Oct. 22, 1946. E. GREENE 2,409,846

BOTTLE CLOSURE

Filed Nov. 13, 1942

Fig. 1.

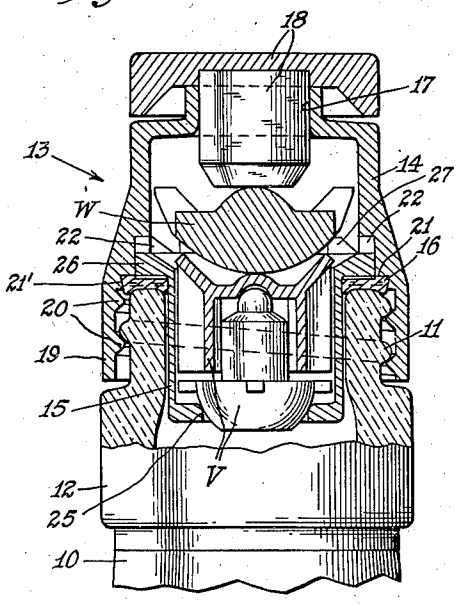


Fig. 5.

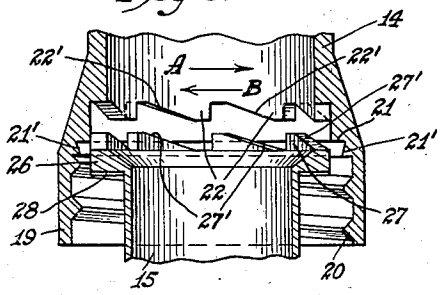


Fig. 7.

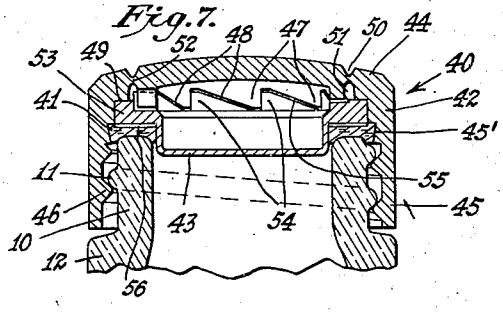


Fig. 2.

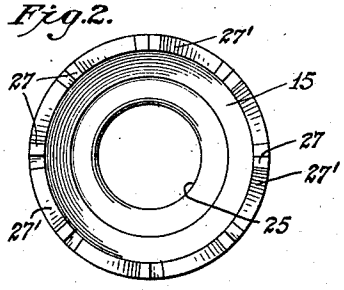


Fig. 8.

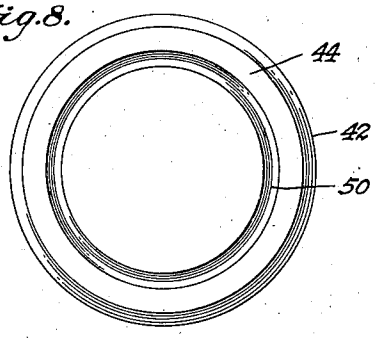


Fig. 3.

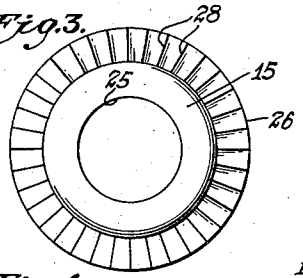


Fig. 9.

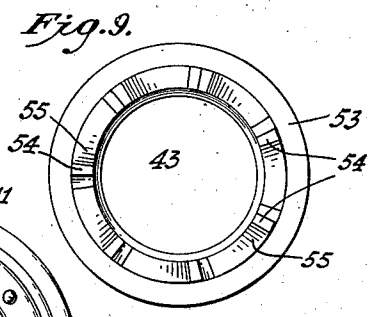


Fig. 4.

