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Description

The invention relates to a thermoplastic closure according to the preamble of claim 1. Such a closure is known from AU—B—510 121.

For many years it has been general practice to utilize bottles which are sealed by means of the so-called crown closure to package products which effect a positive pressure in the bottles. Exemplary of such products are carbonated beverages such as beer. The crown closure is commonly made of tinplate and its fluted skirt is engaged under a peripheral rib which extends around the neck of the bottle in close proximity to its mouth.

The crown closure suffers from two defects, namely, it requires a special tool to remove it from the bottle and it cannot be used to reclose the bottle. In recent years non-returnable bottles have come into more general use and these have been adopted for some carbonated beverages. When non-returnable bottles are adopted, it is practicable to adopt the most convenient form of closure consistent with economy in price. The most widely employed form of non-returnable bottle system for carbonated beverages has employed a bottle with a externally screw-threaded neck, having a cylindrical sealing surface between the top of the bottle and the start of the thread. With this bottle there has been employed a closure in the form of an aluminum shell having a gasket covering the inner surface of the top of the shell which forms a sealing liner. The diameter of the skirt of the closure shell is sufficiently large to fit over the thread on the bottle neck at the maximum size allowed by the range of tolerances set out in the specification of the neck finish of the bottle. The skirt of this shell is deformed by a thread-rolling operation carried out in known way to bring it into engagement with the thread on the bottle neck.

While such aluminum closures have received wide acceptance, there is an economic problem due to the high cost of aluminum. Aluminum's high cost is directly proportional to the ever rising high cost of energy as aluminum production is energy intensive.

GB—A—683 521 discloses a metallic two-piece closure having a liner which forms a seal at the top of a container lip and against the side surface of the neck of the container. The British specification is concerned with problems in forming metal closure blanks onto a container, and not with the subject of the present invention, thermoplastic closures which are preformed and then applied to the container. DE—C—875 454 discloses a preformed closure having a cured-in-place plastics liner engageed with thread surfaces inside the closure and held by projections and depressions on the inner surface of the top of the closure. AU—B—510 121 discloses a tamper-resistent thermoplastic closure having a resilient liner and threads having locking means. The closure is engaged with threads on a container neck and upon rotation of the closure its axial movement towards the container lip compresses the resilient liner against the lip.

A high promising alternative to the use of aluminum closures is the use of closures made of thermoplastic material. Such materials are becoming more and more economically favorable when compared to aluminum. Exemplary of such closures is the one shown in U.S. 3,067,900. As desirable at it may be to use thermoplastic material, there is one serious drawback, i.e., the tendency of thermoplastic closures to lose their seal as positive pressure builds in the bottle. Since the seal is made by the closure making sealing contact with the bottle, the loss of seal is generally due to the closure flexing, as the pressure builds, resulting in the closure structure being distorted and pulled away from the bottle. To prevent flexing, it is possible to select a very rigid thermoplastic material. However, the seal sought to be obtained when using such materials is not always initially achieved as the rigidity of the material will not allow the sealing configuration to follow structural variations which are commonly present on the bottles. Also such rigid materials are often very expensive. Less expensive materials could be used if the flexing portion of the closure was made thicker to achieve the rigidity sought. But, as is obvious, the cost of such a thicker closure rises in direct proportion to the amount of material used and renders such closures commercially unacceptable.

With the economic realities in mind, it would be highly desirable to redesign the thinner commerical closures used today so that the flexing phenomena will not cause loss of seal but rather will be utilized to increase the fidelity of seal as internal container pressures build.

Therefore, it is an object of this invention to provide an inexpensive thermoplastic closure which is capable of maintaining a seal in response to a positive pressure in a container such as a bottle.

According to the present invention there is provided a thermoplastic closure for fitment to a container having a threaded neck terminating in a lip which defines an open mouth, said closure comprising:

a. A circular top wall;

b. an annular skirt downwardly depending from said top wall, said skirt having about its inside surface a closure thread for cooperation with said neck thread to achieve said fitment;

c. a circular, flexible resilient liner positioned adjacent said top wall and having a diameter greater than the outside diameter of said lip and

d. an annular projection located adjacent the inside intersection of said top wall and said skirt, said annular projection having a configuration whereby said annular projection presses said liner around the outside edge of said lip to form a gas-tight seal when said closure is fitted on said container.

