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CHILD-RESISTANT PACKAGE HAVING
PRELOADED LOCKING MECHANISM

TECHNICAL FIELD

5 The present invention has relation to an improved package for storing and dispensing materials which can be harmful, particularly if improperly ingested. Such materials may be in solid, tablet, granular, powdered, semi-solid, paste or liquid form.

In a particularly preferred embodiment, the present invention has relation to a package for storing and dispensing medicaments, such as analgesic tablets or the like.

10 The present invention has further relation to such a package which is resistant to opening by the majority of children coming in contact with it, yet which can be opened without undue difficulty by adults whose manual dexterity may, at least to a degree, be impaired.

15 The present invention has further relation to such a package which can be inexpensively manufactured to facilitate disposal thereof once the contents have been completely dispensed from the package. The present invention has still further relation to methods for manufacturing such a package.

BACKGROUND ART

20 Child resistant packaging is known for being both a blessing and a curse. It is a great concept for preventing children from opening potentially dangerous materials such as medications, but for adults, especially the elderly, such packaging can be a nuisance.

25 Because of deteriorating health, the elderly tend to rely on medication more than the average person. However, simply making medication more easily accessible to the elderly bears with it the risk that the contents of the package could be accessible to children who could be seriously injured if they obtain access to the contents of a medicament package and ingest the medicaments contained therein.

30 The aforementioned problems are recognized generally in the packaging industry, particularly the pharmaceutical industry.



Numerous articles have been written on the subject. See for example "The Dual Vial" published in the Fall 1988 edition of Stout magazine.

One package which has met with good success in providing child resistance without imposing undue opening difficulty for adults whose manual dexterity may, at least to a degree, be impaired is disclosed in commonly assigned U.S. Patent 4,948,002 issued to Thornock et al. on August 14, 1990 and hereby incorporated herein by reference. While packages of the type disclosed in the aforementioned commonly assigned Thornock et al. patent have fared extremely well in test protocols involving both children and adults having impaired manual dexterity, it has quite unexpectedly been discovered that child resistance of the package can be enhanced even further without making the package more difficult to open by adults if the spring-like pushtabs containing vertical extensions which engage interlocking teeth on the innermost surface of the closure skirt are configured so that application of the closure to the package will require a degree of deformation of the spring-like pushtabs whenever the closure is applied to the package in a fully assembled, interlocked condition. This is normally accomplished by configuring the spring-like pushtabs so that their uppermost ends project outwardly to a degree prior to assembly of the closure onto the package. The practical effect of this configuration is that the vertical extensions on the spring-like pushtabs are, at least to a degree, preloaded so as to exert a force against the innermost surface of the closure skirt once the closure has been fully assembled onto the package.

OBJECTS OF THE INVENTION

Accordingly, it is an object of the present invention to provide a package which exhibits improved child resistance without significantly increasing the difficulty of opening by adults having impaired manual dexterity.

It is another object of the present invention to provide methods for producing such an improved package.



DISCLOSURE OF THE INVENTION

In a particularly preferred embodiment, the present invention comprises a package for dispensing potentially dangerous materials, such as medicaments, e.g., analgesic tablets or the like.

5 The package preferably comprises a bottle, a collar which snap fits onto the uppermost portion of the bottle and a screw-on closure, as generally disclosed in the aforementioned commonly assigned U.S. Patent 4,948,002 to Thornock et al. or a child-resistant attachment of the type generally disclosed in co-pending U.S. Application Serial

10 No. 826,747 filed in the names of Peter W. Hamilton, Robert S. Dirksing and Reuben E. Oder on January 28, 1992 and entitled ADULT-FRIENDLY CHILD-RESISTANT ATTACHMENT FOR CONTAINERS USED TO STORE POTENTIALLY DANGEROUS MATERIALS. Child-resistant attachments of the type disclosed in co-pending U.S. Application Serial No.

15 826,747 may be formed separately from the bottle or container used to house the medicament or other potentially hazardous material and thereafter secured to the container or they may be integrally formed with the container. Regardless of its exact configuration and how it is formed, the collar preferably includes a pair of spring-like

20 pushtabs which include vertical extensions at their uppermost ends. The closure has a skirt which includes a pair of interlocking teeth, sometimes referred to as pawls, which resist unscrewing of the closure once the closure has been completely applied to the bottle unless the opposed pushtabs on the collar are depressed so as to

25 disengage their vertical extensions from the interlocking teeth on the innermost surface of the closure skirt.

In improved packages or attachments of the present invention, the portion of the collar containing the spring-like pushtabs to which the vertical extensions are secured is initially

30 produced so that in their undeformed condition, the vertical extensions on the spring-like pushtabs are further apart than the corresponding innermost surfaces of the closure skirt when the closure is fully applied to the package or the attachment. As a result, application of the closure to the package causes at least a

35 degree of resilient deformation of the spring-like pushtabs and/or the vertical extensions attached thereto so that the vertical



extensions are preloaded against the innermost surface of the closure skirt when the package or attachment is in its child resistant condition.

5 It is believed that preloading of the vertical extensions of the spring-like pushtabs against the innermost surfaces of the closure skirt insures positive locking with the interlocking teeth on the interior of the closure skirt even in situations where manufacturing tolerances drift beyond specified limits, i.e., the vertical extensions of the spring-like pushtabs must always undergo
10 enough inward movement to clear the interlocking teeth on the interior of the closure skirt in order to permit unscrewing of the closure. If no preloading of the spring-like pushtabs is present, drifts in manufacturing tolerance can reduce the required amount of travel for the vertical extensions of the pushtabs and thereby permit
15 unscrewing of the closure with less depression of the spring-like pushtabs.