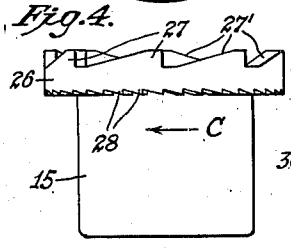
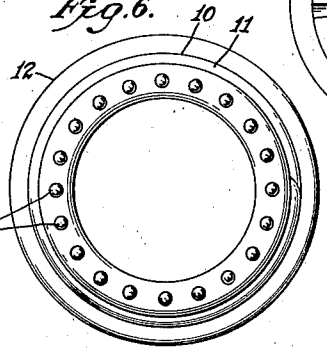


Fig. 6.



INVENTOR.

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BOTTLE CLOSURE

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Application November 13, 1942, Serial No. 465,418

7 Claims. (Cl. 215—22)

1

This invention relates to bottle closures, and particularly to closures for non-removable attachment to bottles or other containers.

An object of the invention is to provide a closure of this character that may be applied to a container without requiring any departure from the standard top threaded finishes in common use on such containers or bottles.

The invention consists in part, of a closure comprising a threaded outer cap member and an inner member, held in asembled cooperative relation as a unit; and another object of the invention is to provide means whereby breakage of the outer cap member is positively induced when forces are applied to unscrew the closure from the bottle.

A further object of the invention is to provide means for preventing the removal of the closure that will operate to increase the grip of the closure on the bottle commensurate with increased forces exerted to unscrew it prior to occurrence of the aforesaid breakage.

A still further object of the invention is to provide a closure of this type that is cheap to manufacture because of its simplicity, relatively few parts, and adaptability to ordinary bottles without, however, adding to its manufacturing cost or difficulty.

Other objects and advantages of the invention will hereinafter be apparent.

In the drawing forming a part of this specification,

Fig. 1 is a central longitudinal section, partly in elevation, of a closure embodying this invention, and showing the same applied to the top of a bottle neck.

Fig. 2 is a top plan view of the inner member of the closure.

Fig. 3 is a bottom plan view of the same.

Fig. 4 is a side elevation thereof.

Fig. 5 is a fragmentary sectional view showing the cooperating parts of the closure members, partially separated for clarity, and particularly illustrating the means employed for inducing breakage of the outer cap member.

Fig. 6 is a top plan view of a modified form of bottle top finish.

Fig. 7 is a view similar to Figure 1, but showing a modified form of the invention.

Fig. 8 is a top plan view of the structure shown in Figure 7, and

Fig. 9 is a top plan view of the inner member of Figure 7.

Referring now in detail to the drawing, 10 indicates a bottle neck having the standard, external, continuous, overlapping, single thread 11 at its outer end which, in conjunction with the usual bead or band 12, is commonly known as the "finish" by manufacturers of glassware.

2

The closure 13 of Figure 1 is adapted for use as protection against illicit refilling of bottles to which it is attached in accordance with this invention. In the form illustrated, the closure consists of an outer cap member 14, a hollow inner member 15, and a gasket 16, the inner member having a portion extending through the central opening of the gasket and, as shown, abutting the wall of the opening. These parts when assembled provide a closure unit constituting a valve housing, and ready to be screwed onto a bottle top. Suitable valve mechanism within said housing is indicated at V, together with weighted means W.

The cap 14 has an outlet opening 17, and a wood-top cork 18 may be utilized to seal the same. The other or lower end of cap 14 is provided with an integral depending skirt part 19 having relatively thin walls formed with internal threads 20 for engagement beneath the thread 11 of the bottle neck. Above threads 20 there is an annular shoulder 21 for engaging the gasket 16, and above shoulder 21 there is provided a plurality of ratchet teeth 22, arranged in a circular row. Each tooth on the cap has a vertical face which leads, when the cap is rotated to mount it securely on the end of the bottle neck. Each tooth also has a surface 22' starting at its free end and sloping backwardly and upwardly with reference to the direction of rotation of the cap. The cap is preferably made of frangible plastic material, such as "Bakelite."

