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(54) IMPROVED CHILD-RESISTANT CAP FOR LIQUID MEDICAMENTS

VERBESSERTE KINDERSICHERE KAPPE FÜR FLÜSSIGE ARZNEIMITTEL

BOUCHON À L'ÉPREUVE DES ENFANTS AMÉLIORÉ POUR MÉDICAMENTS LIQUIDES

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(73) Proprietor: **Comar, LLC**
Buena, NJ 08310 (US)

(72) Inventors:
- **BUEHLER, John**
  Bridgeto, New Jersey 08302 (US)
- **DALY, John**
  Ocean City, New Jersey 08226 (US)
- **DIPLACIDO, Kevin**
  Williamstown, New Jersey 08904 (US)
- **HAROLD, Redd**
  Ocean View, New Jersey 08302 (US)
- **KERSHNER, David**
  Egg Harbor Township, New Jersey 08234 (US)
- **MANERA, David**
  Buena, New Jersey 08310 (US)
- **STANGLE, Timothy**
  Linwood, New Jersey 08221 (US)
- **GRANATO, Russ**
  Vineland, New Jersey 08360 (US)

(74) Representative: **Leonard, Thomas Charles et al**
Kilburn & Strode LLP
Lacon London
84 Theobalds Road
London WC1X 8NL (GB)

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Description

FIELD OF THE INVENTION

[0001] The invention relates to improvements to child-resistant closures for dispensers of liquid medicaments, in particular dispensers of liquid ophthalmic and nasal medicaments, and thereby provides enhanced safety of the dispensers by making the contents of the containers less susceptible to access by children.

BACKGROUND OF THE INVENTION

[0002] Child-resistant caps for medicaments have been known in the art for nearly fifty years. These caps generally require two opposed movements acting at the same time to overcome the locking mechanism. For example, one type of cap requires a user to squeeze the cap at specific points, causing a deformation, and then to rotate the cap. If either the squeezing or rotating step is not performed, the cap cannot be opened. Another common method for imparting child-resistance on a cap is to require that the cap be pushed in a downward direction and then turned in order to be removed. Again, it can be seen that the two movements are opposed to one another; it is only through application of this unnatural combination of movements that the cap can be removed. Such a cap is disclosed in U.S. Patent 5,316,161, and it has the features of the preamble of claim 1.

[0003] However, several issues arose with implementation of prior art caps. Such caps utilized unequal numbers of lugs and their mates; that is to say, in a two-piece closure, the prior art taught a greater number of lugs, beams, or fingers on an inner shell than the corresponding number of lugs, beams, or fingers on an outer shell or vice-versa. This meant that not all of the lugs, beams, or fingers of one shell were being engaged. This lack of engagement allowed for slippage during the rotational process, which can lead to damage to the lugs, beams, and fingers of both the outer and inner caps. Such damage often manifested itself in the form of stripping of the lugs, beams, and fingers. When these parts become stripped, the user is required to apply greater downward force to engage the appropriate mechanisms. However, the application of this downward force would often result in additional damage to the lugs, beams, or fingers. Additionally, prior art caps utilized flexible lugs, beams, or fingers with an angled underside. This angled underside presented problems in that it would concentrate flexion at a very specific point which would often weaken the lug, beam, or finger.

[0004] When excess force is applied to flexible lugs, beams, or fingers, they are often forced to flex beyond their capabilities. This hyper-flexion can result in a permanent deformation and even complete breakage of the lugs, beams, or fingers. In lugs, beams, or fingers having an angled underside, breakage often occurred immediately above the angle. Once breakage has occurred, whether above the angle or elsewhere, the deformed or broken lugs, beams, or fingers may no longer exert a contrary or biasing force on other component parts of the cap. In such situations, no downward force is necessary for removal, leaving only a rotational force required to remove the cap. Therefore, the cap is no longer child-resistant.

[0005] Additionally, prior art caps often permitted an outer cap to float above and rotate unhindered about an inner cap until the application of a downward force. However, a major complaint of child-resistant caps has been that they are difficult for the elderly and infirm to remove. With free-floating caps, the elderly often have a difficult time applying the appropriate amount of downward force necessary to get the appropriate lugs, beams, or fingers to engage. Similarly, the elderly often have a difficult time maintaining the appropriate downward force throughout the rotational movement. When applied to prior art caps, this lack of coordination and partial engagement would result in frustration on the part of the user. Redoubled efforts often resulted in damage to the elements of the cap, through the combination of improper alignment and application of excess force, albeit briefly applied. This was manifested in the crushing of certain portions or the stripping of others. Additionally, when excess force is applied to a misaligned cap, portions of the cap may jam, requiring additional unconventional movements to clear the jam. These unconventional movements may damage the cap, again leading to decreased, if not eliminated, child-resistance.

[0006] Similarly, an additional problem of prior art caps is that they require a downward force to apply them to a pre-existing bottle. This is especially important to manufacturers, as machines capable of applying a downward force are more expensive than those which only apply a rotational force. Work-arounds have been designed, however they are expensive and can often involve re-tooling of a machine, at a cost which eats into the profit margin of the manufacturer. Additionally, on machines imparting a downward force (whether through original design or through later modifications), the amount and timing of downward force must be carefully calculated and must remain within specific tolerances. If the machine ventures too far beyond these tolerances, excess downward force may be applied to the cap as it is being affixed to the pre-existing bottle, and damage to the lugs, beams, and fingers may result. As mentioned above, such damage includes, but is not limited to, deformation or breakage of the lugs, beams, or fingers, as well as crushing of other various critical components of the cap.

[0007] Finally, when prior art child-resistant closure mechanisms were applied to dispensers of liquid medicaments, their design did not significantly differ from bottles for pill-form medicaments. That is to say, the shape of the cap was cylindrical, which created a large interior cavity where medicament could pool when the bottle was inverted while the cap was affixed thereto. In such prior art caps, a large quantity of residual medicament would

then remain in the cap upon removal. Should a young child obtain access to this medicament-laden cap, it would be possible for the child to ingest significant quantities of the liquid medicament simply by removing the residual amount stored in the inner chamber of the cap.

[0008] As a result, in light of the foregoing, it is clear that there is an unmet need in the art. The prior art caps are prone to damage resulting in loss of child-resistant qualities, and further, may unintentionally provide access to significant amounts of residual liquid medicament stored in the removed cap. Specifically, there has been a need for a cap: (1) which reduces potential for damage to component parts through full engagement of lugs, beams, or fingers, (2) prevents over-flexion of lugs, beams, or fingers, (3) modifies the shape of lugs, beams, or fingers, (4) allows the elderly to more easily remove the cap, (5) provides for easier application of the cap by manufacturing processes while at the same time reducing the likelihood of damage to the cap, and (6) minimizes the amount of residual medicament accessible to a child in possession of the removed cap.

BRIEF SUMMARY OF THE INVENTION

[0009] The present invention provides an improved child-resistant closure for liquid ophthalmic and nasal medicaments, as well as a system for providing child-resistant closure of an existing bottle, and a method of application and removal, providing ease of application during the bottling phase and enhanced child-resistant properties once the apparatus and system have been distributed to an end user.

[0010] The subject matter for which protection is sought is as defined in the claims.

[0011] The present invention as defined in claim 1 provides a two-piece, child-resistant closure device for dispensers of liquid medicaments, the closure device comprising:

an outer cap having

a top portion,
a depending skirt,
an internal chamber with

a shoulder having a quantity of shoulder lugs mounted thereon, each shoulder lug having a first end, and a second end, the second end comprising a lug face, wherein the lug faces are oriented in a common rotational direction, and
an annular ridge having a quantity of skirt lugs mounted thereon, each skirt lug having a first end and a second end, the second end comprising a lug face and a bottom surface wherein the lug faces are oriented in a common rotational direction, and wherein the rotational direction of the shoulder lug faces is opposite the rotational direction of the skirt lug faces, and

an assembly retaining bead; and

an inner cap having

a top portion,
a shoulder having a quantity of shoulder lugs mounted thereon, each shoulder lug having a first end, and a second end, the second end comprising a lug face, wherein the lug faces are oriented in a rotational direction complementary to the rotational orientation of the lug faces of the shoulder lugs of the outer cap,
a depending skirt having a quantity of flexible beams mounted thereon, each flexible beam having:

a beam base having an upper face and a leading face, and
a beam arm comprising an angled ridge terminating in a beam head distal to the beam base, the angled ridge having an underside which extends from a leading face in an arcuate or radius manner, the beam head having an upper surface and a beam face, the angled ridge having a top side and an underside, wherein the angled ridge is connected to the beam base such that the top side of the angled ridge extends from the upper face of the beam base and the underside of the angled ridge extends from the leading face of the beam base, wherein the beam faces are oriented in a common rotational direction complementary to the rotational orientation of the lug faces of the skirt lugs of the outer cap; and

an inner threaded cavity;
wherein the quantity of shoulder lugs of the outer cap is equal to the quantity of shoulder lugs of the inner cap, and
wherein the quantity of skirt lugs of the outer cap is equal to the quantity of flexible beams of the inner cap;

characterised in that:
the underside of the angled ridge extends from the leading face of the beam base in an arcuate or radiused manner.

[0012] The invention also provides a system for providing child-resistant closure of a bottle of liquid medicaments using the device of the invention, wherein the flexible beam is capable of deformation.

[0013] The invention also provides a method for removing the child-resistant closure of the invention from

an outwardly-threaded bottle of liquid medicaments, the method comprising:

applying a downward force on the outer cap,
applying a rotational movement upon the outer cap,
continuing to apply the downward force and rotational movement upon the outer cap until the shoulder lugs of the outer cap engage the shoulder lugs of the inner cap,
ceasing to apply a downward force to the outer cap,
maintaining the rotational movement applied to the upper cap such that the outer cap and inner cap rotate in concert about a central axis,
disengaging the closure from the outwardly threaded bottle of liquid medicaments.