It is further believed that adults having impaired manual dexterity do not find the preloading force exerted by the vertical extensions on the spring-like pushtabs against the innermost surfaces
20 of the closure skirt to pose any additional opening difficulty for them because the level of preloading is not so great as to significantly increase the total force required to release the interlocks and permit unscrewing of the closure.

BRIEF DESCRIPTION OF THE DRAWINGS

25 While the specification concludes with claims particularly pointing out and distinctly claiming the present invention, it is believed the present invention will be better understood from the following description in conjunction with the accompanying drawings in which:

30 Figure 1 is an exploded simplified perspective view of a particularly preferred package of the present invention;

Figure 2 is a simplified cross-sectional view of the package generally shown in Figure 1 after the package has been assembled, said view being taken at a point which is perpendicular to
35 anti-rotation lugs 28 on bottle 12;



Figure 3 is a simplified cross-section generally similar to that of Figure 2, but showing a cross-section through anti-rotation lugs 28 on bottle 12;

Figure 4 is a simplified cross-sectional view of the package of Figure 2 taken through section line IV-IV of Figure 2;

Figure 5 is a simplified partial perspective view of the package of Figure 1 illustrating the position of the vertical extensions on the spring-like pushtabs prior to application of the closure to the package;

Figure 6 is a side elevation view of a particularly preferred child resistant attachment of the present invention;

Figure 7 is a cross-sectional view of the attachment shown in Figure 1, said view being taken along section line I-I of Figure 6;

Figure 7A is a cross-sectional view of the child resistant attachment of Figure 6 taken along section line II-II of Figure 6;

Figure 8 is a cross-sectional view of the attachment shown in Figure 6 with the pushtabs in the depressed condition, said view being taken at a point corresponding to section line I-I of Figure 6;

Figure 8A is a cross-sectional view of the child resistant attachment of Figure 6 with the pushtabs in the depressed condition, said view being taken at a point corresponding to section line II-II of Figure 6;

Figure 9 is a side elevation view of a child resistant attachment of the present invention wherein the finish portion is integrally molded to a vial; and

Figure 9A is a cross-sectional view of the child resistant attachment and vial of Figure 9.

DETAILED DESCRIPTION OF THE INVENTION

Figure 1 shows an exploded view of an improved child resistant package 100 of the present invention. The basic package 100 is of the type generally disclosed in commonly assigned U.S. Patent 4,948,002 issued to Thornock et al. on August 14, 1990 and incorporated herein by reference. However, the present disclosure in the context of a Thornock et al. type package is intended to be a non-limiting illustrative example. Package 100 is particularly well



suited for housing medicaments. Package 100 is particularly well suited for housing medicaments, such as analgesic tablets 20. However, advantageous use of packages of the present invention is in no way limited to the field of medicaments or even to tablets.

5 Packages of the present invention may be used for storing and dispensing nearly any potentially dangerous material whether in solid, tablet, granular, powdered, semi-solid, paste or liquid form. The accompanying description in the context of a medicament tablet package is merely to facilitate a complete understanding of

10 particularly preferred embodiments of the present invention.

Figure 1 shows a bottle 12, which is preferably made of polyethylene, the most common and inexpensive analgesic bottle material. The bottle 12 is preferably injection blow molded with a wall thickness in the range of about 0.015 inches to about 0.050

15 inches. The particular bottle 12 shown in Figure 1 has a base 14 with a substantially constant elliptical cross-section. In a particularly preferred embodiment the ratio of ellipse minor dimension to major dimension is approximately 0.7.

The upper shoulder portion 16 of the bottle 12 is preferably an elliptical cone in shape. The cone included angles of upper shoulder portion 16 preferably range between about 36° and about 70°, as measured about the periphery of the bottle 12. In a particularly preferred exemplary embodiment, the base 14 exhibits a major axis of about 1.75 inches, a minor axis of about 1.25 inches

20 and an overall height of about 1.12 inches. The altitude of the truncated cone of shoulder portion 16 is about 0.75 inches in this exemplary embodiment.

Above the shoulder portion 16 of bottle 12 is a cylindrical finish portion 18, which is, in the aforementioned exemplary

25 ~~embodiment~~, about 0.5 inches in height. The three portions, base portion 14, shoulder portion 16, and finish portion 18 of bottle 12 are preferably concentrically aligned on a common vertical axis.

The internal diameter of finish 18 is a function of the diameter (or other major dimension if non-round) of tablet 20 and the fill rate of tablets. In particular, the inside diameter of finish

30 18 should be sufficiently large that bridging of tablets 20, entering the finish 18 from a tapered filling chute, is minimized. Once the



inside diameter of finish 18 has been selected, the diameter of the uppermost end of the truncated cone comprising shoulder portion 16 is determined, i.e., it is substantially equal the inside diameter of finish 18. The included cone angles selected for shoulder portion 16 then determine the major and minor axis dimensions of base portion 14. For analgesic tablets 20 having a diameter of about 0.375 inches, the major axis dimension of base portion 14 typically is in the range of about 1.5 inches to about 2.5 inches. The height of base portion 14 is selected to provide whatever overflow volume is desired in the package 100.

While any suitable means, e.g., a combination of lugs and screw threads, can be employed to rotatably and releasably secure closure 52 to the finish portion 18 of bottle 12, complementary threads are particularly preferred.

The threads 22 on finish 18 are preferably double lead threads, each with a lead angle which provides a thread pitch of about 0.1 inches to about 0.13 inches per half revolution.

Indented recess 24 located at the base of shoulder portion 16 of bottle 12 and outwardly projecting ring 26 located at the uppermost end of shoulder portion 16 of bottle 12 are intended to provide snap-fit attachment of collar 32, also shown in Figure 1. As will be described in greater detail in the following paragraphs, anti-rotation lugs 28 extending from shoulder portion 16 of bottle 12, just below outwardly projecting ring 26, are intended to interlock with collar 32 in order to prevent rotation of collar 32 relative to bottle 12 when removal torque is applied to the closure 52.