The cylindrical inner member 15, also moulded from plastic material, preferably polystyrene, has an inlet opening 25 at its lower end which is sealed by the valve mechanism V, and at its other or top end, is provided with an annular flange 26 fitting snugly yet freely within the cap 14, so as to extend above shoulder 21. On the top surface of the flange 26 there is formed a plurality of ratchet teeth 27, which are complementary to the teeth 22, but facing oppositely, as indicated by the arrows A and B of Figure 5. Each tooth 27 has a vertical face which trails when the inner member is rotated, and the tooth also has a surface 27' starting at its free end and extending downwardly and forwardly therefrom with reference to the direction of rotation of the inner member. Both sets of teeth are constantly in mesh, that is, no jumping of one tooth over another occurs in the manner that ratchet teeth

are commonly understood to operate, and when the closure is being screwed onto the bottle top, the inner member will rotate wtih the outer cap member in order that the cam surfaces 22' and 27' may remain in a fixed relationship so as to be effective immediately at the desired time.

Beneath shoulder 21 the side wall of the cap is undercut, as at 21', for preventing dislodgement of the gasket 16 when forced therein to hold the inner member 15 from falling away from the cap member 14 before the closure is applied to a bottle. The bottom surface of the flange 26 is preferably provided with ratchet teeth 28 which are relatively shallow, approximately ten thousandths of an inch, and which face the same as teeth 27, and function as supplemental means to prevent counter-rotation of the inner member 15.

It will now be apparent, that as the closure 13 is screwed onto the bottle top 10, the leading vertical surfaces of teeth 22, which are then rotated in the direction of the arrow A (Fig. 5), will bear against the trailing vertical surfaces on teeth 27 and thereby cause the inner member 15 to rotate simultaneously in the same direction. During the rotational movement of the cap, it will be simultaneously moved axially of the bottle neck by the action of the screw threads on the outside of the neck, and, in such axial movement of the cap, it will apply pressure to the gasket both directly and through the inner member. The gasket thus under pressure will frictionally grip the upper surface of the neck and teeth 28 on the inner member will slide over the surface of the gasket. When the cap member has been thus rotated to the desired extent, the pressure applied to the gasket will cause it to prevent leakage between the end of the neck and the closure, and the bottle will be effectively sealed.

However, should an attempt then be made to unscrew the closure, cam surfaces 22' will slide to a limited extent up cam surfaces 27', increasing the frictional grip of the gasket by the resulting downward thrust on flange 26. The teeth 28 will now be tending to move in an opposite or holding direction in which they will grip the now stationary gasket, and prevent rotation of the inner member 15. And since the angle of inclination of the cam surfaces is greater than the helix angle of the bottle thread 11, which in a commercial construction may be three degrees five minutes, components of such counter-rotation forces will be set up in direct opposition to the tensile strength of the threaded skirt part 19 of the cap 14 then restrained by the bottle thread 11; and will be increasingly effective until breakage of the skirt part 19 occurs, thus preventing any re-application of the closure to the bottle.

It will be understood that extraordinary forces are required to cause such breakage, and that the walls of the skirt part 19 are of ample strength to withstand the strain of fully compressing the gasket for the purpose of tightly applying the closure. However, when ordinary forces are applied, the cooperating cam surfaces function as stops for preventing counter-rotation of the cap, while at the same time being effective to build up commensurate pressure against both sides of the gasket to hold the gasket and the inner member stationary on the bottle top.

The material of which the gasket is made, such as cork composition, has a naturally high co-efficient of friction, and the cam surfaces being on smooth plastic material, and sloping at an angle to the horizontal which may be only about fifteen

degrees, operate with a relatively low co-efficient of friction. Furthermore, the area of the contacting cam surfaces is less than that of any other contacting surface employed to hold the gasket and inner member stationary. For these reasons, and regardless of the extent of the counter-rotation forces applied to the cap, the closure cannot be removed intact, because such forces can only act to increase the holding power of the gasket with respect to the bottle top and the inner member of the closure.

If desirable, the cork gasket may be treated, such as with finely powdered rosin, to increase its co-efficient of friction, or it may be coated with a tacky compound for the same purpose. Mechanical means may be employed to anchor the gasket to the bottle top, such as the circular row of dots 30 shown in the modified bottle finish of Figure 6, which project upwardly.

