April 27, 1965 E. A. LINDGREN 3,180,515

BOTTLE CLOSURE

Filed Jan. 2, 1964

Fig. 1

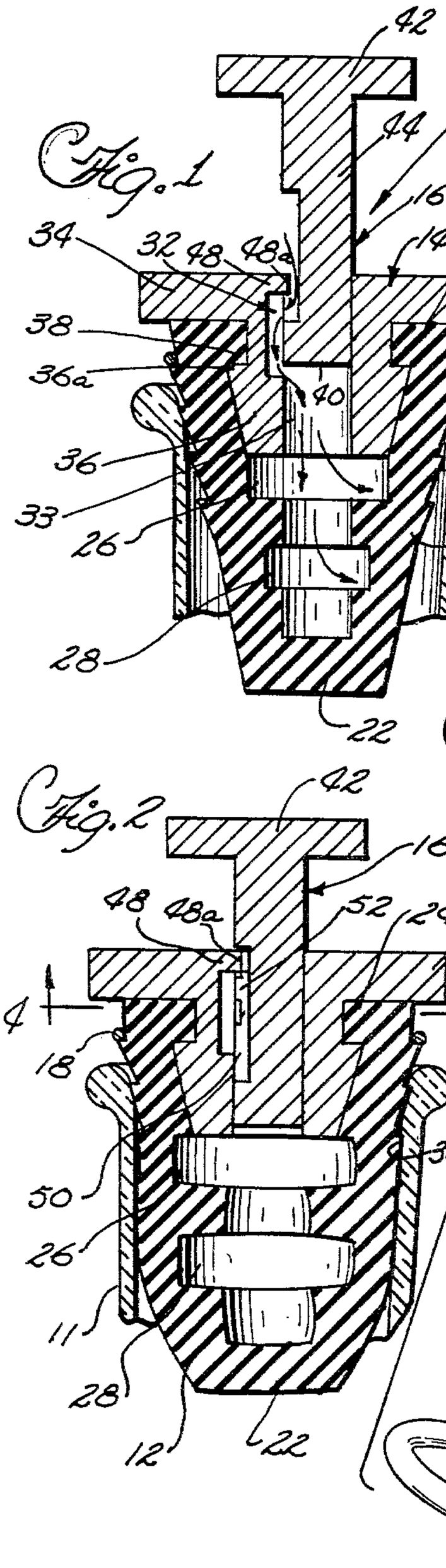

Fig. 2

Fig. 4

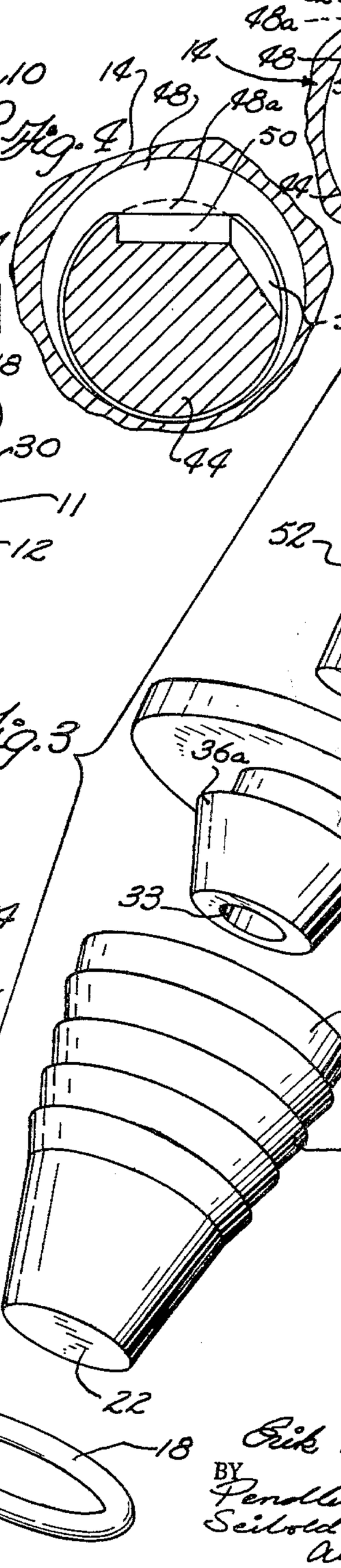

Fig. 5

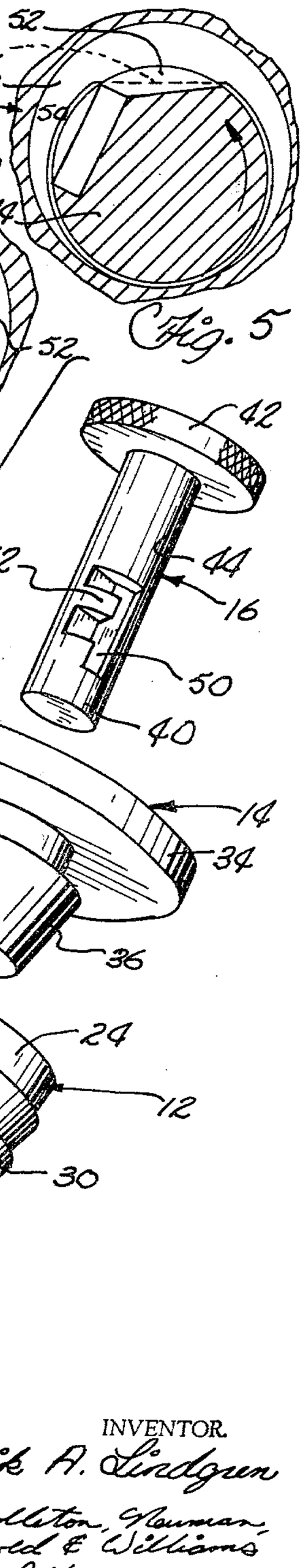

Fig. 3

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3,180,515

Patented Apr. 27, 1965

3,180,515

BOTTLE CLOSURE

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Filed Jan. 2, 1964, Ser. No. 335,203

7 Claims. (Cl. 215—52)

This invention relates to a bottle stopper or closure and, more particularly, to a reusable stopper having a body adapted for insertion into the neck of a bottle, the sides of the body being resiliently expansible into sealing engagement with the bottle neck.

There have been many designs for expansible bottle stoppers but, for the most part, these structures have been complex, with many providing an inherently non-uniform distribution of sealing pressure against the interior surface of the bottle neck.

It is one object of this invention to provide an improved expansible stopper for a bottle.

It is another object of this invention to provide an improved, reusable bottle stopper which has expansible side walls and which employs a minimum number of parts.

It is an additional object of this invention to provide an expansible stopper which provides an inherently uniform distribution of sealing pressure against the interior surface of a bottle neck.

It is still a further object of this invention to provide a stopper which utilizes compressed air to laterally expand the sides thereof into sealing engagement with the bottle neck.

It is a further object of this invention to provide a stopper which is simple to use, may be easily manufactured, and provides an effective seal for the bottle.

Other objects may be seen and a fuller understanding of the invention may be had by referring to the following description and claims, taken in conjunction with the accompanying drawings.

In accordance with one embodiment of the invention, the stopper comprises a resiliently expansible hollow body adapted for insertion into the neck of the bottle. The body is closed at one end and open at the other, and a positive air displacement means is provided to effect selective movement of an additional charge of air into the relaxed but air-filled body so that the walls of the body may be forced radially and elastically outward by the pressure of the air developed within the body until the walls sealingly engage the neck of the bottle.

The air displacement means preferably includes a pair of elements, the first element being mounted in fixed position within the open end of the body and having a bore communicating with the interior of the body. The second element of the air displacement means is a plunger having a piston portion slidably and sealably mounted within the bore of the first or fixed element and movable to displace air from the bore thereof into the body when the plunger is moved from an elevated position downwardly toward a predetermined position relative to the first element. This downward displacement of air from the bore of the first element into the expansible hollow body provides the necessary internal pressure needed to effect expansion of the side walls of the body into sealing engagement with the neck of the bottle.