Collar 32 is preferably an injection molded part having an outside shape of a truncated cone intersecting an elliptical cylinder of the same shape as base 14 of bottle 12. Collar 32 is preferably made of a polymer which has an adequate bending modulus to provide a pair of resiliently deformable spring-like pushtabs 34. In the embodiment shown in Figure 1, spring-like pushtabs 34 are molded so that they are cantilevered at their base in their at rest position in the opposing conical sides of collar 32. Preferably they have a thickness substantially equal to that of the walls of collar 32, e.g., between about 0.040 inches and about 0.060 inches.



The top of each spring-like pushtab 34 has a vertical extension 36 which projects above the top edge of collar 32. The pushtab vertical extensions 36 interlock with teeth 62 on the innermost surface of the outer skirt 60 of closure 52 when the closure 52 is fully threaded onto the finish portion 18 of bottle 12.

As can be most clearly seen from the perspective view of Figure 5 and the cross-section of Figure 4, the spring-like pushtabs 34 are preferably molded so that in their undeformed condition their vertical extensions 36 which project above the top edge of collar 32 exhibit a dimension X_1 , as measured across their outermost surfaces, which is slightly greater than the corresponding internal dimension X_2 , which corresponds to the points of contact between the vertical extensions 36 and the opposing innermost surfaces of the closure skirt 60 immediately adjacent the closure teeth 62 when the closure 52 is fully assembled onto the package. As a result of dimension X_1 being slightly larger than dimension X_2 , application of the closure to the package causes a degree of deformation of the spring-like pushtabs 34 and/or the vertical extensions 36 attached thereto once the teeth 62 on closure skirt 60 pass by, thereby preloading the outermost surfaces of the vertical extensions 36 against the corresponding innermost surfaces of skirt 60 whenever the closure is in its fully engaged position. This is represented by the outwardly directed forces F_1 , as shown in the cross-section of Figure 4.

While the difference in dimensions X_1 and X_2 may be relatively small, e.g., on the order of about 0.001 inches and about 0.050 inches, it has unexpectedly been learned that the improved packages of the present invention employing preloaded spring-like pushtabs 34 significantly increase the child resistance of the package without at the same time causing significantly increased difficulty of opening of the package by adults having impaired manual dexterity.

For a package which fits within the user's palm, and which is to be opened by applying the user's thumb and forefinger to the opposing spring-like members 34 to release the teeth 62 on closure skirt 60 and thereby permit unscrewing the closure 52 from the package, the amount of preloading force exerted by the vertical extensions 36 against the corresponding innermost surfaces of the



closure skirt 60 need not be extremely high. For example, forces in the range of between about 0.01 pounds and about 2.00 pounds, as measured by pressing against the uppermost end of one of the opposing spring-like pushtabs 34, have been found to function reasonably well in accomplishing the objectives of the present invention. In a particularly preferred embodiment, a preloading force F_1 of about 0.25 pounds, as measured by pressing against the uppermost ends of the opposing spring-like pushtabs 34, has been found to function extremely well both in terms of improving child resistance and avoiding any significant increase in difficulty when the package is to be opened by adults having at least a degree of impairment to their manual dexterity.

While the precise phenomenon which produces the foregoing improved result is not fully understood, it is recognized that preloading of the spring-like tabs 34 in the foregoing manner will insure that the vertical extensions 36 must always undergo at least enough travel to release them from teeth 62 on closure skirt 60. Specifically, if the outermost surfaces of vertical extensions 36 are always maintained in physical contact against the corresponding innermost surfaces of closure skirt 60, the opposing spring-like pushtabs 34 must always undergo at least enough movement so that the vertical extensions 36 will clear the interlocking teeth 62 on the innermost surface of the closure skirt.

In addition, since children do not typically understand the mechanism by which opening occurs in a child resistant package, it is believed that preloading of the spring-like pushtabs 34, which offers a degree of initial resistance to their depression, naturally tends to discourage children from attempting to simultaneously further depress the opposing pushtabs while concurrently applying an unscrewing force to the closure 52. This, in turn, reduces the chances that the closure will be inadvertently opened by one who does not understand the opening mechanism.

Perhaps more importantly, because improved packages of the present invention do not pose increased opening difficulties for elderly adults or those having a degree of impairment to their manual dexterity, the adults are more prone to reapply the closure to the package once the desired amount of contents have been removed rather



than leaving the closure only partially secured to or completely off of the package after the initial opening.

Finally, improved packages of the present invention employing preloaded spring-like pushtabs 34 enhance the audible "click" which sounds whenever the teeth 62 on closure member 52 are advanced past the vertical extensions 36 on spring-like pushtabs 34. This is due to the fact that the distance between the vertical extensions 36 on resiliently deformable spring-like pushtabs 34 is minimized just prior to their clearing teeth 62 on closure skirt 60. Hence, resiliently deformable spring-like pushtabs 34 are deformed to their maximum extent just prior to teeth 62 clearing the edges of vertical extensions 36. This condition combined with the fact that the vertical extensions 36 would, in the absence of closure member 52, return to their undeformed dimension X_1 which is greater than the corresponding dimension X_2 of the interior of the closure skirt, enhances the audible "click" which occurs as soon as the vertical extensions 36 clear teeth 62.