This invention relates to a thermoplastic closure for fitment to a container having a threaded neck terminating in an open mouth. The closure

has a circular top wall and an annular downwardly depending skirt, the skirt having about its inside surface a closure thread for cooperation with the neck thread to achieve the fitment desired. There is positioned adjacent the top wall a circular flexible resilient liner which has a diameter greater than the outside diameter of the container mouth. There is also provided annular structure which is located adjacent the inside intersection of the top wall and the skirt. This annular structure has a configuration such that it presses the liner around the outside edge of the container mouth to form a gas-tight seal when the closure is fitted onto the container.

Preferably there is additionally provided a retaining ring about the inside surface of the skirt which is positioned below the annular structure but above the closure thread. This retaining ring prevents the liner from moving down to the closure thread. Thus, if the liner should fall away from the top wall the retaining ring will prevent it from being separated from the remainder of the closure.

To aid in maintenance of the position of the liner in its sealing position with respect to the container there is preferably aditionally provided an annular tap which projects downward from the top wall. This tab will engage the liner and prevent any lateral movement thereof.

It is believed, but the closure of this invention is not restricted to this theory, that by having the liner wrapped around the outside edge of the container lip a gas-tight seal is maintained even upon upward flexure of the top wall which flexure is caused by positive pressure build-up in the container. When the closure is originally fitted to the container there are two principal sealing areas, i.e., there is a seal formed between the liner and the top of the container lip and a second seal formed between the outside edge of the lip and the liner. When the closure top wall begins to flex upwardly in response to positive pressure in the container the first seal between the liner and the top of the container lip is compromised as the liner is no longer as well supported due to upward flex of the top wall. However, due to the unique configuration of the closure of this invention, the upward flexing of the top wall increases the fidelity of the second seal as that portion of the liner which is wrapped aound the outside edge of the container lip is pressed into a tighter relationship with the outside edge. This is due to the fact that the flexing of the top wall causes the upper portion of the container sidewall to be pulled inwardly. As the sidewall upper portion is pulled inwardly the annular structure presses more firmly against the liner thereby increasing the fidelity of the seal. Thus, the closure of this invention utilizes the heretofore undesirable flexing of the top wall to increase the fidelity of the seal. This is directly opposite to present-day closures in which the upward flexing of the top wall results in a reduction in seal fidelity.

There are different configurations which the annular structure can have to achieve the above-mentioned seal between the liner and the outside edge of the container lip. For example, the annular structure can have a configuration, when viewed in cross-section, which has a horizontal portion, a vertical portion, and a convex portion, the convex portion connecting the horizontal portion and the vertical portion one to the other. When utilizing this configuration, there is a concentration of sealing pressure at a point near the center of the convex portion. Another configuration is one in which the annular structure is a convex bead. By utilizing a convex bead the pressure exerted by the annular structure is distributed over a wider area of the liner than is the case with the just-described annular structure having the horizontal, vertical and convex portions.

There are other configurations which may be utilized, the only requirement being that the liner be pressed into a position around the outside edge of the lip and that the configuration results in an increasing of pressure between the liner and the outside edge of the lip as the top of the closure flexes upward in response to positive pressure in the container.

In a preferred embodiment, the closure of this invention utilizes a liner which is free to rotate with respect to the closure. This freedom to rotate results in the liner being able to achieve essentially a single position on the container lip even though the closure continues to rotate as it is tightened to the container. If the liner was fixed to the closure, the opposite effect would occur as the liner would have to rotate along with the closure as it is tightened to the container. Liner rotation with respect to the container lip results in the liner being rubbed over the lip surface as it rotates with the closure. Such liner-lip rubbing is disadvantageous as each irregularity in the container lip will cause its particular liner deformation and such deformations will, when the closure reaches its final tightened position, almost always not coincide with particular lip irregularity which caused the liner deformation. The result of this non-coincidence is deleterious to seal fidelity as the contacting liner-lip sealing surfaces are not in as intimate contact as would be possible if the liner deformation matched the lip irregularity which caused it. On the other hand, when the liner is free to rotate with respect to the closure and is not forced to rotate about the container lip, the liner is simply pressed downwardly onto the container lip and each liner deformation caused by a particular lip irregularity will coincide with the irregularity. With matching of the liner deformations to the lip irregularities a highly intimate contact is made and seal fidelity is preserved. Achievement of the non-rotation of the liner with respect to the container lip is a result of the liner freedom vis-a-vis the rest of the closure and the friction beteen the liner and lip being greater than the friction between the closure and the liner. This difference in friction can be attributed to a higher coefficient of friction for the liner-lip contact than for the liner-closure contact and/or a more irregu-