Releasable locking means is provided for locking the two elements of the air displacement means in position to maintain the pressure within the body member. This locking means is preferably in the form of interengageable projecting formations on the aperture fixed element and plunger.

To accomplish the desired expansion of the resilient body, the lateral walls thereof should be made relatively thin, and it is preferred that selected axially spaced portions of these walls be made thin so that the expansion

may be concentrated in these portions and so that successive seals may be effected by the expansion of the body. It is also preferred that the exterior of the body be stepped in order to aid the sealing between the body and the bottle neck.

With reference to the drawings,

FIGURE 1 is a sectional elevation view of a bottle stopper constructed in accordance with the instant invention, showing the stopper positioned within the bottle neck and the plunger raised prior to expansion of the side walls of the stopper body;

FIG. 2 is a sectional elevation view of the stopper with the plunger lowered and the sides of the body expanded into sealing engagement with the bottle neck;

FIG. 3 is an exploded perspective view of the bottle stopper;

FIG. 4 is a sectional view taken along line 4—4 of FIG. 2 showing the elements of the air displacement means prior to engagement of the latching formations thereon; and

FIG. 5 is a sectional view similar to FIG. 4 but showing the elements with their latching formations interengaged.

With further reference to the drawings and, more particularly, to FIGS. 1 and 2 the bottle stopper 10 is adapted for insertion into the neck 11 of a bottle in order to close the bottle and seal the contents therewithin. Narrow neck bottles of this type are of well known construction and commonly used as convenient containers for beverages such as for wine, champagne or soft drinks.

The stopper constructed in accordance with this invention comprises a soft, elastic rubber or plastic plug or body 12, an air displacement means including a first element or insert 14 and a second element or plunger 16, and a metal clamping ring 18 which resiliently clamps the soft, elastic plug 12 to the relatively hard insert 14.

The plug or body 12 is closed at its bottom end 22 and it is open at its upper end 24. This plug or body is hollow and the lateral walls thereof are preferably constructed relatively thin so that they may be easily expanded by the increase of air pressure developed within the body as will be hereinafter described. While the lateral walls may be uniformly thin, it is preferred that the thinning be concentrated in several spaced annular areas as indicated at 26 and 28 in order to concentrate the lateral expansion of the body or plug into two successive annular seals. The exterior of the plug is preferably tapered toward the closed end, and there may be provided a plurality of annular and angular steps 30 these also serving to facilitate the seal between the stopper body and the surrounding bottle neck 11 .

The insert 14 which functions as one part of the air displacement means is preferably constructed of hard plastic or rubber although, if desired, it may be constructed of metal. The insert 14 is provided with a central aperture 32, the lower or forward end of which is restricted or narrowed to form a substantial cylindrical bore 33 which is spaced from the upper end of the insert and the diameter of which is smaller than the other portions of the aperture 32. At the upper or rearward end of the insert 14 is a disk-like shoulder portion 34 which abuts and preferably laterally overextends the open end 24 of the body 12 to afford a grip for facilitating extraction of the stopper from the bottle.

The forward end or nose portion 36 of the insert 14 is disposed within the open end 24 of the plug and preferably is provided with an outwardly extending shoulder 36*a*, which is adapted to engage a corresponding inwardly extending shoulder 38 on the interior of the plug 12 adjacent the open end thereof. The nose portion is preferably forwardly (downwardly) tapered to facilitate initial insertion into the open end of the plug. The metal

clamping ring **18** surrounds the body **12** in the area of the engaging shoulders **36***a* and **38**, and thus the body **12** and insert **14** are locked in sealing relationship with one another.

The second element of the air displacement means is the plunger **16** which has a piston portion **40** at its lower or forward end, a knurled knob **42** at its upper end and a shank **44** connecting the knurled knob **42** and the piston portion **40**. The piston portion **40** of the plunger **16** has a cylindrical surface which is adapted to slidingly and sealingly fit within the cylindrical bore **33** of the insert **14**, the arrangement being such that the plunger may be easily moved upwardly and downwardly in the bore **33**, but substantially no air will be permitted to leak past the piston portion **40** when the latter is within the bore **33** and is either moving or has been moved to pressurize the plug. If desired and to facilitate the seal, a suitable lubricant may be provided between the piston portion **40** of the plunger and the bore **33** of the insert.