In order to unscrew closure 52 from finish portion 18 once the closure has been fully assembled onto the finish portion 18 of bottle 12, both pushtabs 34 must be depressed such that the pushtab vertical extensions 36 disengage the closure teeth 62 located on the innermost surface of closure skirt 60. The squeezing force required to depress pushtabs 34 is preferably great enough to be difficult for a child, yet low enough that people using the medication, such as arthritics, can readily depress the opposing pushtabs 34 while concurrently applying an unscrewing force to the closure 52. The preferred squeezing force for the pushtabs is believed to be in the range of about 0.5 pounds and about 5 pounds.

In addition, pushtabs 34 are preferably substantially flush with the outermost surface of collar 32 when closure 52 has been fully assembled onto the package so that simply grasping the collar about its entire periphery is unlikely to permit vertical extensions 36 of pushtabs 34 from becoming inadvertently disengaged from closure teeth 62. Rather, a conscious decision to squeeze the opposing pushtabs must be made by the user to initiate the opening process. This minimizes the chance that a child will be able to remove closure

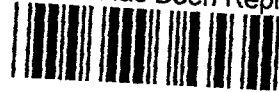


52 simply by squeezing the entire periphery of collar 32 in his or her hand while trying to unscrew closure 52.

To ensure that package 12 will remain functional until all of its contents have been dispensed, the thickness and length of spring-like pushtabs 34 should be such that bending stresses resulting either from the initial preloading or from the deflection necessary to disengage pushtab vertical extensions 36 from closure teeth 62 remain below the yield strength of the polymer comprising collar 32. Materials such as polypropylene have bending moduli and yield strengths which normally can provide squeeze forces on the lower end of the aforementioned force range, while materials such as acrylonitrile-butadiene-styrene (commonly referred to as "ABS") can be used to provide squeeze forces on the upper end of the aforementioned force range.

As can best be seen in Figure 4, the edge 44 of each pushtab extension 36 interlocks with one of the closure teeth 62 to prevent the closure 52 from being unscrewed unless both of the spring-like pushtabs 34 are depressed. These two surfaces contact in such a way that torque applied in a direction to unscrew closure 52 (direction of arrow 3) will cause pushtab extensions 36 to be pulled outward against the inner surface of skirt 60 unless the pushtabs 34 have been depressed prior to applying the unscrewing torque. This feature enhances the child resistance of package 100, since it prevents high closure removal torque alone from causing pushtab extensions 36 to become disengaged from closure teeth 62.

As can best be seen in Figures 2 and 3, collar 32 has an inwardly projecting ring 38 on its lowermost inner surface and an inwardly projecting ring 40 on its uppermost inner surface. Inwardly projecting ring 40 further includes an inwardly projecting lip 41 on its lowermost surface. Ring 38 of collar 32 snap-fits into recess 24 of bottle 12 and ring 40 with inwardly projecting lip 41 snaps over outwardly projecting ring 26 of bottle 12, as generally shown in Figures 2 and 3. A recess 42 on opposing sides of ring 40 of collar 32 mates with anti-rotation lugs 28 on shoulder portion 16 of bottle 12 to prevent rotation of collar 32 on bottle 12, as discussed earlier, once the collar has been snapped into place on bottle 12.



Closure 52 shown in Figure 1 preferably has an outer skirt 60 which has the same outside diameter as the top of the truncated cone surface of collar 32. The two teeth 62 projecting from the inside of skirt 60 are preferably 180° from each other. The teeth 62 preferably have gentle ramps that cam the vertical extensions 36 of the spring-like pushtabs 34 inward when the closure 52 is being screwed onto the finish portion 18 of bottle 12, but sharp edges that interlock with the pushtab vertical extensions 36 once the closure 52 has been fully assembled onto the bottle 12 and is thereafter twisted in the direction of removal.

Outer skirt 60 of closure 52 preferably has its inner bottom edge beveled, as shown in Figure 2, to act as a lead-in when skirt 60 first contacts the top of the vertical extensions 36 of spring-like pushtabs 34 during closure installation. A second skirt 54 of closure 52, inside of skirt 60, has internal threads 56 which are complementary to external threads 22 on the finish portion 18 of bottle 12.

The double skirted closure design permits the use of a relatively wide, annular, inwardly projecting ring 40 at the top of collar 32. This relatively wide annular ring 40 provides rigidity to collar 32 such that it can be readily snap-fit onto bottle 12.

The closure 52 is preferably made of polypropylene for good frictional properties between the internal closure threads 56 and the preferred polyethylene exterior threads 22 on finish portion 18 of bottle 12. Inside closure 52 there is preferably provided a cardboard or other suitable liner 58, which seals against the top of the finish portion 18 of bottle 12 when the closure 52 is installed on the bottle. Because of the variation in thickness and compressibility of liner 58, the location of teeth 62 relative to the start of internal closure threads 56 is preferably such that teeth 62 pass beyond the vertical extensions 36 of spring-like pushtabs 34 somewhat when closure 52 is fully assembled onto the bottle. This minimizes the need for tight tolerances on mating parts.

The relationships of the mating parts of package 100 are best shown in Figures 2 and 3, which are vertical cross-sectional views of the bottle 12, collar 32, and closure 52 in their fully assembled condition. The cross-section of Figure 3 is taken at 90°



to the cross-section of Figure 2 to better show anti-rotation lugs 28.

Figure 4 is a sectional view, taken along section line IV-IV of Figure 2, which better shows how the teeth 62 on skirt 60 of closure 52 interlock with the vertical extensions 36 of spring-like pushtabs 34 once the closure has been fully installed on the bottle.

As will be appreciated by those skilled in the art, the preloading of the spring-like pushtabs 34 described in connection with the package embodiment of Figure 1 of the present invention may also be applied to many of the other package embodiments disclosed in commonly assigned U.S. Patent 4,948,002 issued to Thornock et al. on August 14, 1990 and incorporated herein by reference.