[0014] The invention also provides a method for affixing the child-resistant closure of the invention to an outwardly-threaded bottle of liquid medicaments, the method comprising:

applying a rotational movement upon the outer cap until the skirt lugs of the outer cap engage the flexible beams of the inner cap,
maintaining the rotational movement applied to the outer cap such that the outer cap and inner cap rotation in concert about a central axis,
allowing the concerted rotation of the outer and inner caps to engage a thread of an outwardly-threaded bottle, and
ceasing to apply rotation movement upon the outer cap once the inner cap has fully engaged the thread of the outwardly-threaded bottle.

[0015] The invention provides for a cap with matching numbers of complementary lugs and beams, with the flexible beams having an angled ridge with an arcuate underside. Additional embodiments of the closure include the requirement that an underside of an upper lug overlap a lower flexible beam by a predetermined distance or range of distances when the lug faces of upper lugs are properly aligned. These embodiments improve upon the reliability of a child-resistant closure by ensuring that it is only engaged when properly aligned, providing ideal frictional contact, and preventing undue stress upon the flexible beams when a downward force has been applied to them. Additional embodiments include modifications to a top portion of the cap, wherein one embodiment provides for a flat top and an alternative embodiment provides for a shaped top, complementary to the shape of a dispenser of liquid medicaments, to minimize the internal volume available for unintentional pooling of excess medicament.

[0016] An additional embodiment of the invention is a system in which flexion of the flexible beams is limited such that the beam head does not extend below the beam base of an adjacent flexible beam. By limiting such flexion, the beams are not damaged by hyper-flexion. The prior art does not address this issue, and by permitting beams to be unnecessarily hyper-flexed, the resiliency of the beam is decreased, often to the point where no downward force is necessary to engage the lugs of the cap, and the child-resistant nature of the cap has been eliminated.

[0017] The final embodiments of the invention relate to methods for attaching and removing the closure from a bottle containing liquid medicaments. In one embodiment, the steps of applying a downward force and rotating the outer cap are sequential. In another embodiment, the steps are simultaneous. However, the present invention advantageously eliminates the requirement of a constant downward force, such elimination being beneficial for elderly populations or those with arthritis. The final embodiment of the invention relates to the manner in which the invention is affixed to a bottle containing liquid medicaments. In this embodiment, no downward force is necessary. As a result, the present method is advantageous in that it does not require a re-tooling of present cap-applying machinery which lack the ability to exert a downward force. By providing for a method in which no downward force is needed, not only are more machines capable of affixing the cap to the bottle, but there is also a reduction in the likelihood of damage to the flexible beams due to miscalibrations in the amount of downward force required.

[0018] Additional objects, advantages and novel features of the invention will be set forth in part in the description, examples and figures which follow, all of which are intended to be for illustrative purposes only, and not intended in any way to limit the invention, and in part will become apparent to those skilled in the art on examination of the following, or may be learned by practice of the invention.

BRIEF DESCRIPTION OF THE FIGURES

[0019] The foregoing summary, as well as the following detailed description of the invention, will be better understood when read in conjunction with the appended drawings. It should be understood, however, that the invention is not limited to the precise arrangements and instrumentalities shown.

Figure 1 shows the improved child-resistant cap.
Figures 2A-2C show multiple views of the outer cap.
Figures 3A-3C show multiple views of the inner cap.
Figures 4A-4B show a cap with top sections complementary to the shape of a dispenser nozzle for liquid medicaments affixed to a pre-existing bottle.
Figure 5 shows the overlap of the skirt lug with the flexible beams when lug faces of the shoulder lugs are aligned.
Figures 6A-6C shows the movements of the skirt lugs of the outer cap and the flexible beam of the inner cap as the outer cap is rotated counter-clockwise relative to the inner cap.

Figure 7 shows the flexible beam when the lug faces of the shoulder lugs of the inner and outer caps have been aligned and a downward force has been applied to the outer cap.

Figure 8 shows engagement of the flexible beam and the skirt lugs required to thread the cap onto a bottle.

DETAILED DESCRIPTION OF EXEMPLARY EMBODIMENTS OF THE INVENTION

[0020] For the purposes of the present disclosure, the term "overlap" shall be understood to mean the horizontal distance measured from the vertical plane of a lug face of a skirt lug to the vertical plane of the nearest beam face of a flexible beam, when the lug faces of shoulder lugs on inner and outer caps are aligned.

[0021] For the purposes of the present disclosure, the term "lug" shall be understood to include both male lugs and female lugs. Thus, discussion of "lugs" engaging one another shall be understood to include complementary male and female lugs engaging one another, two or more male lugs engaging one another, as well as two or more female lugs engaging one another. Similarly, discussions of flexible beams engaging lugs shall be understood to include engagement of male or female lugs by a flexible beam.

[0022] For the purposes of the present disclosure, the term "depth," when referring to lugs, shall be understood to be a measure of the change in vertical length between a first end and a second of a lug. As such, with regard to a female lug, the term "depth" shall be understood to be a measure of the trough created by second end of the lug. Similarly, with regard to a male lug, the term "depth" shall be understood to be a measure of the peak created by the second end of the lug. The term "depth" has been selected because in the embodiments shown, shoulder lugs of the outer cap are male and extend in a downward direction, where they mate with female shoulder lugs of the inner cap. However, the term "depth" is not limited to such male-to-female engagements nor to the relative directions depicted in the figures.

[0023] The closure device of the present invention may be constructed of any one of a number of polyolefins, including but not limited to polypropylene, as well as high- , medium- , and low-density polyethylene. These materials are known for their critical mechanical properties including, but not limited to, their flexural modulus, tensile strength, and elongation, and with the benefit of the present disclosure, one of ordinary skill in the art would understand that other materials exhibiting the same properties could be used in the construction of the cap, and therefore the invention is not limited to embodiments constructed of the materials listed above, but is intended to include all materials, whether presently known or developed in the future, which may exhibit similar structural properties.

[0024] Turning now to Figure 1, it can be seen that the child-resistant cap **100** is of a two-part construction, with an outer cap **101** and an inner cap **102.** As can be seen in Figure 2C, outer cap **101** has a top portion **103** which is adjacent to depending skirt **104.** As shown in Figure 2B, in one embodiment, depending skirt **104** contains a gripping surface **105,** which may be defined by ridges, dimples, cross-hatching, or any other mechanism or method known to one skilled in the art to increase the friction between the hand of a user and outer cap **104.** However, although the embodiment depicted in Figure 2B includes gripping surface **105** embodied in the form of ridges, the invention is not so limited, and it is contemplated that in alternative embodiments, the materials used in the construction of outer cap **101** will provide adequate friction and gripping capabilities for a user, and thus no independent gripping surface **105** may be present.

[0025] Turning to Figures 2A and 2C, outer cap **101** also has an internal chamber **106** defined by the interior surfaces of top portion **103** and depending skirt **104**. The shape of internal chamber **106** includes shoulder **107**, on which is mounted a quantity of shoulder lugs **108**. Shoulder lugs **108** have a first end **109** and a second end **110**. The depth of shoulder lugs **108** increases from first end **109** to second end **110**. The depth of shoulder lugs **108** may be varied to suit the specific needs of the enclosure, and with the benefit of the present disclosure, one skilled in the art would be enabled to tailor the depth of shoulder lugs appropriately. In one embodiment, the depth of shoulder lugs **108** ranges from between 0.381 mm and 1.016 mm (0.015 to 0.040 inches), although the present invention is not limited to this embodiment. Second end **110** has a lug face **111**, oriented perpendicular to the longitude of shoulder lug **108** and distal to first end **109**. Further, the orientation of each lug face **111** is common, providing for a common rotational direction. That is to say, when each lug face **111** is acted upon by another object, the direction of action provides for a consistent rotational action around a central axis. In an alternative embodiment, second end **110** also includes a bottom surface extending parallel to the longitude of shoulder lug **108** and providing for a ninety-degree or "right angle" transition from second end **110** to lug face **111**.

[0026] Internal chamber **106** is further defined by an annular ridge **112** located at a predetermined distance from shoulder **107**. The distance between shoulder **107** and annular ridge **112** is greater than the height of shoulder lugs **108**, and with the benefit of the present disclosure, one skilled in the art would be enabled to tailor the distance between shoulder **107** and annular ridge **112** as required for the size and shape of the bottle and closure in question. In one embodiment, this may range from 14.275 mm and 14,63 mm (0.562 to 0.576 inches), although the present invention is not limited to this embodiment.

[0027] Annular ridge **112** contains a quantity of skirt lugs **113**. As with shoulder lugs **108**, skirt lugs **113** have a first end **114** and a second end **115**, with second end **115** having a lug face **116**. Lug faces **116** are oriented

perpendicular to the longitude of skirt lug **113** and distal to first end **114**. Further the orientation of each lug face **116** is common, such that when each lug face **116** is acted upon by another object, a common rotational direction is achieved, providing for rotation about a central axis. However, the orientations of lug faces **116** is opposite that of the orientations of lug faces **111**. That is to say, if a clockwise application of force is required to act upon and engage lug faces **111**, the opposite, counter-clockwise application of force is required to act upon and engage lug faces **116**, and vice versa. Second end **115** also has bottom surface **117**, oriented distal to top portion **103**.

[0028] Outer cap **101** also includes an assembly retaining bead **130** located within internal chamber **106** at a location distal to both shoulder **107** and annular ridge **112**. In one embodiment, assembly retaining bead **130** is located a distance inward from open end **131** of outer cap **101**. In an alternative embodiment, assembly retaining bead **130** is located at open end **131**.

[0029] Outer cap **101** is capable of vertical movement relative to inner cap **102.** In one embodiment depicted by the figures, the vertical downward travel distance of outer cap **101** relative to inner cap **102** is 1.70 mm (0.067 inches), although the present invention is not so limited. Indeed, with the benefit of this disclosure, one skilled in the art would be enabled to determine the appropriate downward travel for bottles of varying sizes, as may be required by product specifications set forth by the manufacturer.

