that this web will break when the bottle is opened for the first time with a bottle opener or the like. The supporting flange is thus broken and its resistance is thereby reduced when the cap is removed a second time.

When the bottle cap is pressed over the mouth of a bottle **33** to assume the position shown in FIG. **4** and the retaining bead **10** engages a corresponding groove **32** in the bottleneck, the rounded transition **7** of the cap is pressed outwardly and the thin-walled part **1** of the cap is stretched to permit the sidewall of the cap to adapt itself to the external contour of the lip **31** of the bottle.

The cylindrical flange forming the strain regulator **2** on the underside of the peripheral edge of the peripheral edge of the thin-walled part **1** has the effect of evenly distributing the strain of the cap around its entire periphery and of preventing the cap from being unevenly stressed. The full engagement of the retaining bead **10** with the groove **32** in the bottleneck when the cap is secured, pulls the annular sealing face **3** against the end face **34** of the bottle mouth in such manner that the inner thicker section part of the annular seal bears tightly against the inside edge of the bottle mouth, whereas the tapering outer edge of the annular seal is pressed against the seam in the bottle mouth which is formed by the divided mold used for making the bottle. The thickness of the annular seal that is pressed against the bottle mouth causes the thin top part **1** of the cap to be further stretched and, due to the presence of the cylindrical strain regulator **2**, this has the effect of inwardly arching the top part **1** of the cap inside the diameter of the strain regulator and thus improving the press fit of the annular seal.

When the rounded transition **7** arches and adapts itself to the radius of the bottle lip, the sealing compound **5** tightly contained in the groove **4** is pressed against the bottle mouth and by its elasticity also forms a seal across the bottle seam which extends longitudinally down the side of the bottle mouth.

In the embodiment illustrated in FIG. **1** on the left which comprises two dovetailed grooves **4***a* which are formed with inner edges that extend further downwards and thus define additional sealing face **6**, the latter possesses sufficient elasticity to seal the mold parting seam at the bottle mouth without the provision of a sealing compound. This latter arrangement is intended for bottle caps that are to be used for bottles containing pasteurizable liquids, and that may therefore be made of a cheaper soft plastic material.

An additional sealing effect may be provided inside the sidewall **8** of the cap by the peripheral sealing ribs **9** which are so shaped that the tension of the sidewall will cause the seams running down the sides of the bottleneck to press into the sealing ribs and thus to insure the creation of a tight seal.

The retaining bead **10** with the recesses **11** is so formed that is its most constricted portion does not make contact with the groove in the bottleneck and only its upper face **23**, which is inclined at an angle of 45°, is urged against the underside of the bottle lip.

The thin but wide peripheral supporting flange **12** at the bottom end of the sidewall **8** has the effect of a clamping strap which embraces the bottom, otherwise unsupported edge of the retaining bead, and thus prevents the bead from being excessively stretched.

In the embodiment according to FIG. **2** which can also be used as a duplicate closure, the supporting flange merges with the thin delta-shaped extension **14** which is so formed that the retaining bead **10** is not unilaterally excessively loaded within a small part of the circumference of the cap, thereby eliminating any risk of the closure being forced off its seat by rising internal pressure. By attaching the delta-shaped extension to an angular region of about 60° along the periphery, the embracing grip of the supporting flange on this side is improved and the opening thrust generated by the flexure of the narrow elastic band-shaped connecting web **15** is thus compensated.

The slot **16** in the delta-shaped member **17** permits the retaining ring **19** to be more easily pushed over the bulges on the bottleneck and a good fit of the retaining ring **19** to be assured when this is in its proper position. The broad configuration of the delta-shaped member **17** insures that the slot **16** which opens during the process of slipping the retaining ring over the bottleneck will automatically later reclose. Apart from technical requirements which arise in production, the purpose of the tab **18** is to reinforce that part of the ring which is principally stressed when under accidental load so that the ring will not break unless torn off with the intentional application of considerable force.

The bottle cap **36** in FIG. **3** is of similar construction to that illustrated in FIGS. **1** and **2** with the exception of the configuration of the cylindrical internal flange. The same reference numerals are therefore used to identify the same parts.

The central cylindrical flange **24** in the cap **36** according to FIG. **3** extends to the bottom edge of the cap. Its diameter is slightly less than the internal diameter of the bottleneck and at most equal thereto. The cylindrical flange **24** contains three windows **25** through which air trapped inside the cylinder **24** and possibly also inside the bottle can escape when the cap is pressed into position. As seen in the drawing, the upper edge of the window **25** is straight, whereas the bottom edge slopes downwards and obliquely from the outside to the inside of the cylinder **24**. This arrangement insures that in practice all the air trapped inside the cylinder **24** can escape when the cap **36** is pushed onto the bottle **33** from the position shown in FIG. **5** into the seated position shown in FIG. **4**. It also facilitates molding of the cap during production since the core which fills the window can be more easily extracted by pulling it down the sloping bottom edge and elastically slightly expanding the cylinder **24**.