lar lip surface than the closure surface contacted by the liner.

The liner utilized should also be flexible and resilient. Furthermore, since the closure of this invention is to be utilized on either glass or plastic containers, the liner should be made of a material which is compatible with the container to which the closure is attached. For example, liners made of materials which stick to the container lip should be avoided as unscrewing the closure from the container will be difficult and, even if achieved, could result in tearing of the liner. It has been found that liners made of an ethylene vinyl acetate copolymer gives superior results on both glass and plastic containers. Further, such liners are acceptable from a toxicological and odor standpoint when the container is utilized to hold consumable products such as carbonated beverages, beer, etc. If the container is to hold a non-consumable, other materials may be utilized such as polyvinyl chloride. To help reduce the torque required to remove the closure from the container it may be desirable, when the liner is of a thermoplastic material, to add an additive which will increase the liner's lubricity characteristics. A slip additive such as synthetic wax or fatty amide have been found very useful for this purpose.

The remainder of the closure can be made of any moldable thermoplastic material which will provide the prior-described characteristics for the top wall of the closure. However, the thermoplastic material should not be so flexible that, under building positive container pressure, the sidewall of the closure will flex outwardly resulting in the closure threads jumping over the container threads. It has been found that a highly preferred thermoplastic material is polypropylene. Other thermoplastic materials which may be useful are polyethylene terephthalate, high density polyethylene, nylon, polyvinyl chloride, etc. Other materials which would be useful are well known to those skilled in the art given the preceding identified criteria.

These and other features contributing to satisfaction in use and economy in manufacture will be more fully understood when taken in connection with the following description of preferred embodiments and the accompanying drawings in which identical numerals refer to the identical parts and in which:

Figure 1 is a partial sectional view showing a closure of this invention fitted to a container neck;

Figure 2 is a partial sectional view of the closure shown in Figure 1 under the influence of a positive pressure in the container;

Figure 3 is an enlarged sectional view of a portion of the container and closure shown in Figure 2;

Figure 4 is a sectional view taken along section lines 4—4 in Figure 1;

Figure 5 is a sectional view taken along section lines 5—5 in Figure 2;

Figure 6 is an enlarged sectional view showing a second embodiment of this invention.

Referring now to Figures 1—4, it can be seen that a closure, generally designated by the numeral 10, is fitted to a container neck, generally designated by the numeral 8. Container neck 8 has about its outside surface adjacent its upper end helical thread 26. At the terminal end of container neck 8 there is a mouth through which the container contents are dispensed. Lip 15 defines the boundaries of the container mouth. As mentioned previously, the container with which closure 10 is utilized can be made of any suitable material, e.g, glass or a thermoplastic material such as polyethylene terephthalate, polyethylene, polyvinyl chloride, etc.

Closure 10 has an annular top wall 12 with a sidewall 14 downwardly depending therefrom. About the inside surface of sidewall 14 there is provided helical closure thread 16 which is of a design whereby it cooperates with container helical thread 26 to achieve fitment of closure 10 to the container. In close proximity to top wall 12 there is provided liner 18. Liner 18 has a diameter greater than the outside diameter of container neck 8 measured at the container mouth. By having a greater diameter, line 18 will be able to extend around the outside edge 28 of lip 15 to effect the seal of this invention. Liner 18 is prevented from moving away from top wall 12 by means of annular ring 24. Annular ring 24 may be continuous or discontinuous. Attention is drawn to Figure 5 in which a discontinuous annular retaining ring 24 is shown. Projecting downwardly from top wall 12 there is provided annular tab 22. Annular tab 22 has a triangular shape when viewed in cross-section. See Figures 3, 6 and 7. As mentioned previously, annular tab 22 is utilized to insure that liner 18 does not move laterally during the buildup of internal container pressure. Note that annular tab 22 is positioned so that it is over lip 15. By having annular tab 22 so positioned, it is assured that annular tab 22 will obtain a grip on liner 18 by penetration.