[0030] As shown in Figures 3A-3C, inner cap **102** has a top portion **118**, a shoulder **119**, a depending skirt **124**, and an open end **132**. As can be seen in Figure 3B, Shoulder **119** is located at the transition point between top portion **118** and depending skirt **124.** Figure 3A depicts a quantity of shoulder lugs **120** mounted on shoulder **119**. Shoulder lugs **120** have a first end **121** and a second end **122**. Second end **122** has a lug face **123** located distal to first end **121** and oriented perpendicular to the longitude of shoulder lugs **120.** The orientation of lug faces **123** is common, such that when each lug is acted upon by another object, common rotational direction is achieved, providing for rotation about a central axis. The orientation of lug faces **111** is complementary to the orientation of lug faces **123** to provide for engagement of one lug face by the opposing lug face. In one embodiment, the depth of shoulder lugs **120** ranges from between 0.381 mm and 1.016 mm (0.015 to 0.040 inches), although the present invention is not limited to this embodiment.

[0031] Turning to Figure 3B, depending skirt **124** has a quantity of flexible beams **125** mounted thereon. Flexible beams **125** extend around portions of the perimeter of depending skirt **124**. Each flexible beam **125** consists of a beam base **126** and a beam arm **127**. Beam arm **127** has an angled ridge **128** which terminates in a beam head **129**. Beam base **126** has an upper face **133** and a leading face **134**. Angled ridge **128** has a top side **135** and an underside **136**. Angled ridge **128** is connected to beam base **126** such that top side **135** extends from upper face **133** and underside **136** extends from leading face **134**. Underside **136** extends from leading face **134** in an arcuate or radiused manner. When downward force is exerted upon flexible beam **125**, flexion or deformation takes place along angled ridge **128**. The construction of flexible beam **125** is such that it has a resiliency which permits for it to return to its original shape and location when the downward force is no longer applied. In one embodiment, as pictured in Figures 3A-3C, underside **136** consists of an arcuate or radiused portion **137** adjacent to a straight portion **138**. In an alternative embodiment not shown, underside **136** consists entirely of an arcuate or radiused portion **137**. Beam head **129** has an upper surface **139** and a beam face **140**. In one embodiment, the radius of arcuate or radiused portion **137** is 1.651 mm (0.065 inches), although the invention is not so limited. With the benefit of the present specification, one skilled in the art would understand that any radius up to and including a radius of 2.413 mm (0.095 inches) could be utilized. Indeed, as the materials used in the construction of flexible beam **125** vary, different radii may be necessary to provide for maximum resiliency of flexible beam **125** while at the same time ensuring that downward forces exerted upon flexible beam **125** do not result in the deformation of flexible beam **125** in a vector oriented radially to a central axis.

[0032] Beam faces **140** are located distal to beam base **126** and have an orientation permitting for a common rotational direction about a central axis, such that force imparted on any beam face **140** will result in inner cap **102** rotating in the same direction about a central axis. The orientation of beam faces **140** is complementary to the orientation of lug face **116**, and correspondingly the common rotational direction of beam faces **140** is complementary to the common rotational direction of lug faces **116**.

[0033] The quantity of shoulder lugs **108** must be equivalent to the quantity of shoulder lugs **120**. Additionally, the quantity of skirt lugs **113** must be equivalent to the quantity of flexible beams **125**. Equivalent quantities provide for maximum engagement of lugs and complementary lugs and/or beams. Additionally, equivalent quantities of shoulder lugs **108**, shoulder lugs **120**, skirt lugs **113**, and flexible beams **125** provide for maximal engagement of outer cap **101** with inner cap **102**. As such, according to the invention, the quantity of shoulder lugs **108** is equal to the quantity of shoulder lugs **120** and the quantity of skirt lugs **113** is equal to the quantity of flexible beams **125**. In an embodiment, the quantities of shoulder lugs **108**, shoulder lugs **120**, skirt lugs **113**, and flexible beams **125** are all equal. Traditional closure mechanisms have permitted unequal numbers of complementary lugs and or beams; such as six lugs designed to be complementary mates to eight fingers. These unequal quantities result in an increased chance of slippage between beams and lugs, and such slippage can result

in damage to the flexible beams themselves, including permanent upward or downward deformation of the beams or crushing of the lugs, leading to a decrease in, or even full elimination of, the child-resistant nature of the two-part closure.

[0034] As can be seen in Figure 3C, inner cap also has an internal cavity **141** defined by the internal surfaces of top portion **118**, shoulder **119**, and depending skirt **124**. The internal surface of depending skirt **124** is configured with threads **142** to permit attachment of the cap to a pre-existing bottle with complementary, mated threads on its neck face.

[0035] In one embodiment, top portions **103** and **118**, are flat and do not extend above shoulder **107** and **119** respectively.

[0036] Figures 4A-4B depict cap **100** when it is attached to a pre-existing bottle. Figure 4A shows the outer view of cap **100** when it is attached to a pre-existing bottle. Figure 4B shows a cross-sectional view of cap **100** attached to a bottle, with top portions **103** and **118** extending above and away from shoulder **107** and shoulder **119** respectively. In the depicted embodiment, top portions **103** and **118** have a shape which is complementary to the shape of a dispenser nozzle for liquid medicaments. This complementary shape provides for an extra level of safety with regard to access of the medicament by a child. In embodiments with flat top portions **103** and **118**, when cap **100** is affixed to a bottle of liquid medicaments and the bottle is inverted, there is the potential for liquid to flow out of the bottle and pool within the area created by the internal cavity of inner cap **102**. Embodiments containing such an extruded shape complementary to the shape of a nozzle of a dispenser of liquid medicaments significantly reduce the overall volume of the cap cavity by more closely approximating the size and shape of the dispenser nozzle. By providing for a smaller cavity where medicaments may inadvertently pool, the embodiment depicted in the Figures reduces the likelihood of accidental overdose by children who ingest residual medicament from a cap which has been removed from the dispenser.

[0037] Another feature of the present invention involves the spatial relationship of shoulder lugs **108** and **120** as they relate to skirt lugs **113** and flexible beams **125**. Figure 5 demonstrates the overlap exhibited by skirt lugs **113** and flexible beam **125** when lug faces **111** and **123** are aligned. In one embodiment, the overlap is a predetermined horizontal distance of 0.483 mm (0.019 inches), although the present invention is not so limited, and alternative embodiments include overlaps in a variety of ranges. For example, in an alternative embodiment, the range for predetermined horizontal distances of overlap is between 0.406 mm and 0.483 mm (0.016 and 0.022 inches). In yet another alternative embodiment, the range for overlap distance as between 0.330 mm and 0.635 mm (0.013 and 0.025 inches). With the benefit of the present disclosure, one skilled in the art would be enabled to create a closure with an overlap appropriate to any size of cap as may be required by production specifications.

[0038] An additional benefit of the present invention relates to the interaction between shoulder lugs **108**, flexible beams **125**, and assembly retaining bead **130**. As discussed above, flexible beams **125** have a resiliency which allow them to be deformed when a downward force is applied and then return to their original shape and location when the downward force is removed. This resiliency provides an upwards biasing force on shoulder lugs **108**. This upward biasing force is counteracted by assembly retaining bead **130**, in that assembly retaining bead **130** prevents the upward biasing force exerted on shoulder lugs **108** by flexible beams **125** from detaching outer cap **101** from inner cap **102** entirely. As seen in Figures 6A-6C, when outer cap **101** is rotated relative to inner cap **103** in the direction required for removal of cap **100** from a bottle, most commonly in the counter-clockwise direction, skirt lugs **113** will come in contact with flexible beam **125**. Figure 6A shows skirt lug 113 first coming into contact with flexible beam **125**. Figure 6B demonstrates the result when the rotational direction of outer cap **101** continues with skirt lugs **113** riding along angled ridge **128**. If no downward force is applied to outer cap **101**, the incline of angled ridge **128** will cause outer cap **101** to rise vertically with respect to inner cap **102** until assembly retaining bead **130** engages inner cap **102**, thus preventing any further vertical movement of outer cap **101** relative to inner cap **102**. When assembly retaining bead **130** has engaged inner cap **102**, despite the vertical movement of outer cap **101** relative to inner cap **102**, bottom surface **117** of skirt lug **113** remains in contact with beam head **129** of flexible beam **125**. As such, at not time does bottom surface **117** extend above beam head **129** in such a manner as to provide unencumbered rotation of outer cap **101**. Instead, even when the vertical distance between outer cap 101 and inner cap 102 is at its greatest, there is still a frictional force between bottom surface 117 and beam head 129. As a result, outer cap **101** rises and falls vertically with respect to inner cap **102**, in a ratcheting motion when it is rotated in this manner.

[0039] As has been described above, if no downward force is exerted upon outer cap **101**, it will rise vertically with respect to inner cap **102** when rotated in the direction of removal. This is shown in Figure 6C. Additionally, if no downward force has been exerted upon outer cap **101**, when it has been rotated to align lug face **111** with lug face **123** of inner cap, outer cap **101** will be at its furthest possible vertical distance from inner cap **101**, although, as has been described, the two caps remain in contact with one another due to the effects of assembly retaining bead **130** engage inner cap **102**. However, when in this aligned position, lug face **111** has not yet engaged lug face **123**, due to the vertical differential between the two caps. When a downward force is applied to outer cap **101** as shown in Figure 7, this vertical differential is decreased, and lug face **111** may finally engage lug face **123**. This downward force deforms or flexes each flexible

beam **125**, however this downward force is halted when shoulder lug **108** is fully nested in and engaged with shoulder lug **120**. Further, this downward force acts upon beam head **129** and causes it to change position. However, the relationship of the depth of the shoulder lugs and the displacement of the beam head is such that when shoulder lugs **108** have fully engaged and nested in shoulder lug **120**, that is to say, when it is no longer possible for outer cap **101** to move any further downward relative to inner cap **101**, beam head **129** is at its lowest position. This position is the optimal deformation of flexible beam **125**, does not travel below the bottom of the adjacent beam base **126**. Further, this downward force deforms or flexes angled ridge **128** such that angled ridge becomes approximately parallel with the adjacent beam base **126** when beam head **129** is at its lowest position. By limiting the distance which beam head **129** travels, hyper-flexion of flexible beam **125** can be prevented. This is advantageous, because hyper-flexion can result in a loss of resilience of flexible beam **125**. When resilience is lost, an active downward force is no longer required to engage lug face **111** of shoulder lug **108** with lug face **123** of shoulder lug **120**. When the downward force is no longer required, the cap has lost its child-resistant nature. Therefore, the design of the present invention represents an improvement upon prior art, in that it eliminates hyper-flexion, and thus preserves the child-resistant nature of the cap; while the prior art, lacking such a defined spatial limitation on flexion, permits hyper-flexion and its resultant damage to flexible beam **125** and loss of child-resistant functionality.