The particular method by which preloading of the resiliently deformable spring-like pushtabs 34 will, of course, have to be adjusted to accommodate the construction of the particular package. For example, in a particularly preferred embodiment of the present invention, resiliently deformable spring-like pushtabs 34 are simply molded so that their uppermost ends project slightly beyond the outermost surface of shroud 32 prior to application of the closure 52 to the package. Application of the closure 52 to the package causes a degree of resilient deformation of the spring-like pushtabs 34 so that in the assembled condition of the package, the uppermost ends of spring-like pushtabs 34 are substantially flush with the outermost surfaces of shroud 32.

For those embodiments of the shroud employing a simple hinge-like connection between the spring-like pushtabs and the shroud or collar, the auxiliary support members used to impart in-use spring-like resistance to the innermost surface of the pushtabs may be outwardly extended to a degree so as to produce a slight initial outward orientation of the pushtabs in relation to the surrounding shroud prior to application of the closure to the package.

The particular method employed to produce a resiliently deformable spring-like pushtab configuration which will serve to preload the outermost surfaces of vertical extensions 36 against the corresponding innermost surfaces of the closure skirt 60 is non-critical.



As pointed out earlier in the present specification, the present invention may also, if desired, be practiced to great advantage with child-resistant attachments of the type generally disclosed in co-pending commonly assigned U.S. Patent Application
5 Serial No. 826,747 filed in the names of Peter W. Hamilton, Robert S. Dirksing and Reuben E. Oder on January 28, 1992 and entitled ADULT FRIENDLY CHILD-RESISTANT ATTACHMENT FOR CONTAINERS USED TO STORE POTENTIALLY DANGEROUS MATERIALS. Child-resistant attachments of the type disclosed in co-pending U.S. Application Serial No. 826,747 may
10 be formed separately from the bottle or container used to house the medicament or other potentially hazardous material and thereafter secured to the bottle or container or they may be integrally formed with the bottle or container.

Figure 6 shows a side view of a preferred child resistant attachment 2100 of the type generally disclosed in co-pending
15 commonly assigned U.S. Patent Application Serial No. 826,747, said attachment further embodying the present invention. Attachment 2100 is particularly well suited for use in conjunction with typical cylindrical pharmaceutical bottles and vials to dispense pharmaceutical products, such as tablets. However, the present
20 invention may also, if desired, be practiced to advantage using containers having a noncylindrical cross-section, as measured perpendicular to the container's vertical axis, e.g., elliptical cross-sections, rectangular cross-sections, etc. Attachment 2100 comprises finish portion 2001 and closure 2002. Finish portion 2001 and closure 2002 are preferably injection molded of polypropylene, polystyrene, polycarbonate, or the like. Finish portion 2001
25 comprises attachment ring 2004 and tab ring or annular collar 2005. While the annular collar shown in Figure 6 is generally cylindrical in cross-section, it can, if desired, be of other cross-sectional shapes, e.g., elliptical, etc., with the cantilevered pushtabs (described in detail hereinafter) located at the opposed ends of the ellipse's major axis. Bead 2003 on attachment ring 2004 is used to secure attachment 2100 to a pharmaceutical package (not shown). Tab
30 collar 2005 is interrupted by slots 2006, thereby forming a pair of opposed cantilevered pushtabs 2007, as shown in Figure 7.



Figure 7 is a cross-sectional view of attachment 2100 taken through section line I-I of Figure 6. The closure securement ring includes first means for rotatably and releasably securing closure 2002 to finish portion 2001. In the illustrated embodiment, the first means comprises helical threads 2009 on the outermost surface of thread ring 2010. The closure 2002 includes second means complementary to said first means for rotatably and releasably securing the closure to the closure securement ring. In the embodiment of Figure 7, the second means comprises threads 2018 on the innermost surface of thread collar 2017 on closure 2002. While any suitable releasable securement means, e.g., a combination of lugs or screw threads, can be employed to rotatably and releasably secure closure 2002 onto finish portion 2001, complementary screw threads 2009 and 2018, respectively, as shown in Figure 7 are particularly preferred.

The threads 2009 on the exterior surface of thread ring 2010 are preferably double lead threads. The pitch of complementary threads 2009 and 2018 is preferably such that closure 2002 is fully seated onto finish portion 2001 with approximately 180° of rotation.

The collar 2005, thread ring 2010, and attachment ring 2004 are preferably integrally molded and are generally concentric with one another. The top of each spring-like pushtab 2007 has a vertical extension 2008 which projects above the plane of the top edge of tab collar 2005. The vertical extensions 2008 interlock with pawls 2015 on the innermost surface of lock ring 2016 of closure 2002 when the closure 2002 is fully threaded onto finish portion 2001. A channel 2011, formed between the inner surface of tab collar 2005 and thread ring 2010, accepts thread collar 2017 when closure 2002 is threaded onto finish portion 2001.

During assembly of closure 2002 onto finish portion 2001, pawls 2015 must rotate past vertical extensions 2008. However, vertical extensions 2008 interfere with rotation of pawls 2015 and cause pushtabs 2007 to be resiliently deflected inwardly. Gradual lead-in ramps on pawls 2015 facilitate the deflection. In general it is preferred that the lead-in ramps exhibit a gradual inwardly directed taper so as to avoid a sudden increase in the reapplication torque required to fully seat the closure 2002 onto the finish



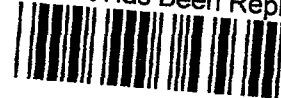
portion 2001. If desired, the mating surfaces of vertical extensions 2008 may also be profiled, as generally shown in the cross-sections of Figures 7A and 8A, to minimize the reapplication torque required to fully seat the closure 2002 onto the finish portion 2001 of the attachment 2100. Both of these features help to ensure that the user will properly reapply the closure to restore child resistance to the package after the package has been opened.