It will be noted that a downward pressure may be manually applied to the knob **42** to effect downward movement of the piston portion **40** within the bore **33**, and the air which has been entrapped within the bore **33** will be forcibly displaced therefrom into the hollow plug or body **12** to effect expansion thereof as illustrated in FIG. 2. Since the lateral expansion of the side walls of the body **12** is preferably restricted to the selected thin annual areas **26** and **28** of the body, the amount of displaced air required to effect sealing is minimized.

It may be seen that the enlarged upper portion of the aperture **32** above bore **33** permits air to enter the aperture and thus there is no resistance to the downward stroke of the plunger **16** until the piston portion **40** enters the bore **33**. While this upper portion of the aperture **32** is thus enlarged relative to the bore **33**, it need only be enlarged enough to facilitate entry thereinto of the plunger piston portion **40** and to permit free entry of air. This upper portion, however, may if desired, be sufficiently restricted to provide at least partial guidance for the plunger, especially when the latter has been raised as illustrated in FIG. 1.

Once the plunger has been lowered and the air charge has been delivered into the hollow plug **12** to expand and effect a seal between the sides of the plug and the surrounding bottle neck, it is necessary to lock the plunger in its lowered position in order to maintain this internal pressure so that the sides of the plug will remain expanded and the seal will be retained. In order to accomplish this a flat formation **48** extends partially across the aperture **32** at the upper or rearward end thereof, and a chord-like projecting portion **48***a* of this formation further restricts this end of aperture **32**.

The cylindriform shank **44** of the plunger is recessed in the area **50** except for a remaining tongue formation **52**. The recess **50** is of sufficient depth and width to permit the initial insertion of the plunger portion **40** into the aperture **32** by a slight tilting insertive movement, and this recess is of sufficient length to permit the desired restricted longitudinal movement of the plunger **16** within the insert **14**.

When the plunger **16** has been forced downwardly from the position illustrated in FIG. 1 to the position illustrated in FIG. 2, latching tongue formation **52** within the recess on the plunger shank will be positioned below the chord-like latching projection **48***a* on the insert. The relative positions of the formations **48***a* and **52** are illustrated in FIG. 4. At this point the plunger **16** may be rotated slightly in the direction of the arrow in FIG. 4 so that the tongue formation **52** will rotate under the chord-like projecting portion **48***a*, as illustrated in FIGS. 2 and 5. In this rotated position, the plunger **16** is locked against upward movement and the pressure within the plug **12** is maintained so that the lateral sides of the body will remain in sealing engagement with the surrounding bottle neck.

In order to remove the stopper, the plunger **16** may be rotated in the reverse direction to disengage the tongue formation **52** in the recess on the shank thereof from the chord-like projecting portion **48***a* on the insert. Thereafter the pressure of the air within the hollow plug **12** will urge the piston portion **40** of the plunger upwardly in the bore **33** until the air pressure in the body normalizes and the sides of the plug return to their relaxed position as illustrated in FIG. 1. The stopper may then be easily withdrawn from the bottle neck.

While the foregoing exemplifies the preferred structure, it will be readily apparent that a number of modifications may be made in the structure without departing from the spirit of the invention. For example, instead of the interlocking formations **48** and **52**, threads may be provided on on the insert and on the shank of the plunger in order to drive the plunger downwardly into the insert for displacement of the air from the bore **33**. Also, other latching arrangements may be readily apparent. In addition, the interconnection between the insert **14** and the body **12** may be accomplished in a manner other than that described and illustrated such as, for example, by adhesives or possibly even by a threaded arrangement. In addition, if desired, the number of annular recesses such as **26** and **28** may be increased or reduced, or if desired, the side walls of the body **12** may be made uniformly very thin although this is not preferred.