METHOD OF USE

[0040] The closure described above is designed to be applied to pre-existing bottles for liquid medicaments. It is understood that these bottles will already have threads provided on their neck finishes.

[0041] Application of the cap to the pre-existing bottle is effected thusly: a rotational movement is applied to outer cap **101** in an attaching direction about a central axis and relative to inner cap **102**, the direction most commonly being clockwise, until lug face **116** engages beam face **129**, as shown in Figure 8. Once lug face **116** has engaged beam face **140**, the rotational movement is maintained on outer cap **101**. This force is then transferred to inner cap **102**, permitting the two caps to rotate in concert about a central shared axis. This rotation of inner cap **102** allows threads **142** to engage the threads of the pre-existing bottle. Rotation is maintained until threads **142** have fully engaged the threads of the pre-existing bottle. At this point, rotation ceases, and cap **100** has been affixed to the pre-existing bottle. As a result, no additional downward force is required to apply cap **100** to the pre-existing bottle. The engagement of threads **142** with the threads of the pre-existing bottle will impart a downward force on the cap **100** and cause it to travel downwards relative to the pre-existing bottle. However, this downward force is the mechanical result of the engagement of threads **142** and is not imparted directly by the user. This represents a benefit over the prior art in that present machinery which is only capable of imparting a rotational direction may be used to affix cap **100** to a bottle - there is no re-tooling of the machine necessary. Additionally, machines imparting a downward force require careful calibration which can often be thrown out of alignment over the course of time. In such cases, caps may be insufficiently applied to a bottle, or more importantly, may be over tightened, causing damage to flexible beam **125**, more specifically beam head **129**. Prior art methods of affixing a child-resistant to a cap containing flexible beams **125** have often required a downward force, which could potentially crush beam head **129** or result in an increase in the depth of shoulder lugs **108** and **120**. Crushed beam heads **129** prevent the proper upward biasing of outer cap **101**.

[0042] Removal of the cap is effected thusly: a downward force is applied upon outer cap **101**, moving it in a downward direction relative to inner cap **102**. A rotational movement is then applied to outer cap **101** in a removal direction about a central axis relative to inner cap **102**, the direction most commonly being counter-clockwise. Rotation of outer cap **101** is continued until shoulder lugs **108** engage shoulder lugs **120**. Rotation of outer cap **101** continues, and the rotational force is transferred to inner cap **101** due to the engagement of shoulder lugs **108** with shoulder lugs **120**. This continued rotation permits outer cap **101** and inner cap **102** to rotate in concert about a central axis. This rotation of inner cap **102** begins to disengage threads **142** from the threads of the pre-existing bottle. Once the initial torque needed to overcome the static frictional forces between threads **142** and the threads of the pre-existing bottle has been achieved, the user may optionally cease applying a downward force on outer cap **101**. This option is available to the user because the flexible beam **125** will impart an upward biasing force on outer cap **101**; at the same time, the placement of assembly retaining bead **130** will maintain contact between bottom surface **117** of skirt lugs **113** and the angled ridge **128** and beam head **129** of flexible beam **125**. This contact results in friction which continues to transfer the rotational force imparted on outer cap **101** to inner cap **102**. Thus, maintained rotation of outer cap **101** will result in concerted rotation of inner cap **102** despite the fact that shoulder lugs **108** may no longer be engaging shoulder lugs **120**. The rotational force continues to be applied to outer cap **101** and transferred to inner cap **101** until threads **142** are fully disengaged from the threads of the pre-existing bottle. At this point the cap may be lifted from the pre-existing bottle. The method described above is particularly advantageous for the elderly, as it only requires the downward force to be applied until the torque needed to overcome the static frictional forces between threads **142** and the threads of the bottle has been overcome; it requires the two-directional movement necessary to ensure child-resistance, but by permitting only

single-directional movement at later stages of removal, ease of use is increased for those who have decreased coordination or strength due to advanced age and infirmity.

[0043] In an alternate embodiment, the first step of applying a downward force and the second step of applying a rotational force may be reversed, such that the rotational force is applied first and the downward force is applied second. In yet another alternative embodiment, the first two steps of applying a downward force and applying a rotational force are combined into a single step wherein the downward and rotational forces are applied simultaneously.

[0044] While the foregoing specification has been described with regard to certain preferred embodiments, and many details have been set forth for the purpose of illustration, it will be apparent to those skilled in the art without departing from the invention, that the invention may be subject to various modifications and additional embodiments, and that certain of the details described herein can be varied considerably without departing from the basic principles of the invention which are defined in the appended claims.

Claims

1. A two-piece, child-resistant closure device for dispensers of liquid medicaments, the closure device comprising:

an outer cap (101) having:

a top portion (103),
a depending skirt (104),
an internal chamber (106) with

a shoulder (107) having a quantity of shoulder lugs (108) mounted thereon, each shoulder lug having

a first end (109), and
a second end (110), the second end comprising a lug face (111), wherein the lug faces (111) of the shoulder lugs (108) are oriented in a common rotational direction, and

an annular ridge (112) having a quantity of skirt lugs (113) mounted thereon,

each skirt lug having
a first end (114) and
a second end (115), the second end comprising

a lug face (116) and
a bottom surface (117),

wherein the lug faces (116) of the skirt lugs (113) are oriented in a common rotational direction, and

wherein the rotational direction of the shoulder lug faces (111) is opposite the rotational direction of the skirt lug faces (116), and

an assembly retaining bead (130); and

an inner cap (102) having:

a top portion (118),
a shoulder (119) having a quantity of shoulder lugs (120) mounted thereon, each shoulder lug having

a first end (121), and
a second end (122), the second end comprising a lug face (123), wherein the lug faces (123) of the shoulder lugs (120) of the inner cap are oriented in a rotational direction complementary to the rotational orientation of the lug faces of the shoulder lugs (111) of the outer cap,

a depending skirt (124) having a quantity of flexible beams (125) mounted thereon,

each flexible beam (125) having:

a beam base (126) having an upper face (133) and a leading face (134), and
a beam arm (127) comprising an angled ridge (128) terminating in a beam head (129) distal to the beam base (126),

the beam head (129) having an upper surface (139) and a beam face (140),
the angled ridge (128) having a top side (135) and an underside (136),
wherein the angled ridge (128) is connected to the beam base (126) such that the top side (135) of the angled ridge (128) extends from the upper face (133) of the beam base (126) and the underside (136) of the angled ridge (128) extends from the leading face (134) of the beam base (126),

wherein the beam faces (140) are oriented in a common rotational direction complementary to
the rotational orientation of the lug faces (116) of the skirt lugs (113) of the outer cap; and

an internal threaded cavity (141)
wherein the quantity of shoulder lugs (108) of the outer cap (101) is equal to the quantity of shoulder lugs (120) of the inner cap (102), and
wherein the quantity of skirt lugs (113) of the outer cap is equal to the quantity of flexible beams (125) of the inner cap (102);

characterised in that:
the underside (136) of the angled ridge (128) extends from the leading face (134) of the beam base (126) in an arcuate or radiused manner.

2. The child-resistant closure device of claim 1, wherein when the lug faces (111) of the shoulder lugs of the outer cap are aligned with the lug faces (123) of the shoulder lugs of the inner cap, the skirt lugs (113) of the outer cap overlap the flexible beams (125) of the inner cap by a predetermined horizontal distance.

3. The child-resistant closure device of claim 2, wherein the predetermined horizontal distance is between 0.330 mm and 3.175 mm (0.013 and 0.125 inches), or between 0.406 mm and 3.1 mm (0.016 and 0.122 inches), optionally wherein the predetermined horizontal distance is 0.483 mm (0.019 inches).

4. The child-resistant closure device of claim 2, wherein the top portions (103, 118) of the inner and outer caps have a shape which extends above the shoulders (107, 119) of the inner and outer caps (101, 102) respectively.

5. The child-resistant closure device of claim 4, wherein the shape of the top portions of the inner and outer caps is complementary to a shape of a dispenser nozzle for liquid medicaments.

6. A system for providing child-resistant closure of a bottle of liquid medicaments using the device of claim 1, wherein the flexible beams (125) are capable of deformation.

7. The system of claim 6, wherein the flexible beams (125) have an optimal deformation, wherein upon optimal deformation of the flexible beams (125), the respective beam head (129) is not oriented below the beam base (126) of an adjacent flexible beam.

8. The system of claim 6, wherein the flexible beams (125) exert an upward biasing force on the outer cap.

9. The system of claim 8, wherein the assembly retaining bead (130) prevents the upward biasing force of the flexible beams (125) from detaching the outer cap (101) from the inner cap (102).

10. The system of claim 9, wherein the assembly retaining bead (130) is located on the outer cap (101) at a distance from the bottom surface (117) of the skirt lugs (113) of the outer cap such that when the lug faces (111) of the shoulder lugs (108) of the outer cap are aligned with the lug faces (123) of the shoulder lugs (120) of the inner cap, the bottom surfaces (117) of the skirt lugs (113) of the outer cap (101) remain in contact with the flexible beams (125) of the inner cap (102).

11. A method for removing the child-resistant closure of claim 1 from an outwardly-threaded bottle of liquid medicaments, the method comprising:

applying a downward force on the outer cap (101),
applying a rotational movement upon the outer cap,
continuing to apply the downward force and rotational movement upon the outer cap until the shoulder lugs (108) of the outer cap engage the shoulder lugs (120) of the inner cap (102),
ceasing to apply a downward force to the outer cap,
maintaining the rotational movement applied to the upper cap such that the outer cap and inner cap rotate in concert about a central axis, and
disengaging the closure from the outwardly threaded bottle of liquid medicaments.

12. The method of claim 11, wherein the steps of applying a downward force on the upper cap and applying a rotational movement upon the upper cap are performed simultaneously.