Continued rotation of closure 2002 causes pawls 2015 to clear the vertical extensions 2008, thereby permitting vertical extensions 2008 and pushtabs 2007 to resiliently return to the latched condition shown in Figures 7 and 7A. The finish portion 2001 is molded so that the vertical extensions 2008 exhibit an unrestrained maximum exterior dimension which is somewhat greater than the inside diameter of the closure lock ring 2016. In this situation, application of closure 2002 to finish portion 2001 results in preloading of the vertical extensions 2008 against the interior surface of lock ring 2016 when the closure 2002 is fully seated, as shown in Figure 7A.

The arrangement of threads 2009 and 2018 in conjunction with vertical extensions 2008 and pawls 2015 is such that latching of pawls 2015 past vertical extensions 2008 occurs nearly simultaneously with the seating of closure 2002 onto finish portion 2001, at which point seal lip 2020 preferably engages finish taper 2025 to form a seal. This is readily achievable, since the thread 2009 is integrally molded with the finish portion 2001 that includes the integrally formed pushtabs 2007, vertical extensions 2008 and finish taper 2025 while the thread 2018 is integrally formed with the closure 2002 which includes pawls 2015 and seal lip 2020.

Figure 7A is a cross-sectional view of attachment 2100 taken along section line II-II in Figure 6. With pushtabs 2007 in the position shown in Figures 7 and 7A, edges 2030 of vertical extensions 2008 impede counter-clockwise rotation of pawls 2015 preventing attempts to reopen the attachment by rotating the closure 2002 in the counter-clockwise direction indicated by the arrow "T".

Clearance in channel 2011 between the outer surface of thread collar 2017 and the inner surface of pushtabs 2007 noted as dimension "X" in Figure 7 permits sufficient inward deflection of



pushtabs 2007 from the position shown in Figures 7 and 7A that the vertical extensions 2008 will clear pawls 2015 when the user concurrently depresses pushtabs 2007 and applies an unscrewing torque in the direction of arrow "T" to the closure 2002.

5 Figure 8 is a view of attachment 2100 taken at a point corresponding to section line I-I of Figure 6, but with pushtabs 2007 deflected inwardly. In order to unscrew closure 2002 from finish portion 2001 once the closure has been fully assembled, sufficient manual pressure must be applied to opposed pushtabs 2007 in the
10 direction indicated by arrows "P" in Figure 8 such that the vertical extensions 2008 on pushtabs 2007 disengage the pawls 2015 on the innermost surface of lock ring 2016 of closure 2002. The squeezing force required to depress pushtabs 2007 is preferably great enough to be difficult for a child, yet low enough that people using the
15 medication, such as arthritics, can readily depress the opposing pushtabs 2007 while concurrently applying an unscrewing torque in the direction of arrow "T" in Figure 8A to the closure 2002. The preferred squeezing force "P" for the pushtabs 2007 to provide child resistance without imposing undue difficulty for adults with impaired
20 manual dexterity is believed to be within the range of about 0.5 pounds to about 5 pounds.

 In addition, pushtabs 2007 are preferably substantially flush with the outermost surface of tab ring or collar 2005 when the closure 2002 is fully secured in place so that simply grasping the
25 collar about its entire periphery and squeezing is unlikely to permit both of the vertical extensions 2008 on the opposed pushtabs 2007 to become inadvertently disengaged from pawls 2015 at the same time an unscrewing torque is being applied to the closure 2002. Rather, a conscious decision to squeeze the opposing pushtabs 2007 must be made
30 by the user to initiate the opening process, and this must be accompanied by a concurrent application of unscrewing torque to the closure 2002 to proceed further. This minimizes the chance that a child will be able to remove closure 2002 simply by squeezing the entire periphery of tab collar 2005 in his or her hand while trying
35 to unscrew closure 2002.

 Figure 8A is a cross-sectional view of attachment 2100 taken at a point corresponding to section line II-II of Figure 6, but



showing the attachment 2100 in the condition shown in Figure 8, i.e., with pushtabs 2007 deflected inwardly. Vertical extensions 2008 are thus shifted to a position wherein edges 2030 no longer impede counter-clockwise rotation of pawls 2015 on lock ring 2016 in the direction indicated by the arrow "T". The user of child resistant attachment 2100 is then able to further rotate closure 2002 in a counter-clockwise direction, thereby causing the closure 2002 to rise above vertical extensions 2008 and release the engagement of threads 2009 and 2018 on thread ring 2010 and thread collar 2017, respectively. This permits closure 2002 to be completely removed from finish portion 2001.

Figure 9 is a partially segmented side elevation view of still another alternative embodiment 2500 of a child resistant attachment of the present invention. However, as can be seen from Figures 9 and 9A, finish portion 2501 of child resistant attachment 2500 is integrally molded as a single component with vial 2550. Closure 2502 is shown unassembled from finish portion 2501 in Figure 9. A portion of the tab collar 2505 is shown partially segmented to expose channel 2511 which accepts thread collar 2517 of closure 2502. Tab ring or collar 2505 is interrupted by slots 2506 to form a pair of opposed cantilevered spring-like pushtabs 2507. Pushtabs 2507 have vertical extensions 2508 which project above the plane of the upper surface of tab collar 2505.

Figure 9A shows a cross-sectional view of child resistant attachment 2500 and vial 2550 with closure 2502 in a fully assembled condition, said view be taken through the opposed pushtabs 2507. The lowermost end of attachment ring 2504 is integrally molded to the uppermost end of vial 2550. Complementary threads 2509 and 2518 on the outermost surface of thread ring 2510 and the innermost surface of thread collar 2517, respectively, secure closure 2502 onto finish portion 2501. Vertical extensions 2508 interlock with pawls 2515 on the innermost surface of lock ring 2516. As with the embodiment of Figures 6-8A, the finish portion 2501 is molded so that the vertical extensions 2508 exhibit an unrestrained maximum exterior dimension which is somewhat greater than the inside diameter of the closure lock ring 2516. In general, operation of child resistant attachment



2500 is similar to that described for child resistant attachment 2100.