Located adjacent the inside intersection of top wall 12 and downwardly deponding sidewall 14 there is provided annular bead 20. An enlarged view of the cross-section of annular bead 20 is shown in Figure 3. As can be seen in this configuration, annular bead 20 has a horizontal portion 21 and a vertical portion 23. Convex portion 25 connects horizontal portion 21 to vertical portion 23. Convex portion 25 is preferably opposite the outside edge 28 of lip 15.

In Figure 6, there is shown another configuration which may be utilized in place of annular bead 20. In Figure 6, annular bead 40 is used in place of annular bead 20. Annular bead 40 has, for all practical purposes, no horizontal or vertical portions, but rather is simply a convex bead.

Figures 3 and 6 show that the annular beads press against liner 18 to cause it to wrap around outside edge 28 of lip 15. When top wall 12 is flexed upwards due to pressure in the container the intersection of top wall 12 and sidewall 14 is brought inwardly towards outside edge 28. As a result of this movement, the annular bead, since it is integral with the intersection, will also move

inwardly towards outside edge 28. Thus, liner 18 is pressed by the annular bead so that it wraps around outside edge 28. The greater the flexure of top wall 12 the greater the inward movement of the before-mentioned intersection and the annular bead, and the further the annular bead is forced to move inwardly the greater the pressure it exerts on liner 18. It can therefore be seen that the seal between liner 18 and outside edge 28 is increased as the pressure grows since the top wall flexes in response to the amount of pressure present.

Claims

1. A thermoplastic closure for fitment to a container having a threaded neck (8) terminating in a lip (15) which defines an open mouth, said closure (10) comprising:

a. a circular top wall (12);

b. an annular skirt (14) downwardly depending from said top wall (12), said skirt (14) having about its inside surface a closure thread (16) for cooperation with said neck thread (26) to achieve said fitment;

c. a circular, flexible resilient liner (18) positioned adjacent said top wall (12) and having a diameter greater than the outside diameter of said lip (15), and characterized by

d. an annular projection (20, 40) located adjacent the inside intersection of said top wall (12) and said skirt (14), said annular projection (20, 40) having a configuration whereby said annular projection (20, 40) presses said liner (18) around the outside edge of said lip (15) to form a gas-tight seal when said closure (10) is fitted on said container.

2. The closure of claim 1, wherein said annular projection (20) is an annular bead having a configuration, when viewed in cross-section, which has a horizontal portion (21), a vertical portion (23) and a convex portion (25), said convex portion (25) connecting said horizontal portion (21) and said vertical portion (23) one to the other.

3. The closure of claim 1, wherein said annular projection is a convex bead (40).

4. The closure of claims 1, 2 or 3, wherein said closure (10) additionally has a retaining means (24) about the inside surface of said skirt (14) downwardly positioned below said annular projection (20, 40) but above said closure thread (16) for preventing said liner (18) from moving down to said closure thread (16).

5. The closure of claims 1, 2 or 3, wherein said closure (10) additionally has an annular tab (22) downwardly projecting from said top wall (12) for engaging said liner (18) to prevent said liner (18) from pulling away from its seal position.

6. The closure of claims 1, 2 or 3, wherein said closure (10) is made of polypropylene.

7. The closure of claim 1, 2 or 3, where in said liner (18) is an ethylene vinyl acetate copolymer.

8. The closure of claim 1, wherein said annular projection is an annular bead (20) having a configuration, when viewed in cross-section, which has a horizontal portion and vertical portion.

9. The closure of claims 1, 2 or 3, wherein said closure (10) is made of polypropylene and said liner (18) is an ethylene vinyl acetate copolymer.