13. A method for affixing the child-resistant closure of claim 1 to an outwardly-threaded bottle of liquid medicaments, the method comprising:

applying a rotational movement upon the outer cap (101) until the skirt lugs (113) of the outer cap engage the flexible beams (125) of the inner cap (102),
maintaining the rotational movement applied to the outer cap such that the outer cap and inner cap rotation in concert about a central axis,
allowing the concerted rotation of the outer and inner caps to engage a thread of an outwardly-threaded bottle, and
ceasing to apply rotation movement upon the

outer cap (101) once the inner cap (102) has fully engaged the thread of the outwardly-threaded bottle.

Patentansprüche

1. Zweistückige kindersichere Verschlussvorrichtung für Spender für flüssige Medikamente, wobei die Verschlussvorrichtung Folgendes umfasst:
eine Außenkappe (101), die Folgendes aufweist:

einen oberen Abschnitt (103),
eine herabhängende Schürze (104),
eine Innenkammer (106) mit
einer Schulter (107), die eine Menge an daran befestigten Schulteransätzen (108) aufweist, wobei jeder Schulteransatz ein erstes Ende (109) und ein zweites Ende (110) aufweist, wobei das zweite Ende eine Ansatzseite (111) umfasst, wobei die Ansatzseiten (111) der Schulteransätze (108) in einer gemeinsamen Drehrichtung ausgerichtet sind, und
einem Ringsteg (112), der eine Menge an daran befestigten Schürzenansätzen (113) aufweist, wobei jeder Schürzenansatz ein erstes Ende (114) und ein zweites Ende (115) aufweist, wobei das zweite Ende eine Ansatzseite (116) und eine untere Fläche (117) umfasst, wobei die Ansatzseiten (116) der Schürzenansätze (113) in einer gemeinsamen Drehrichtung ausgerichtet sind, und
wobei die Drehrichtung der Schulteransatzseiten (111) zur Drehrichtung der Schürzenansatzseiten (116) entgegengesetzt ist, und
einen Anordnungshaltewulst (130); und
eine Innenkappe (102), die Folgendes aufweist:

einen oberen Abschnitt (118),
eine Schulter (119), die eine Menge an daran befestigten Schulteransätzen (120) aufweist, wobei jeder Schulteransatz ein erstes Ende (121) und ein zweites Ende (122) aufweist, wobei das zweite Ende eine Ansatzseite (123) umfasst, wobei die Ansatzseiten (123) der Schulteransätze (120) der Innenkappe in einer zu der Drehausrichtung der Ansatzseiten der Schulteransätze (111) der Außenkappe komplementären Drehrichtung ausgerichtet sind,
eine herabhängende Schürze (124), die eine Menge an daran befestigten flexiblen Trägern (125) aufweist,
wobei jeder flexible Träger (125) Folgendes aufweist:

eine Trägerbasis (126), die eine obere Seite (133) und eine vordere Seite (134) aufweist, und
einen Trägerarm (127), der einen Winkelsteg (128) umfasst, der in einem zu der Trägerbasis (126) distalen Trägerkopf (129) endet,
wobei der Trägerkopf (129) eine obere Fläche (139) und eine Trägerseite (140) aufweist,
wobei der Winkelsteg (128) eine Oberseite (135) und eine Unterseite (136) aufweist,
wobei der Winkelsteg (128) derart mit der Trägerbasis (126) verbunden ist, dass die Oberseite (135) des Winkelstegs (128) von der oberen Seite (133) der Trägerbasis (126) verläuft und die Unterseite (136) des Winkelstegs (128) von der vorderen Seite (134) der Trägerbasis (126) verläuft,
wobei die Trägerseiten (140) in einer gemeinsamen Drehrichtung, die zu der Drehrichtung der Ansatzseiten (116) der Schürzenansätze (113) der Außenkappe komplementär ist, ausgerichtet sind; und
einen mit einem Gewinde versehenen Innenhohlraum (141),
wobei die Menge an Schulteransätzen (108) der Außenkappe (101) gleich der Menge an Schulteransätzen (120) der Innenkappe (102) ist, und
wobei die Menge an Schürzenansätzen (113) der Außenkappe gleich der Menge an flexiblen Trägern (125) der Innenkappe (102) ist;
dadurch gekennzeichnet, dass:
die Unterseite (136) des Winkelstegs (128) von der vorderen Seite (134) der Trägerbasis (126) gewölbt oder abgerundet verläuft.

2. Kindersichere Verschlussvorrichtung nach Anspruch 1, wobei, wenn die Ansatzseiten (111) der Schulteransätze der Außenkappe auf die Ansatzseiten (123) der Schulteransätze der Innenkappe ausgerichtet sind, die Schürzenansätze (113) der Außenkappe die flexiblen Träger (125) der Innenkappe in einem vorbestimmten horizontalen Abstand überlagern.

3. Kindersichere Verschlussvorrichtung nach Anspruch 2, wobei der vorbestimmte horizontale Abstand zwischen 0,330 mm und 3,175 mm (0,013 und 0,125 Inch) oder zwischen 0,406 mm und 3,1 mm (0,016 und 0,122 Inch) liegt, wobei optional der vorbestimmte horizontale Abstand 0,483 mm (0,019 Inch) beträgt.

4. Kindersichere Verschlussvorrichtung nach Anspruch 2, wobei die oberen Abschnitte (103, 118) der Innen- und der Außenkappe eine Form aufweisen, die sich über den Schultern (107, 119) der Innen- bzw. der Außenkappe (101, 102) erstreckt.

5. Kindersichere Verschlussvorrichtung nach Anspruch 4, wobei die Form der oberen Abschnitte der Innen- und der Außenkappe zu einer Form einer Spenderdüse für flüssige Medikamente komplementär ist.

6. System zur Bereitstellung eines kindersicheren Verschlusses einer Flasche mit flüssigen Medikamenten unter Verwendung der Vorrichtung von Anspruch 1, wobei sich die flexiblen Träger (125) verformen können.

7. System nach Anspruch 6, wobei die flexiblen Träger (125) eine optimale Verformung aufweisen, wobei bei optimaler Verformung der flexiblen Träger (125) der jeweilige Trägerkopf (129) nicht unter der Trägerbasis (126) eines benachbarten flexiblen Trägers ausgerichtet ist.

8. System nach Anspruch 6, wobei die flexiblen Träger (125) eine nach oben gerichtete Vorspannkraft auf die Außenkappe ausüben.

9. System nach Anspruch 8, wobei der Anordnungshaltewulst (130) verhindert, dass die nach oben gerichtete Vorspannkraft der flexiblen Träger (125) die Außenkappe (101) von der Innenkappe (102) löst.

10. System nach Anspruch 9, wobei der Anordnungshaltewulst (130) an der Außenkappe (101) in einem Abstand zu der unteren Fläche (117) der Schürzenansätze (113) der Außenkappe positioniert ist, so dass, wenn die Ansatzseiten (111) der Schulteransätze (108) der Außenkappe auf die Ansatzseiten (123) der Schulteransätze (120) der Innenkappe ausgerichtet sind, die unteren Flächen (117) der Schürzenansätze (113) der Außenkappe (101) in Kontakt mit den flexiblen Trägern (125) der Innenkappe (102) bleiben.

11. Verfahren zum Entfernen eines kindersicheren Verschlusses nach Anspruch 1 von einer mit einem Außengewinde versehenen Flasche mit flüssigen Medikamenten, wobei das Verfahren Folgendes umfasst:

Anlegen einer nach unten gerichteten Kraft an die Außenkappe (101),
Anlegen einer Drehbewegung an die Außenkappe,
Fortsetzen des Anlegens der nach unten gerichteten Kraft und der Drehbewegung an die Außenkappe, bis die Schulteransätze (108) der Außenkappe mit den Schulteransätzen (120) der Innenkappe (102) in Eingriff gelangen,
Abbrechen des Anlegens einer nach unten gerichteten Kraft an die Außenkappe,
Beibehalten der Drehbewegung, die an die obere Kappe angelegt wird, so dass sich die Außenkappe und die Innenkappe im Einklang um eine Mittelachse drehen, und
Außereingriffbringen des Verschlusses und der mit dem Außengewinde versehenen Flasche mit flüssigen Medikamenten.

12. Verfahren nach Anspruch 11, wobei die Schritte des Anlegens einer nach unten gerichteten Kraft an die obere Kappe und des Anlegens einer Drehbewegung an die obere Kappe gleichzeitig ausgeführt werden.

13. Verfahren zum Anbringen des kindersicheren Verschlusses nach Anspruch 1 an einer mit einem Außengewinde versehenen Flasche mit flüssigen Medikamenten, wobei das Verfahren Folgendes umfasst:

Anlegen einer Drehbewegung an die Außenkappe (101), bis die Schürzenansätze (113) der Außenkappe mit den flexiblen Trägern (125) der Innenkappe (102) in Eingriff gelangen,
Beibehalten der Drehbewegung, die an die Außenkappe angelegt wird, so dass sich die Außenkappe und die Innenkappe im Einklang um eine Mittelachse drehen,
Gestatten der im Einklang erfolgenden Drehung der Außen- und der Innenkappe zur Ineingriffnahme eines Gewindes einer mit einem Außengewinde versehenen Flasche, und
Abbrechen des Anlegens einer Drehbewegung an die Außenkappe (101), sobald die Innenkappe (102) vollständig mit dem Gewinde der mit einem Außengewinde versehenen Flasche in Eingriff gelangt ist.