In Figure 7 there is shown a modified form of the invention in the form of a tamper-proof closure 40. It is constructed to be readily applied to a bottle having a threaded top finish and, when first removed therefrom, to leave unmistakable and exteriorly visible evidence that it has been unscrewed to open the bottle. In all other respects it still remains a perfect closure respecting re-application as a seal.

This closure is cheap to manufacture, chiefly because it has but three parts, one of which is a simple gasket 41, preferably made of composition cork. The other members of this closure may be moulded from plastic material, and consist of a cap 42 and an inner member 43. The cap 42 has a crown 44 with an annular skirt 45 depending therefrom which is suitably threaded internally at 46 for engagement with the bottle thread 11. Beneath its crown, and forming an integral part thereof, is a circular row of ratchet teeth 47 which face in a direction corresponding to that of the teeth 22 of Figure 5, and which constitute in effect, a plurality of cam surfaces 48. Surrounding the row of teeth 47, and spaced therefrom, is a shoulder 49 also formed on the under surface of the crown 44. Between shoulder 49 and teeth 47 the crown of the cap is weakened by opposing grooves 50 and 51, so as to provide a zone 52 therebetween relatively thin in cross section.

Member 43 is cylindrical and hollow, resembling an inverted shallow cap the open end of which is provided with a surrounding outwardly extending flange 53 adapted to overlie a bottle top when member 43 is assembled within the cap 42. On top of the flange 53 there is a plurality of ratchet teeth 54, complementary to teeth 47 and normally in constant mesh therewith. The teeth 54, like teeth 47, constitute in effect, a plurality of cam surfaces 55. Beyond the row of teeth 54 the flange 53 is in contact with the shoulder 49, but a slight clearance is provided vertically between the two sets of ratchet teeth, the purpose of which will subsequently appear. Relatively shallow ratchet teeth 56 are formed on the bottom of the flange 53, similar to the teeth 28, and for the same purpose.

Above the threads 46, the side wall of the cap member is undercut at 45' for the snug insertion of the gasket 41, and to prevent its accidental displacement. In this fashion the inner member 43 will be securely held in place within the cap member 42 by the gasket 41 due to the latter being beneath the flange 53.

To apply this closure it is merely screwed down on the bottle top until tight, by turning it in the same direction indicated by arrow A of Figure 5.

During this operation the shoulder 49 will bear against the outer top edge of flange 53, and the teeth 47 will cooperate with the teeth 54 to rotate member 43 with member 42, until the gasket 41 is compressed and its lower face in firm contact with the bottle top 10. In the meantime the teeth 56 will have become embedded in the upper face of the gasket 41.

It will be noted that the resulting thrust of threads 46 and 11 is taken by the shoulder 49 which is substantially in vertical alignment with the plane in which the said thrust is transmitted, and also that such forces cannot place any strain on the weakened zone 52 because of the clearance between the cam surfaces 48 and 55.

Now if an attempt is made to unscrew the closure, these cam surfaces will immediately impose a lift on the center portion of the crown 44, defined by the grooves 50 and 51, and at the same time impart a downward thrust on the flange 53, which in turn, will add to the frictional grip of gasket 41, so that the closure cannot be unscrewed until the zone 52 is ruptured, causing the center of crown 44 to fall away. Following this procedure, the inner member 43 will remain intact, and because in this instance the skirt 45 of the outer member also remains intact, the closure can be re-applied to seal the bottle until such time as it is completely emptied.

It will be understood that counter-rotation forces of only ordinary extent are needed to break the top disk free of the cap, and thereby also remove the teeth 47 from their engagement with teeth 54, so that the cap 42 may be now readily unscrewed together with the inner member 43 and gasket 41.

The cooperating ratchet teeth are not to be taken in a sense of limitation, as the term "ratchet teeth" is intended to be descriptive rather than functional. It is obvious that ratchet teeth on either the cap member or the inner member would answer if the other member be provided with cooperating lugs adapted to ride the cam surfaces, and also effect rotation of both members during application of the closure.