Patentansprüche

1. Thermoplastischer Verschluß zum Anbringen an einem Behälter, der einen gewindetragenden Hals (8) besitzt, der in einer lippe (15) endet, die eine offene Mündung begrenzt, wobei der Verschluß (10)

a. eine kreisförmige Decke (12) besitzt; ferner

b. einen ringförmigen Mantel (14), der sich von der Decke (12) abwärts erstreckt und auf seiner Innenwandung mit einem umlaufenden Verschlußgewinde (16) versehen ist, das zum Anbringen des Verschlusses mit dem Halsgewinde (26) zusammenwirken kann; und

c. eine im Bereich der Decke (12) angeordnete, kriesförmige, flexible, elastische Auflage (18), deren Durchmesser größer ist als der Außendurchmesser der Lippe (15), gekennzeichnet durch

d. einen im Bereich der innen angeordneten Schnittlinie zwischen der Decke (12) und dem Mantel (14) angeordneten, ringformigen Vorsprung (20, 40), der eine solche Form hat, daß der ringförmige Vorsprung (20, 40) die Auflage (18) um den Außenrand der Lippe (15) herum unter Bildung einer gasdichten Abdichtung gegen die Lippe (15) drückt, wenn der Verschluß (10) an dem Behälter angebracht ist.

2. Verschluß nach Anspruch 1, dadurch gekennzeichnet, daß der ringförmige Vorsprung (20) ein Ringwulst ist, der im Querschnitt gesehen einen horizontalen Teil (21), einen vertikalen Teil (23) und einen konvexen Teil (25) besitzt, der den horizontalen Teil (21) und den vertikalen Teil (23) miteinander verbindet.

3. Verschluß nach Anspruch 1, dadurch gekennzeichnet, daß der ringförmige Vorsprung eine konvexer Wulst (40) ist.

4. Verschluß nach Anspruch 1, 2 oder 3, dadurch gekennzeichnet, daß der Verschluß (10) ferner an der Innenwandung des Mantels (14) eine umlaufende Halteeinrichtung (24) besitzt, die unterhalb des ringförmigen Vorsprunges (20, 40), aber oberhalb des Verschlußgewindes (16) angeordnet ist und eine Abwärtsbewegung der Auflage (18) zu dem Verschlußgewinde (16) verhindert.

5. Verschluß nach Anspruch 1, 2 oder 3, dadurch gekennzeichnet, daß der Verschluß (10) einen von der Decke (12) abwärts vorstehenden, ringförmigen Fortsatz (22) besitzt, der an der Auflage (18) angreift und ein Wegziehen der Auflage (18) aus ihrer Dichtstellung verhindert.

6. Verschluß nach Anspruch 1, 2 oder 3, dadurch gekennzeichnet, daß der Verschluß (10) aus Polypropylen besteht.

7. Verschluß nach Anspruch 1, 2 oder 3, dadurch gekennzeichnet, daß die Auflage (18) aus einen Ethylenvinylacetat-Copolymer besteht.

8. Verschluß nach Anspruch 1, dadurch gekennzeichnet, daß der ringförmige Vorsprung ein Ringwulst (20), der im Querschnitt gesehen einen horizontalen Teil und einen vertikalen Teil besitzt.

9. Verschluß nach Anspruch 1, 2 oder 3, dadurch

gekennzeichnet, daß der Verschluß (10) aus Polypropylen und die Auflage (18) aus einem Ethylenvinylacetat-Copolymer besteht.

Revendications

1. Fermeture thermoplastique pouvant s'adapter sur un récipient qui possède un goulot fileté (8) se terminant par une lèvre (15) qui définit une embouchure ouverte, ladite fermeture (10) comprenant;

a) une paroi supérieure circulaire (12);

b) une jupe annulaire (14) s'étendant vers le bas depuis ladite paroi supérieure (12), ladite jupe (14) possèdant à proximité de sa surface interne un filetage de fermeture (16) apte à coopérer avec ledit goulot fileté (26) pour obtenir ladite adaptation;

c) une couche élastique flexible (18) circulaire et disposée adjacente à la paroi supérieure (12) et possédant un diamètre supérieur à celui du diamètre externe de ladite lèvre (15), et caractérisée par

d) une projection annulaire (20, 40) située adjacente à l'intersection intérieure de ladite paroi supérieure (12) et de ladite jupe (14), ladite projection annulaire (20, 40) venant presser ladite couche (18) autour du rebord extérieure de ladite lèvre (15) pour réaliser une étanchéité de retenue des gaz lorsque ladite fermeture (10) es adaptée sur ledit récipient.