It is believed that the package designs, attachment designs and processes described herein and their intended advantages will be understood from the foregoing description. It will, of course, be apparent to those skilled in the art that various changes may be made in form, construction, and arrangement without departing from the spirit and scope of the invention and it is intended to cover in the appended claims all such modifications that are within the scope of this invention.

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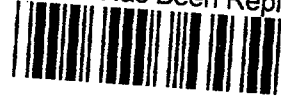
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CLAIMS:

1. A package suitable for storing and dispensing potentially dangerous material, said package being resistant to opening by children yet readily openable by adults, said package comprising:

- (a) a bottle for containing said potentially dangerous material, said bottle having a base portion and a finish portion;
- (b) first means for releasably securing a closure to said finish portion of said bottle, said first means being secured in fixed relation about the periphery of said finish portion;
- (c) a collar secured in relation to said base portion of said bottle, said collar including at least one resiliently deformable pushtab having a vertical extension projecting above the uppermost surface of said collar, the uppermost end of said pushtab being inwardly movable relative to the rest of said collar when a squeezing force is applied to said uppermost end of said pushtab; and
- (d) a closure having at least one skirt and including second means for cooperating with said first means to rotatably and releasably secure said closure to said bottle, said closure also having at least one interlocking tooth on the innermost surface of said skirt, said interlocking tooth being so shaped and positioned that it will deflect said vertical extension of said resiliently deformable pushtab when said closure is rotatably secured onto said finish portion of said bottle, but will prevent removing said closure from said finish portion of said bottle by rotating said closure in the reverse direction unless said resiliently deformable pushtab on said collar is first depressed to disengage said pushtab vertical extension from said interlocking tooth, said





resiliently deformable pushtab having an undeformed configuration which will cause interference between the innermost surface of said closure skirt and the outermost surface of said vertical extension on said pushtab whenever said closure is fully secured onto said finish portion of said container, whereby said pushtab is resiliently deformed, at least to a degree, whenever said closure is fully secured onto said finish portion of said container so that said vertical extension on said pushtab exerts a preloading force against the innermost surface of said closure skirt.

2. A package suitable for storing and dispensing potentially dangerous material, said package being resistant to opening by children yet readily openable by adults, said package comprising:

- (a) a bottle for containing said potentially dangerous material, said bottle having a base portion and a finish portion;
- (b) first means for releasably securing a closure to said finish portion of said bottle, said first means being secured in fixed relation about the periphery of said finish portion, said base portion and said finish portion being interconnected to one another by a shoulder portion which converges in the direction of said finish portion;
- (c) a collar secured in relation to said shoulder portion of said bottle, said collar including at least one resiliently deformable pushtab having a vertical extension projecting above the uppermost surface of said collar, the uppermost end of said pushtab being inwardly movable relative to the rest of said collar when a squeezing force is applied to said uppermost end of said pushtab; and
- (d) a closure having at least one skirt and including second means for cooperating with said first means to releasably secure said closure to said bottle, said





closure also having at least one interlocking tooth on the innermost surface of said skirt, said interlocking tooth being so shaped and positioned that it will deflect said vertical extension of said resiliently deformable pushtab when said closure is advanced onto said finish portion of said bottle, but will prevent removing said closure from said finish portion of said bottle unless said resiliently deformable pushtab on said collar is first depressed to disengage said pushtab vertical extension from said interlocking tooth, said resiliently deformable pushtab having an undeformed configuration which will cause interference between the innermost surface of said closure skirt and the outermost surface of said vertical extension on said pushtab whenever said closure is fully secured onto said finish portion of said container, whereby said pushtab is resiliently deformed, at least to a degree, whenever said closure is fully secured onto said finish portion of said container so that said vertical extension on said pushtab exerts a preloading force against the innermost surface of said closure skirt.

3. A package suitable for dispensing medicament tablets or the like, said package being resistant to opening by children yet readily openable by adults, said package comprising:

- (a) a bottle for containing said medicament tablets, said bottle having a base portion;
- (b) first means for releasably securing a closure to said finish portion of said bottle, said first means being secured in fixed relation about the periphery of said finish portion, said base portion and said finish portion being interconnected to one another by a shoulder portion which converges in the direction of said finish portion;
- (c) a collar secured in relation to said shoulder portion of said bottle, said collar including a pair of





resiliently deformable spring-like pushtabs located approximately 180° from one another on the periphery of said collar, each of said resiliently deformable spring-like pushtabs having a vertical extension projecting above the uppermost surface of said collar, the uppermost ends of said pushtabs being inwardly movable relative to the rest of said collar when opposed squeezing forces are applied to said uppermost ends of said pushtabs; and

- (d) a closure having at least one skirt and including second means for cooperating with said first means to releasably secure said closure to said bottle; said closure also having a pair of interlocking teeth located approximately 180° from one another on the innermost surface of said skirt, said interlocking teeth being so shaped and positioned that they will deflect said vertical extensions of said resiliently deformable spring-like pushtabs when said closure is advanced onto said finish portion of said bottle, but will prevent removing said closure from said neck portion of said bottle unless said resiliently deformable spring-like pushtabs are first depressed to disengage said pushtab vertical extensions from said interlocking teeth, said resiliently deformable pushtabs having an undeformed configuration which will cause interference between the innermost surface of said closure skirt and the outermost surface of said vertical extensions on said pushtabs whenever said closure is fully secured onto said finish portion of said container, whereby said pushtabs are resiliently deformed, at least to a degree, whenever said closure is fully secured onto said finish portion of said container so that said vertical extensions on said pushtabs exert a preloading force against the innermost surfaces of said closure skirt.