Revendications

1. Dispositif de fermeture en deux parties, résistant aux enfants, pour des distributeurs de médicaments liquides, le dispositif de fermeture comprenant :

un capuchon extérieur (101) ayant :

une partie supérieure (103),
une jupe (104) descendant depuis celle-ci,
une chambre interne (106) avec

un épaulement (107) ayant un certain nombre de pattes d'épaulement (108)

montées sur celui-ci, chaque patte d'épaulement ayant

une première extrémité (109), et
une deuxième extrémité (110), la deuxième extrémité comprenant une face de patte (111), les faces de pattes (111) des pattes d'épaulement (108) étant orientées dans une direction de rotation commune, et

une crête annulaire (112) ayant un certain nombre de pattes de jupe (113) montées sur celle-ci,

chaque patte de jupe ayant
une première extrémité (114) et
une deuxième extrémité (115), la deuxième extrémité comprenant

une face de pattes (116) et
une surface inférieure (117),

les faces de pattes (116) des pattes de jupe (113) étant orientées dans une direction de rotation commune, et

la direction de rotation des faces de pattes d'épaulement (111) étant opposée à la direction de rotation des faces de pattes de jupe (116), et

un bourrelet de retenue d'ensemble (130) ; et un capuchon intérieur (102) ayant :

une partie supérieure (118),
un épaulement (119) ayant un certain nombre de pattes d'épaulement (120) montées sur celui-ci, chaque patte d'épaulement ayant

une première extrémité (121), et
une deuxième extrémité (122), la deuxième extrémité comprenant une face de patte (123), les faces de pattes (123) des pattes d'épaulement (120) du capuchon intérieur étant orientées dans une direction de rotation complémentaire à l'orientation de rotation des faces de pattes des pattes d'épaulement (111) du capuchon extérieur,

une jupe (124) descendant de celui-ci, ayant un certain nombre de barrettes flexibles (125) montées sur celle-ci,

chaque barrette flexible (125) ayant :

une base de barrette (126) ayant une face supérieure (133) et une face avant (134), et
un bras de barrette (127) comprenant une crête inclinée (128) se terminant par une tête de barrette (129) en position distale par rapport à la base de barrette (126),
la tête de barrette (129) ayant une surface supérieure (139) et une face de barrette (140),
la crête inclinée (128) ayant un côté supérieur (135) et un côté inférieur (136),
la crête inclinée (128) étant connectée à la base de barrette (126) de telle sorte que le côté supérieur (135) de la crête inclinée (128) s'étende depuis la face supérieure (133) de la base de barrette (126) et que le côté inférieur (136) de la crête inclinée (128) s'étende depuis la face avant (134) de la base de barrette (126),

les faces de barrettes (140) étant orientées dans une direction de rotation commune complémentaire de l'orientation de rotation des faces de pattes (116) des pattes de jupe (113) du capuchon extérieur ; et

une cavité interne filetée (141),
le nombre de pattes d'épaulement (108) du capuchon extérieur (101) étant égal au nombre de pattes d'épaulement (120) du capuchon intérieur (102), et
le nombre de pattes de jupe (113) du capuchon extérieur étant égal au nombre de barrettes flexibles (125) du capuchon intérieur (102) ;

caractérisé en ce que
le côté inférieur (136) de la crête inclinée (128) s'étend depuis la face avant (134) de la base de barrette (126) de manière arquée ou arrondie.

2. Dispositif de fermeture résistant aux enfants selon la revendication 1, dans lequel, lorsque les faces de pattes (111) des pattes d'épaulement du capuchon

extérieur sont alignées avec les faces de pattes (123) des pattes d'épaulement du capuchon intérieur, les pattes de jupe (113) du capuchon extérieur chevauchent les barrettes flexibles (125) du capuchon intérieur d'une distance horizontale prédéterminée.

3. Dispositif de fermeture résistant aux enfants selon la revendication 2, dans lequel la distance horizontale prédéterminée est comprise entre 0,330 mm et 3,175 mm (entre 0,013 et 0,125 pouce), ou entre 0,406 mm et 3,1 mm (entre 0,016 et 0,122 pouce), facultativement dans lequel la distance horizontale prédéterminée est de 0,483 mm (0,019 pouce).

4. Dispositif de fermeture résistant aux enfants selon la revendication 2, dans lequel les parties supérieures (103, 118) des capuchons intérieur et extérieur ont une forme qui s'étend au-dessus des épaulements (107, 119) des capuchons intérieur et extérieur (101, 102), respectivement.

5. Dispositif de fermeture résistant aux enfants selon la revendication 4, dans lequel la forme des parties supérieures des capuchons intérieur et extérieur est complémentaire d'une forme d'une buse de distributeur pour médicaments liquides.

6. Système pour fournir une fermeture résistante aux enfants d'une bouteille de médicaments liquides, utilisant le dispositif selon la revendication 1, dans lequel les barrettes flexibles (125) peuvent être déformées.

7. Système selon la revendication 6, dans lequel les barrettes flexibles (125) présentent une déformation optimale, lors de la déformation optimale des barrettes flexibles (125), la tête de barrette respective (129) n'étant pas orientée sous la base de barrette (126) d'une barrette flexible adjacente.

8. Système selon la revendication 6, dans lequel les barrettes flexibles (125) exercent une force de sollicitation vers le haut sur le capuchon extérieur.

9. Système selon la revendication 8, dans lequel le bourrelet de retenue d'ensemble (130) empêche que la force de sollicitation vers le haut des barrettes flexibles (125) ne détache le capuchon extérieur (101) du capuchon intérieur (102).

10. Système selon la revendication 9, dans lequel le bourrelet de retenue d'ensemble (130) est situé sur le capuchon extérieur (101) à une distance de la surface inférieure (117) des pattes de jupe (113) du capuchon extérieur de telle sorte que lorsque les faces de pattes (111) des pattes d'épaulement (108) du capuchon extérieur sont alignées avec les faces de pattes (123) des pattes d'épaulement (120) du capuchon intérieur, les surfaces inférieures (117) des pattes de jupe (113) du capuchon extérieur (101) restent en contact avec les barrettes flexibles (125) du capuchon intérieur (102).

11. Procédé pour enlever la fermeture résistant aux enfants selon la revendication 1 d'une bouteille de médicaments liquides comprenant un filetage extérieur, le procédé comprenant les étapes consistant à :

appliquer une force descendante sur le capuchon extérieur (101),
appliquer un mouvement de rotation sur le capuchon extérieur,
continuer d'appliquer la force descendante et le mouvement de rotation sur le capuchon extérieur jusqu'à ce que les pattes d'épaulement (108) du capuchon extérieur viennent en prise avec les pattes d'épaulement (120) du capuchon intérieur (102),
cesser d'appliquer une force descendante sur le capuchon extérieur,
maintenir le mouvement de rotation appliqué au capuchon supérieur de telle sorte que le capuchon extérieur et le capuchon intérieur tournent ensemble autour d'un axe central, et
désengager la fermeture de la bouteille de médicaments liquides comprenant un filetage extérieur.

12. Procédé selon la revendication 11, dans lequel les étapes consistant à appliquer une force descendante sur le capuchon supérieur et à appliquer un mouvement de rotation sur le capuchon supérieur sont effectuées simultanément.

13. Procédé pour fixer la fermeture résistant aux enfants selon la revendication 1 sur une bouteille de médicaments liquides comprenant un filetage extérieur, le procédé comprenant les étapes consistant à :

appliquer un mouvement de rotation sur le capuchon extérieur (101) jusqu'à ce que les pattes de jupe (113) du capuchon extérieur viennent en prise avec les barrettes flexibles (125) du capuchon intérieur (102),
maintenir le mouvement de rotation appliqué au capuchon extérieur de telle sorte que le capuchon extérieur et le capuchon intérieur tournent en commun autour d'un axe central,
permettre à la rotation en commun des capuchons extérieur et intérieur de provoquer l'engagement avec un filetage d'une bouteille comprenant un filetage extérieur, et
cesser d'appliquer le mouvement de rotation sur le capuchon extérieur (101) une fois que le capuchon intérieur (102) est complètement venu

en prise avec le filetage de la bouteille comprenant un filetage extérieur.