From the foregoing it may be seen that a novel stopper has been provided which will effect a reliable closure for a narrow necked bottle. The side walls of the stopper are expanded by compressed air in a novel manner and the number of parts required for the device are minimized. The force of the compressed air provides an inherently uniform distribution of sealing force.

It will be understood that the above description has been made only by way of example and that this invention is not to be limited to the embodiment illustrated and described herein, as various modifications may be made without departing from the true spirit and scope of the invention as defined by the appended claims.

What is claimed is:

1. An expansible stopper for a bottle, said stopper comprising a hollow body sized to fit into the neck of the bottle, said body being closed at one end and open at the other and having an elastically and radially expansible side wall, positive air displacement means including first and second elements, said first element being sealingly disposed in a fixed position within the open end of said body and having an air chamber, and said second element having a portion slidably and sealingly mounted for movement within said first element air chamber to forcibly displace the air therefrom into said body when said second element is moved into a predetermined position relative to said first element, whereby the side walls of said body may be elastically forced radially outward into sealing engagement with the neck of the bottle, and means releasably locking said second element in said predetermined position relative to said first element.

2. A stopper for a bottle, said stopper comprising an elastically expansible hollow body adapted for insertion into the neck of the bottle, said body being closed at one end and open at the other, positive air displacement means including relatively inelastic first and second elements, said first element being mounted in the open end of said body and having a bore communicating with the interior of said body, said second element having a portion slidably and sealingly mounted for movement within the bore of said first element to displace air therefrom into said body when said second element is moved toward a predetermined position relative to said first element, whereby the air within said body may be compressed to expand said body radially outward for sealing engagement with the neck of the bottle.

3. An expansible stopper for a bottle, said stopper comprising a hollow body sized to fit into the neck of the

bottle, said body being closed at one end and open at the other and having an elastically and radially expansible side wall, positive air displacement means mounted within the open end of said body, said air displacement means including first and second elements, said first element having a bore extending therethrough, the forward portion of said bore being in communication with the interior of said body and being substantially cylindrical and of smaller diameter than the remainder of said bore, said second element having a forward end portion sized to sealingly slide within the forward portion of said first element bore to displace air from said forward portion into said body, when said second element is moved into a predetermined forward position, whereby the air within said body may be compressed to expand said body radially outward into sealing engagement with the neck of the bottle, and means for releasably locking said second element in said predetermined position.

4. An expansible stopper for a bottle, said stopper comprising a hollow body sized to fit into the neck of the bottle, said body being closed at one end and open at the other and having an elastically and radially expansible side wall, positive air displacement means including an apertured first element having a rearward shoulder portion abutting the open end of said body and a forward nose portion sealingly disposed within the open end of said body, said first element having a bore extending through said shoulder and nose portions for communication with the interior of said body, a portion of the bore extending through said nose portion being substantially cylindrical and of smaller diameter than the remaining rearwardly extending portions of said bore, and a second element having a forward end portion sized to sealingly slide within the forward portion of said first element bore to displace air from said forward portion into said body, when said second element is moved into a predetermined forward position, whereby the air within said body may be compressed to expand said body radially outward into sealing engagement with the neck of the bottle, and means for releasably locking said second element in said predetermined position.

5. The structure of claim 4 including means for clamping said body against said first element nose portion.

6. A stopper for a bottle, said stopper comprising an elastically expansible hollow body adapted for insertion into the neck of the bottle, said body being closed at one end and open at the other, selected side wall portions of said body being relatively thin with respect to the remaining portions of said body, whereby said thin wall portions may expand laterally to a greater degree than said remaining portions of said body upon pressurizing of the interior of said body, positive air displacement means including first and second elements formed of relatively inelastic material, said first element mounted in the open end of said body and having a bore communicating with the interior of said body, said second element having a portion slidably and sealingly mounted for movement within the bore of said first element to displace air therefrom into said body when said second element is moved toward a predetermined position relative to said first element, whereby the air within said body may be compressed to expand the thin wall portions of said body radially outward into engagement with the neck of the bottle.

7. The structure of claim 6 wherein said selected thin portions are axially spaced to provide successive seals against the bottle neck when said body is pressurized.

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