As used throughout the specification and claims, the term "rotation" is intended to mean such movement of the cap member, for example, relative to the neck of the bottle as will cause the cap member to be secured in place on the bottle, and "counter-rotation" is intended to mean such movement of the cap member as would normally release it from the bottle.

The surfaces 22', 27', 48 and 55 have been referred to as "cam surfaces." They may also be regarded as wedging surfaces, since they are potentially effective as such between the bottle top and the outer cap member.

I claim:

1. A closure for sealing an opening through the neck of a container, which comprises the combination of an outer cap member adapted to receive the end of the neck and having means engageable beneath external means on the neck, upon rotational movement of the cap member, to hold the cap member in place on the neck, an inner member within the cap member of greater overall diameter than the neck opening, gasket means beneath the inner member and engageable with the end of the neck, the gasket means being capable of resisting slippage on the neck when under pressure, and interengaging projections on the cap member and inner member, the projection on the cap member having a vertical face, which leads during rotation of the cap

member, and a face sloping upwardly and rearwardly from the outer end of said vertical face, and the projection on the inner member having a vertical face, which trails during rotation of the inner member, and a face sloping downwardly and forwardly from the outer end of said vertical face, the vertical faces of said projections positively engaging upon rotation of the cap member to cause the inner member to rotate therewith and the sloping surfaces of said projections having sliding engagement during counter-rotation of the cap member, whereby the cap member is urged away from the inner member against the resistance of said external means on the neck.

2. A closure for sealing an opening through the neck of a container, which comprises the combination of an outer cap member adapted to receive the end of the neck and having means engageable beneath external means on the neck, upon rotational movement of the cap member, to hold the cap member in place on the neck, an inner member within the cap member of greater overall diameter than the neck opening, gasket means beneath the inner member and engageable with the end of the neck, the gasket means being capable of resisting slippage on the neck when under pressure, and interengaging projections on the cap member and inner member, the projection on the cap member having a substantially vertical face, which leads during the rotation of the cap member, and the projection on the inner member having a substantially vertical face, which trails during rotation of the inner member, at least one of the projections having a face sloping upwardly in the direction of counter-rotation of the cap member, the vertical faces of said projections positively engaging upon rotation of the cap member to cause the inner member to rotate therewith and the sloping surface of said projection having sliding engagement with the other projection during counter-rotation of the cap member, whereby the cap member is urged away from the inner member against the resistance of said external means on the neck.

3. A closure for sealing an opening through the neck of a container, which comprises the combination of an outer cap member adapted to receive the end of said neck and having means engageable beneath external means on the neck, upon rotational movement of said cap member, to hold the cap member in place on the neck, an inner member within the cap member and of greater overall diameter than the neck opening, and gasket means between the inner member and the end of the neck, the gasket means being capable of resisting slippage on the neck when under pressure, said inner member being constructed and arranged to rotate with the cap member to be brought into sealing engagement with the gasket means, said cap and inner members having cooperating integral parts having opposed surfaces so constructed and positioned that, upon rotation of the cap member, they engage positively and cause the inner member to rotate with the cap member, the cap member being simultaneously urged by said external means to force the inner member against the gasket means to apply pressure thereto, said cooperating integral parts also having other opposed surfaces, at least one of said other opposed surfaces of at least one of the parts being inclined in such direction and at such an angle that upon counter-rotation of the cap member said other opposed surfaces engage and slide relative to one another and cause the

part on the cap member to move angularly and outwardly relative to the part on the inner member and the parts simultaneously to apply force to the cap member tending to move it away from the inner member against the resistance offered by said external means on the neck.