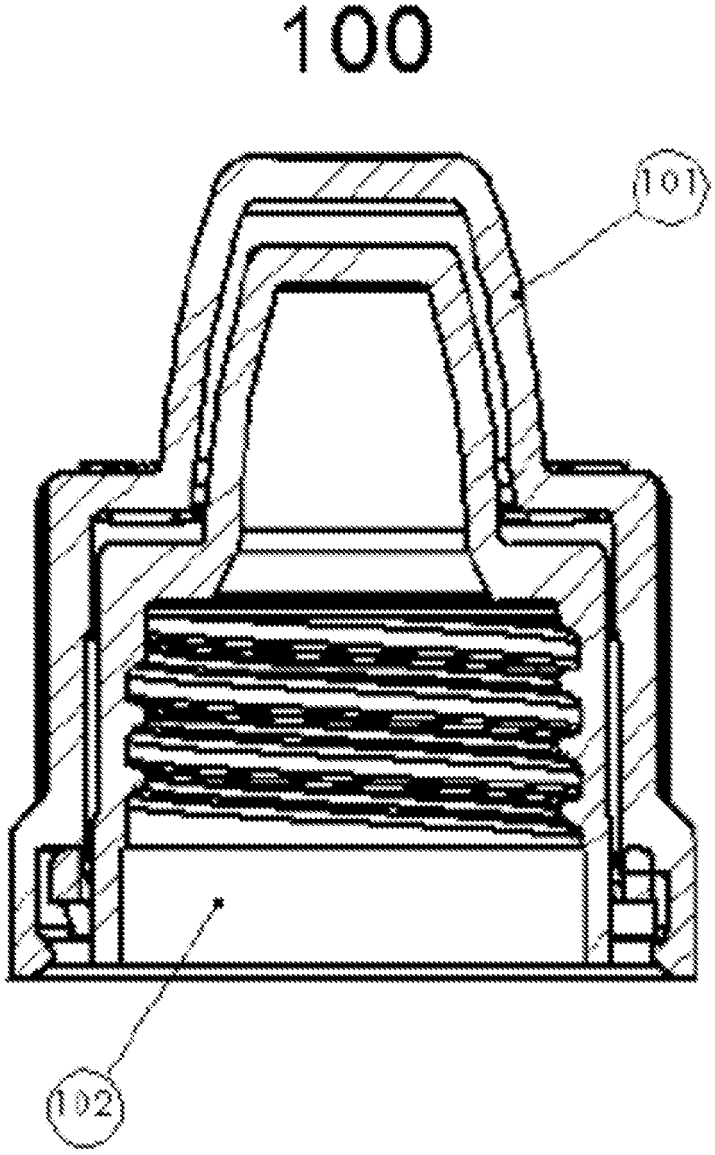


FIGURE 1

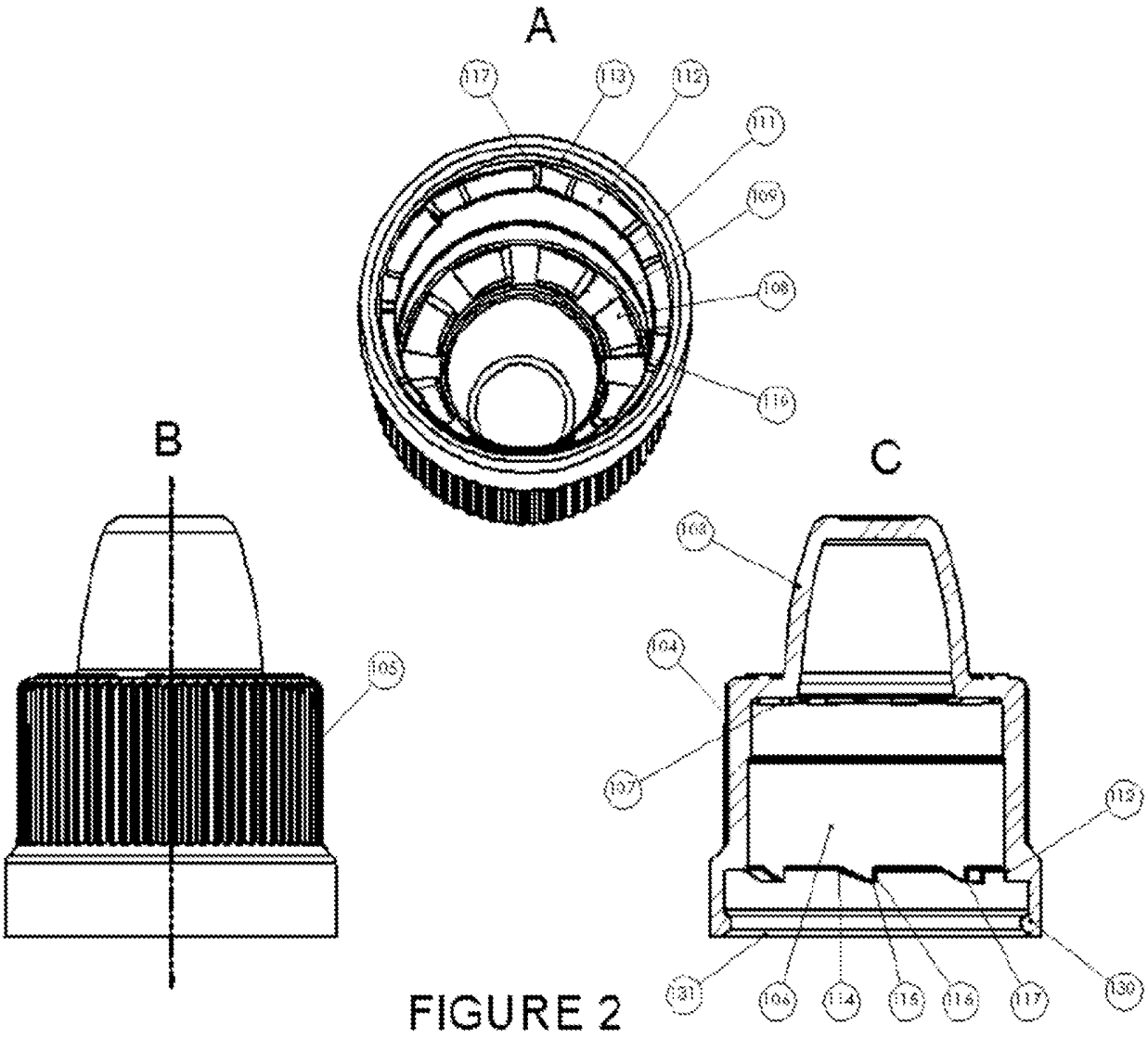

A
117
113
112
111
109
108
116
B
105
C
106
104
107
112
121
104
114
115
116
117
130

FIGURE 2

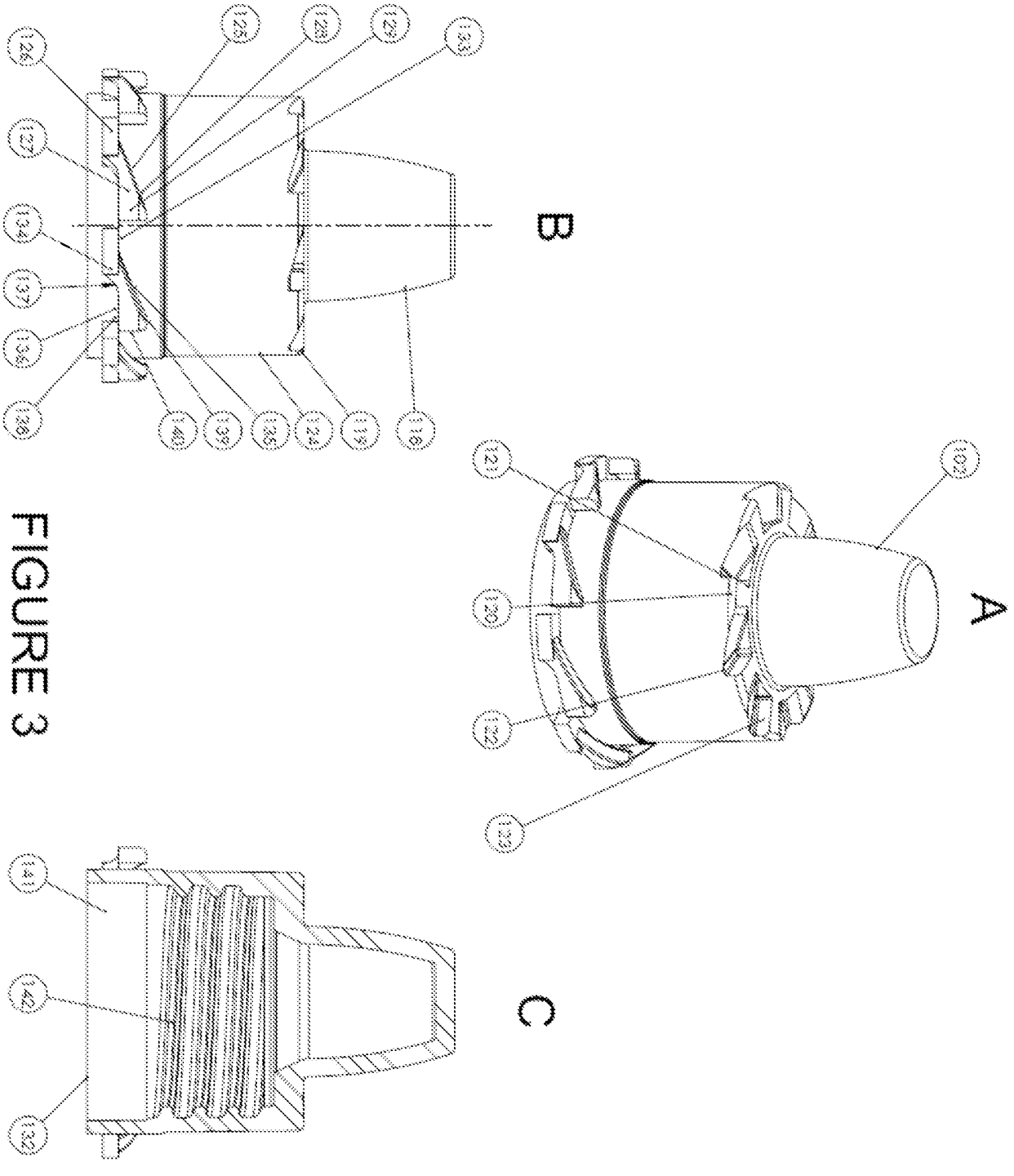


FIGURE 3

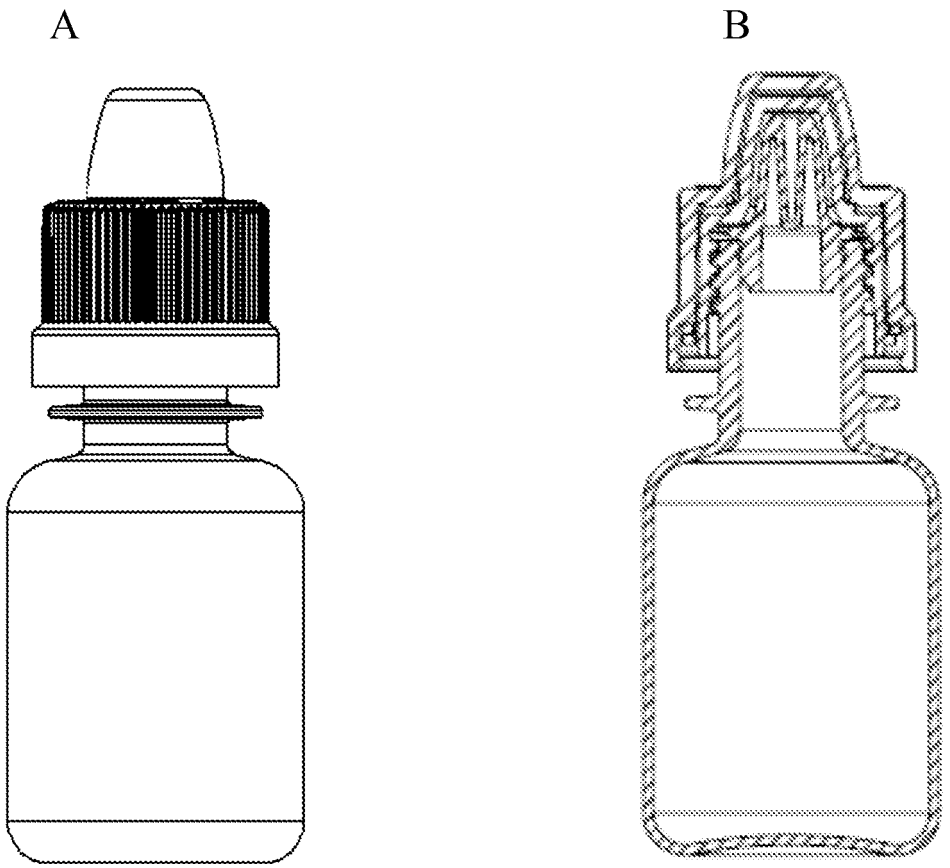


FIGURE 4

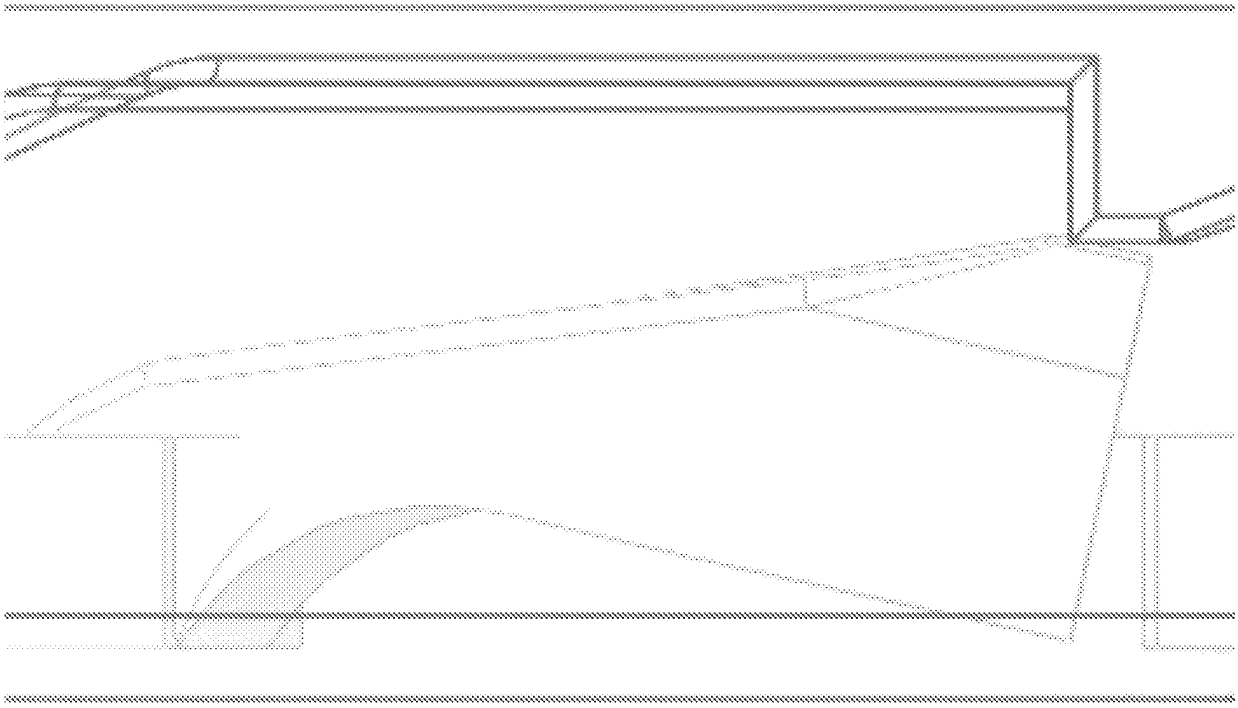