4. A child resistant attachment for a container suitable for storing and dispensing potentially dangerous material, said attachment being resistant to opening by children yet readily openable by adults, said child resistant attachment comprising:

- (a) a finish portion having a closure securement ring including first means for rotatably and releasably securing a closure to said closure securement ring on at least one of its surfaces, means for securing said finish portion to said container, and an annular collar, generally concentrically aligned with said closure securement ring, interrupted by at least one pair of slots, thereby forming at least one resiliently deformable cantilevered pushtab having an exposed surface contour which generally conforms to the exterior surface contour of the adjacent portions of said annular collar to minimize the chance of inadvertent depression thereof when said annular collar is grasped, said pushtab having a vertical extension projecting above the uppermost surface of said annular collar, the uppermost end of said pushtab being inwardly movable relative to the rest of said annular collar when a squeezing force is applied to said uppermost end of said pushtab; and
- (b) a closure having a first skirt including on at least one of its surfaces second means complementary to said first means for rotatably and releasably securing said closure to said closure securement ring on said finish portion and a second skirt external to first skirt, said closure also having at least one interlocking pawl on the innermost surface of said second skirt, said interlocking pawl being so shaped and positioned that it will deflect said vertical extension of said resiliently deformable pushtab when said closure is rotatably secured onto said finish portion, but will prevent removing said closure from said finish portion by rotating said closure in the reverse direction unless said resiliently deformable cantilevered





pushtab on said annular ring is first depressed to disengage said pushtab vertical extension from said interlocking pawl, said resiliently deformable cantilevered pushtab having an undeformed configuration which will cause interference between the innermost surface of said second closure skirt and the outermost surface of said vertical extension whenever said closure is fully secured onto the finish portion of said container.

5. The child resistant attachment of Claim 4, wherein said attaching means for securing said finish portion to said container comprises an attachment ring including a securement means which mates with a corresponding securement means on said container so as to resist separation of said child resistant attachment from said container, especially by children, once said child resistant attachment is fully assembled onto said container.

6. The child resistant attachment of Claim 5, wherein said securement means permits unlimited 360° rotation of said child resistant attachment relative to said container about a vertical axis passing through the center of said child resistant attachment while maintaining said finish portion securely attached to said container, thereby further frustrating attempts by children to gain access to the contents of said container.

7. The child resistant attachment of Claim 4, wherein said finish portion of said child resistant attachment is permanently secured to said container.

8. The child resistant attachment of Claim 7, wherein said finish portion of said child resistant attachment is permanently secured to said container by integrally molding it therewith.

9. The child resistant attachment of Claim 4, wherein said first and second means for rotatably and releasably securing said closure to said closure securement ring comprises complementary screw





threads, wherein said annular collar includes two pairs of slots, thereby forming a pair of opposed resiliently deformable pushtabs having vertical extensions thereon and wherein said closure includes a pair of opposed pawls.

10. The child resistant attachment of Claim 9, wherein the squeezing force required to depress said opposed resiliently deformable pushtabs a sufficient distance to disengage said vertical extensions from said interlocking pawls is in the range of about 0.5 pounds to about 5 pounds.

11. The structure of Claim 1, Claim 2, Claim 3 or Claim 4, wherein said preloading force exerted by the vertical extension of each of said opposed resiliently deformable pushtabs against the innermost surface of said closure skirt is between about 0.01 pounds and about 2 pounds.

12. The structure of Claim 1, Claim 2, Claim 3 or Claim 4, wherein each of said resiliently deformable pushtabs on said collar is joined to said collar at its lowermost end via a cantilevered connection, whereby each of said resiliently deformable pushtab resists said squeezing force applied to its uppermost end by acting as a beam spring through its cantilevered connection to the remainder of said collar.

13. The structure of Claim 1, Claim 2, Claim 3 or Claim 4, wherein said first and second means for releasably securing said closure onto said finish portion of said bottle comprise complementary screw threads.

14. The structure of Claim 1, Claim 2 or Claim 3 wherein said collar is secured in relation to said bottle by means of at least one groove on said bottle or said collar and at least one complementary ring on the other of said bottle or said collar.

15. The structure of Claim 14 further including at least one anti-rotation lug on said bottle and a complementary recess on





the mating portion of said collar, whereby said collar is prevented from rotating relative to said bottle when removal torque is applied to said closure without first depressing each of said resiliently deformable pushtab to disengage each of said pushtab vertical extensions from the interlocking tooth on the skirt of said closure.

16. The structure of Claim 1, Claim 2, Claim 3 or Claim 4, wherein said interlocking tooth on the innermost surface of the skirt of said closure exhibits a cam shaped surface of gradually decreasing radius which will gradually deflect the vertical extension of said resiliently deformable pushtab when said closure is advanced onto said finish portion of said bottle, but which will permit said vertical extension to snap back toward its undeformed condition immediately upon passage of the interlocking tooth beyond said vertical extension of said pushtab, whereby the user is provided with an audible signal that the package has been rendered child resistant for the next dispensing cycle.

17. The structure of Claim 16 wherein said vertical extension of said resiliently deformable pushtab and said interlocking tooth on the skirt of said closure are provided with mating surfaces which will tend to more tightly interlock said tooth and said vertical extension with one another if removal torque is applied to said closure without first depressing the uppermost end of said pushtab.

18. The structure of Claim 1, Claim 2 or Claim 3 wherein said closure skirt containing said interlocking tooth comprises an outermost skirt.