4. A closure for sealing an opening through the neck of a container which comprises the combination of an outer cap member adapted to receive the end of said neck and having means engageable beneath external means on the neck, upon rotational movement of said cap member to hold the cap member in place on the neck, an inner member within the cap member of greater overall diameter than the neck opening, and gasket means between the inner member and the end of the neck, the gasket means being capable of resisting slippage on the neck when under pressure, said inner member being constructed and arranged to rotate with the cap member to be brought into sealing engagement with the gasket means, said cap and inner members having integral cooperating parts of wedge shape so constructed and positioned relative to one another that, upon rotation of the cap member, the bases of the wedge-shaped parts engage and cause the inner member to rotate with it and apply pressure to the gasket means, and, upon counter-rotation of the cap member, the inclined surfaces of the wedge-shaped parts have sliding engagement and simultaneously apply force to the cap member tending to move it away from the inner member against the resistance offered by said external means on the neck.

5. A closure for sealing an opening through the neck of a container which comprises the combination of an outer cap member adapted to receive the end of said neck and having means engageable beneath external means on the neck, upon rotational movement of the cap member, to hold the cap member in place on the neck, the cap member having an area of its top enclosed by a weakened line, an inner member within the cap member of greater overall diameter than the neck opening, and gasket means between the inner member and the end of the neck, said inner member being constructed and arranged to rotate with the cap member to be brought into sealing engagement with the gasket means, said cap and inner members having integral cooperating projections, the projection on the cap member extending from that part of the cap member lying within said weakened line and the projection on at least one of said members having an abutment surface and a surface sloping upwardly in the direction of counter-rotation of the cap member, the projection on one member engaging the abutment surface on the other to cause the members to move together upon rotation of the cap member, the cap member simultaneously being urged by said external means to force the inner member against the gasket means to apply pressure thereto, the projection on one member sliding along said sloping surface on the projection of the other member during counter-rotation of the cap member to cause force to be applied to the area within said weakened line of the cap member, whereby the cap member is ruptured along said line.

6. A closure for sealing an opening through the neck of a container, which comprises the combination of an outer cap member adapted to receive the end of said neck and having

means engageable beneath external means on the neck, upon rotational movement of said cap member, to hold the cap member in place on the neck, an inner member within the cap member of greater overall diameter than the neck opening, an annular gasket engageable with the neck, the inner member having a portion extending into the opening through the gasket and making contact with the wall of said opening, the gasket being capable of resisting slippage on the neck when under pressure, said inner member being constructed and arranged to rotate with the cap member to be brought into sealing engagement with the gasket means, said cap and inner members having cooperating integral parts having opposed surfaces so constructed and positioned that, upon rotation of the cap member, they engage positively and cause the inner member to rotate with the cap member, the cap member simultaneously being urged by said external means to force the inner member against the gasket means to apply pressure thereto, said cooperating integral parts also having other opposed surfaces, at least one of said other opposed surfaces of at least one of the parts being inclined in such direction and at such an angle that upon counter-rotation of the cap member said other opposed surfaces engage and slide relative to one another and cause the part on the cap member to move angularly and outwardly relatively to the part on the inner member and the parts simultaneously to apply force to the cap member tending to move it away from the inner member against the resistance offered by said external means on the neck, the outer cap member having a portion defined by a weakened line, said integral parts on the cap member lying within the weakened line, whereby said force is applied to the part of the cap member enclosed by the weakened line.

7. A closure for sealing an opening through the neck of a container, which comprises the combination of an outer cap member adapted to receive the end of the neck and having means engageable beneath external means on the neck, upon rotational movement of the cap member, to hold the cap member in place on the neck, an inner member within the cap member of greater overall diameter than the neck opening, gasket means beneath the inner member and engageable with the end of the neck, the gasket means being capable of resisting slippage on the neck when under pressure, and a circular series of integral projections around each of the cap and inner members, the projections on the cap member having substantially vertical faces, which lead during the rotation of the cap member, and the projections on the inner member having substantially vertical faces which trail during rotation of the inner member, at least one of the projections having a face sloping upwardly in the direction of counter-rotation of the cap member, the vertical faces of said projections positively engaging upon rotation of the cap member to cause the inner member to rotate therewith and said sloping surface having sliding engagement with another projection during counter-rotation of the cap member, whereby the cap member is urged away from the inner member against the resistance of said external means on the neck.

EDGEWORTH GREENE.