2. Fermeture selon la revendication 1, dans lequelle ladite projection annulaire (20) est une collier annulaire ayant une configuration qui, vue en section transversale, possède une partie horizontale (21), une partie verticale (23) et une partie convexe (25), ladite partie convexe (25) connectant ladite partie horizontale (21) et ladite partie verticale (23) l'une à l'autre.

3. Fermeture selon la revendication 1, dans laquelle ladite projection annulaire est un collier convexe (40).

4. Fermeture selon les revendications 1, 2 ou 3, dans laquelle ladite fermeture (10) comporte de plus un moyen de retenue (24) autour de la surface interne de ladite jupe (14) positionné vers le bas en dessous de ladite projection annulaire (20, 40) mais au-dessus dudit filétage de la fermeture (16) pour éviter que ladite couche (18) se déplace vers le bas vers ledit filetage de fermeture (16).

5. Fermeture selon les revendications 1, 2 ou 3, dans laquelle ladite fermeture (10) comporte de plus une patte annulaire (22) qui s'étend vers le bas depuis ladite paroi supérieure (12) pour finir en prise avec ladite couche (18) afin d'éviter à ladite couche (18) d'être tirée à distance depuis sa position d'étanchéité.

6. Fermeture selon les revendications 1, 2 ou 3, dans laquelle la fermeture (10) est réalisée en polypropylène.

7. Fermeture selon la revendication 1, 2 ou 3, dans laquelle ladite couche (18) est en copolymère d'acétate vinyl éthylène.

8. Fermeture selon la revendication 1, dans laquelle ladite projection annulaire est un collier annulaire (20) ayant une configuration qui, vue en section transversale, possède une partie horizontale et une partie verticale.

9. Fermeture selon les revendications 1, 2 ou 3, dans laquelle ladite fermeture (10) est réalisée en polypropylène et ladite couche (18) est en copolymère d'acétate vinyl éthylène.

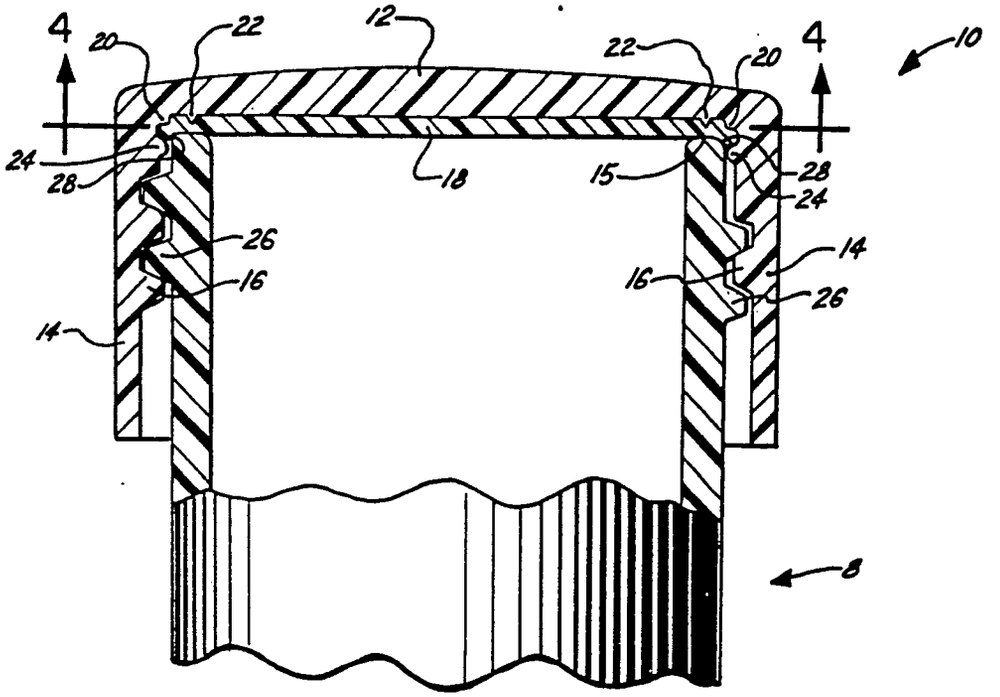
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FIG. 1.