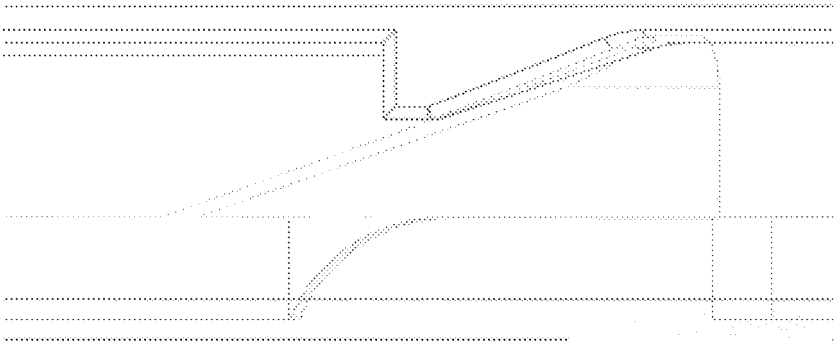
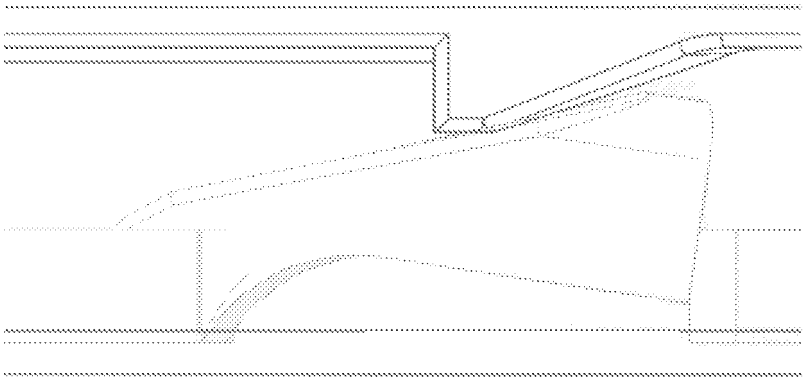


FIGURE 5

A



B



C

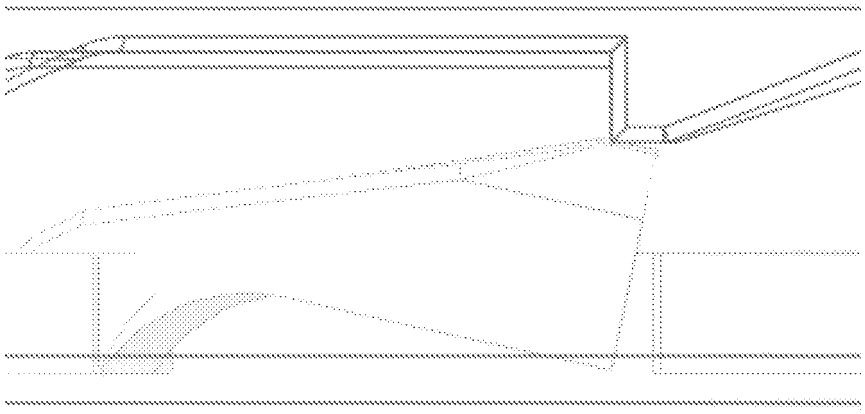


FIGURE 6

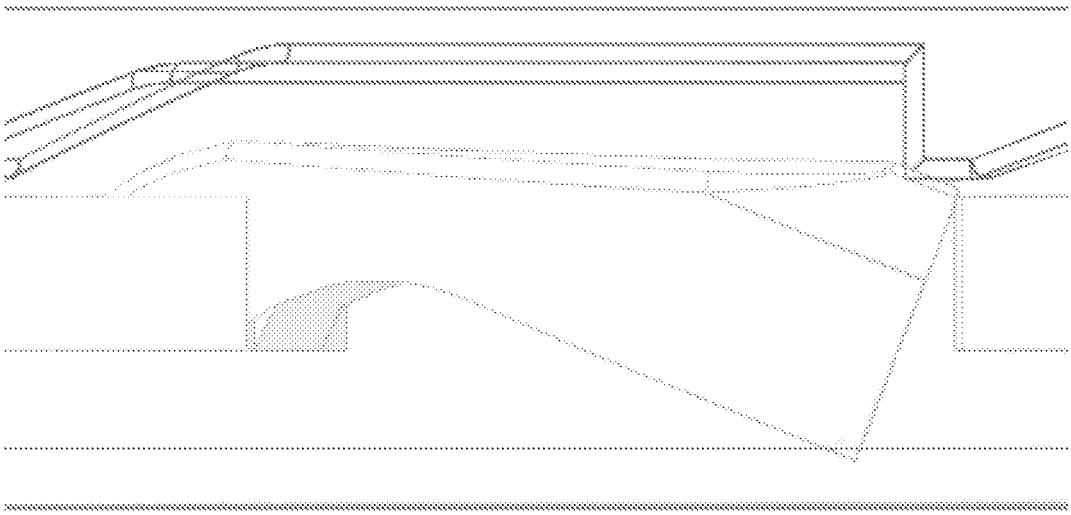


FIGURE 7

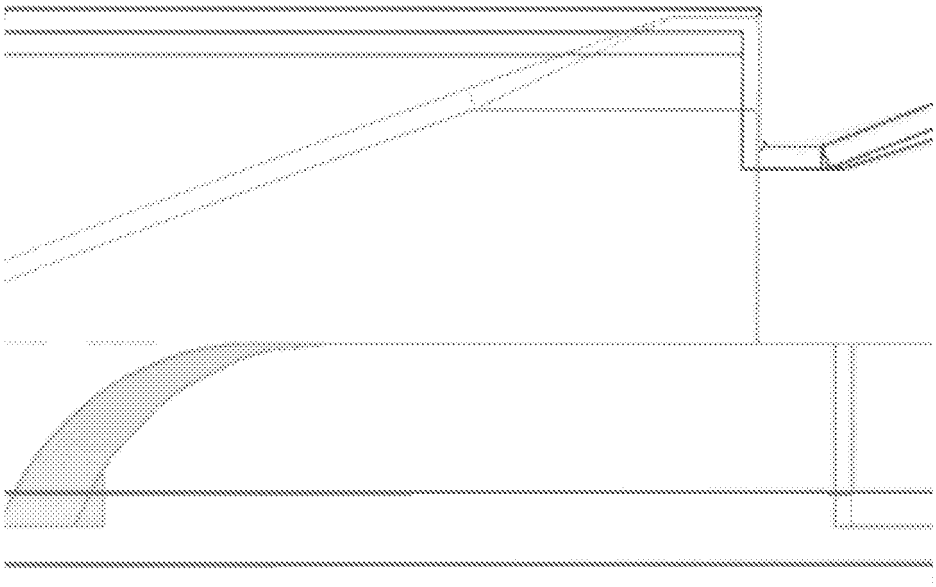


FIGURE 8

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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