The air which escapes from the interior of the cylinder through the window **25** and any additional air expelled by foam formed by the bottle contents, as well as the foam itself, can pass through the space between the top **1** of the cap and the bottle mouth and the recesses **11** until the cap **36** has assumed its final position engaging the bottle neck, at which time the retaining bead **10** embraces the lip **31** of the bottle and completely seals the bottle. The cap **36** is then in the same position as that of the cap **30** in FIG. **4**.

When the a cap **36** is being applied to the top of the bottle, the cylinder **24** guides the cap as it is pressed down and thus prevents it from tipping to one side or the other under the pressure which is applied.

If the pressure inside a bottle, provided with a cap according to the invention, is raised by the evolution of carbon dioxide gas which collects under pressure in the small available space above the level of the liquid inside the bottle, then this pressure will act on the entire interior of the cap formed with the cylindrical flangelike strain regulator **2**. The cap cannot be lifted at only one side because the stresses are evenly distributed, as has been described. Moreover, the cylindrical strain regulator **2** or the cylinder **24** keeps the cap **1** straight.

The cap **1** which contains the strain regulator **2** or the cap **36** with the cylinder **24**, transmits any internal pressure exceeding that which it is designed to seal, to the rounded cap wall which joins the top at an obtuse angle, and thus lifts all the sealing elements in the top of the cap off the mouth of the bottle. The sealing compound **5** that has been pressed into the groove is likewise unable to maintain contact with the bottle because it is firmly anchored in the annular V-section groove **4**.

On the other hand, the sidewall of the cap will transmit the tensile force to the retaining bead **10** which under the overload begins to stretch and to slip upwards on its 45° sloping upper face which bears against the outside of the bottleneck Hence, the sealing ribs **9** of the sidewall **8** are likewise lifted off the bottle and thereby open a path for the gases to escape through the recesses **11**.

The supporting flange **12** which cannot readily expand prevents the bead from expanding too quickly and, as soon as the inadmissible overpressure has been relieved, the flange cooperates with the bead to return the cap to its former position without delay. All the sealing elements are simultaneously restored to their fully effective positions.

All the embodiments of the proposed bottle cap also provide a warranty that the bottle still has its original contents. In the embodiment of the cap provided with the press-off tab **21**, the fact that the thin web **22** is undamaged indicates that the cap has not been tampered with, whereas in the other embodiment, this is indicated by the supporting flange **12** which is necessarily damaged when the cap is opened by the application thereto of a bottle opener from the outside.

I claim:

1. A closure for the mouth of a bottle comprising a dish-shaped cap constituted of an elastic material and including an internal peripheral retaining bead for tightly engaging underneath the lip of the bottle mouth and an external peripheral flange for supporting the retaining bead, said flange being disposed on the outside of the cap opposite the internal retaining bead, said cap being provided with at least one recess forming a gap in the retaining bead to enable the latter to function as a relief valve for excess pressure in the bottle interior, and a press-off tab on said cap, said supporting flange being provided with weakened portions proximate the press-off tab where a said flange is intended preferentially to break.

2. A closure according to claim **1**, wherein the retaining bead is provided with a plurality of recesses spaced equidistantly around its periphery.

3. A closure according to claim **1** comprising an internal ring on said cap for sealingly contacting the rim of the mouth of the bottle.

4. A bottle cap according to claim **1**, wherein the recess in the retaining bead is inwardly rounded.

5. A closure according to claim **1** comprising a retaining ring attached to said cap for embracing the bottleneck.

6. A closure according to claim **1**, wherein said cap has a top provided with an annular recess for the reception therein of a seal.

7. A closure according to claim **1** comprising peripheral sealing ribs on the interior of the sidewall of the cap.

8. A closure according to claim **1**, wherein the supporting flange is provided with a plurality of projections which are damaged when the cap is forced off the bottle.

9. A closure according to claim **6** comprising at least one projecting annular sealing face in the inside surface of the top of the cap.

10. A closure for the mouth of a bottle comprising a dish-shaped cap constituted of an elastic material and including an internal peripheral retaining bead for tightly engaging underneath the lip of the bottle mouth, said cap being provided with at least one recess forming a gap in the retaining bead to enable the latter to function as a relief valve for excess pres-

sure in the bottle interior, said cap further being provided with a hollow cylindrical flange projecting from the inside of the top of the cap and having an external diameter which is smaller than the internal diameter of the mouth of the bottle, a

said hollow cylindrical flange extending approximately to the level of the bottom edge of the cap and having at least one window near its junction with the underside of the top of the cap.