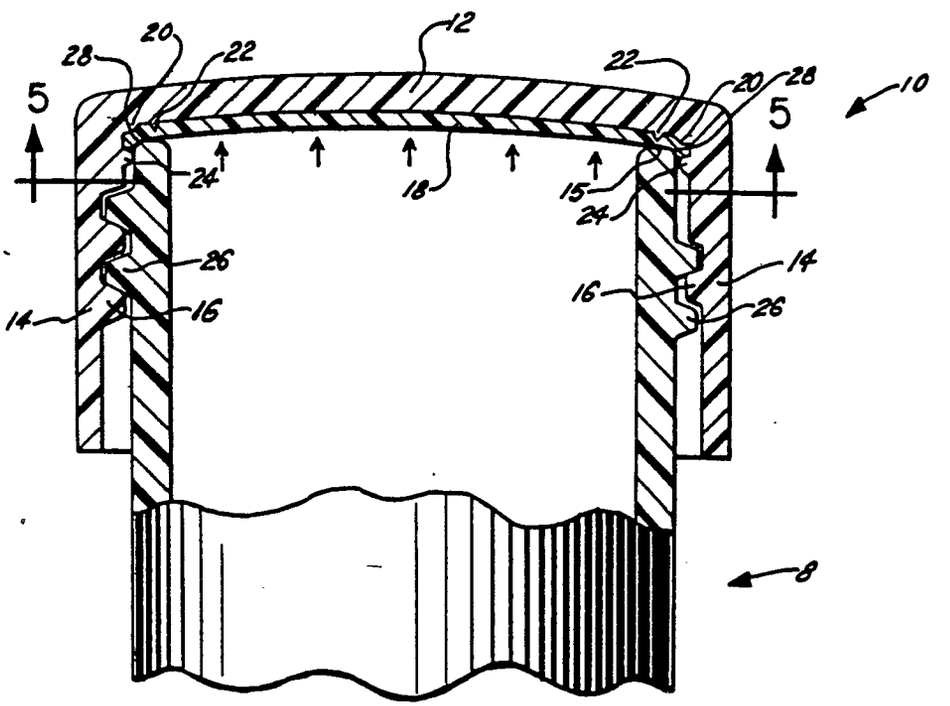
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FIG. 2.

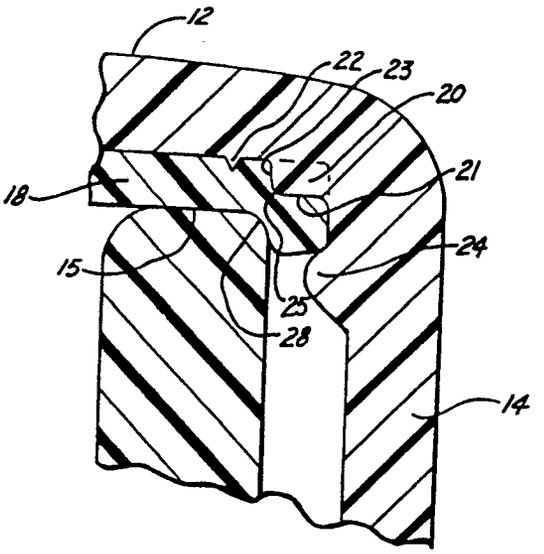

FIG. 3.

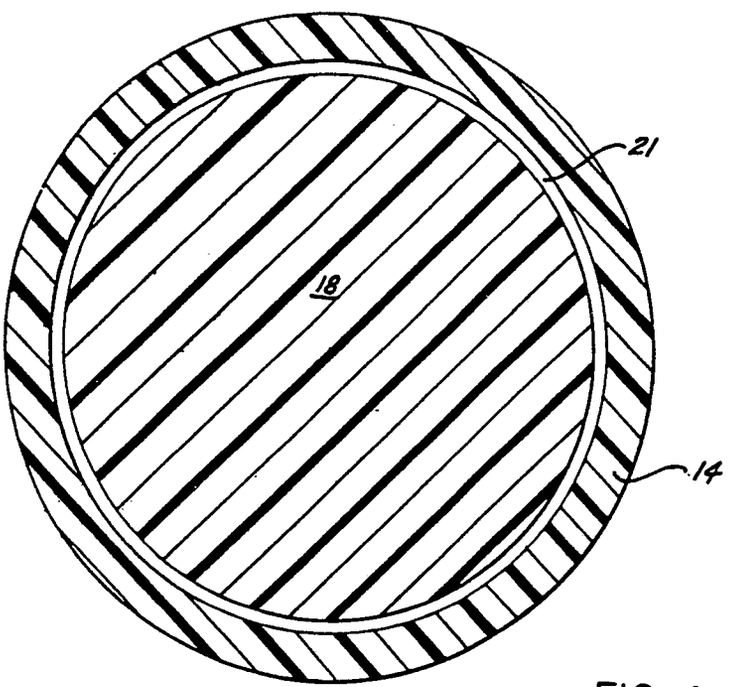

FIG. 4.

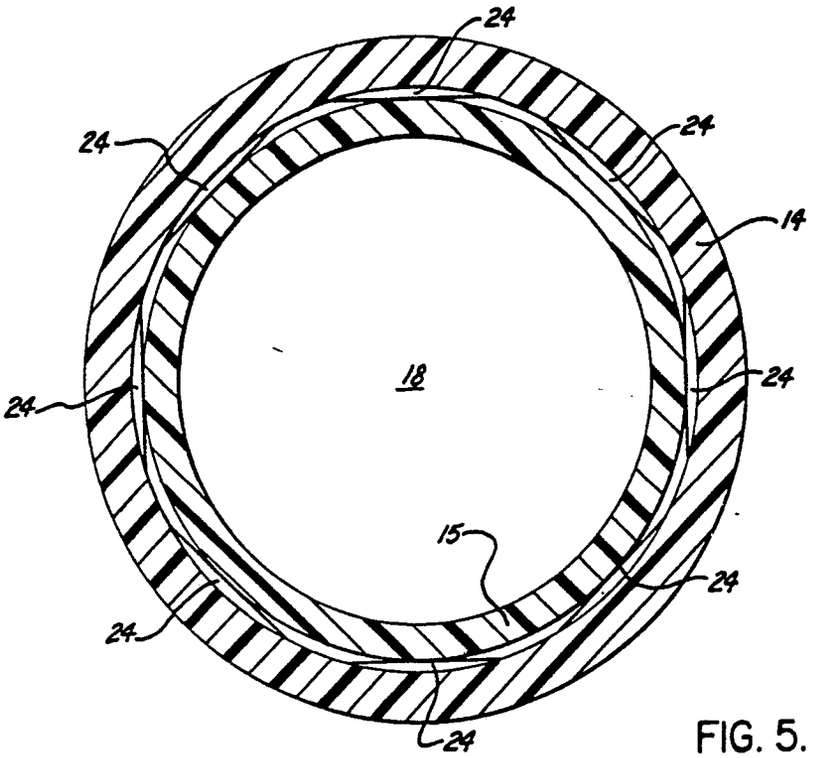

FIG. 5.

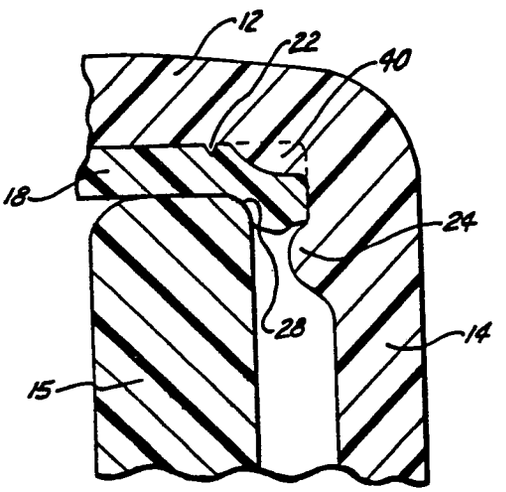

FIG. 6.