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(54) **AIRTIGHT COMPACT**

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**Description****CROSS-REFERENCE TO RELATED APPLICATION**

**[0001]** This application is a continuation-in-part application of United States Non-Provisional Patent Application No.: 16/200,768, filed November 27, 2018 and titled "Airtight Compact," which is a continuation-in-part application of United States Non-Provisional Patent Application No.: 15/021,063, filed March 10, 2016 and titled "Airtight Compact," which is a national stage entry of International Application No. PCT/US2014/055353, filed September 12, 2014 and titled "Airtight Compact," which claims priority to and the benefit of United States Provisional Patent Application No.: 61/877,123, filed September 12, 2013 and titled "Airtight Compact."

**Technical field:**

**[0002]** The invention relates to cosmetic cases, particularly to compacts having airtight functions.

**Background of the invention:**

**[0003]** Historically, cosmetic compacts have been small, flat cases for containing and transporting cosmetic face powder, a powder puff for applying the cosmetic, and a mirror. Typically, compacts were hand sized or smaller cases that could be easily carried in a purse or pocket. Many of these face powders were mineral powders such as talc, often containing mineral pigments. Such mineral powders are typically insensitive to air, containing no components that discolor, decompose, or degrade when exposed to air and containing no volatile materials that could evaporate and damage the consistency of the product. The compacts for such cosmetics were usually flat hinged boxes of various shapes including round, square, oval, or rectangle, consisting of a cover and a base, and had a simple clip holding them closed. While such containers sometimes had a thin paper or plastic seal to prevent the cosmetic from scattering during shipping, this seal was removed and discarded by the consumer before using the cosmetic.

**[0004]** Advances in cosmetic technology and evolutions in packaging have led to the packaging of other types of makeup including eye shadow, lip gloss, rouges, concealers, and new varieties of face powders in small flat containers, some with and some without the associated applicators, and with or without mirrors. All of these containers have been referred to widely as compacts, and many share the same hinged-box construction of the earlier compacts. For the purposes of this patent application, the terms compact and cosmetic case will be used interchangeably to refer to such containers for cosmetics, with or without associated applicators, and with or without a mirror.

**[0005]** Compacts have many advantages, such as being easy to open and use, convenient to carry, and easy

to store and pack. Many of the new cosmetics now being stored and transported in such containers, however, are more sensitive to oxygen, humidity, or air than mineral powders, and cosmetics stored in such containers frequently degrade. Many useful pigments discolor or decompose when exposed to air, and carriers for such pigments frequently contain volatile or air sensitive components. The previous hinged box form compact is poorly suited for cosmetics containing volatile or air sensitive components. It is desirable, therefore, to provide a compact that retains the advantages of ease of opening and use, convenience of carrying, and ease of storage and packing, while also maintaining a reusable airtight seal to preserve the cosmetics before and between uses.

**[0006]** Several attempts have been made to provide an airtight function on a compact, typically by adding additional cover elements inside the compact. In general, providing an airtight function to a container requires either machining the base and the cover of the container from rigid materials to such close tolerances that the fit between the rigid materials leaves no air gaps, or utilizing flexible or elastomeric materials as seals which can be deformed under pressure to fill any openings between the base and the cover. In some designs, a separate inside container is provided, consisting of a cover and a base containing the cosmetic, the inside container fitting into the base of the compact and providing an airtight seal around the cosmetic. In use, the consumer must open first the cover of the compact and then the cover of the inside container to access the cosmetic, and close first the container cover and then the compact cover to store. To maintain the seal on the inside container, the compact lid is provided with either a thread or bayonet-like cam design which locks onto the compact base and applies pressure to the cover of the inside container.

**[0007]** On other airtight compacts, the airtight function is achieved by providing an internal smaller cover that interacts with the base of the compact. In some examples, a flat gasket is pressed between the internal cover and the base to provide an airtight seal. Other examples provide a peripheral gasket such as an O-ring that interacts with a matching element on the base. Still other examples act by pressing a lip molded underneath the internal cover against the base. Similar to examples having a separate inside container, the internal cover is kept in place by the compact cover pressing down on the inside lid and locking on the base by either a thread or a bayonet like cam design. Like compacts with a separate inside container, compacts with internal covers require opening both the compact cover and an interior cover before the cosmetic container can be accessed, and closure of both an interior cover and the compact cover are required for airtight storage.

**[0008]** In addition to the issues with airtight compact cases discussed above, for compacts which contain threads on the cover it can additionally be difficult to determine when the lid is fully secured, giving rise to the possibility that liquid contents may leak out or air sensitive

contents may spoil. Alternatively, if the cover cannot be secured in the open position, it can potentially be lost if not attached to the case by any means or prematurely close when using the case.

**[0009]** Lipstick cases, foundation stick cases, lip balm cases, and other cosmetic cases also can suffer from the same limitations discussed above, namely a lack of airtight mechanisms, which can damage or spoil the contents of the case, or bulky or multi-layer sealing mechanisms which can be troublesome to operate. These cosmetic cases often have the added benefit of shifting the contents of the case up and down to make it easier for the user to access the contents. A cosmetic case according to the preamble of claim 1 is known from WO 2015/038871 A1.

#### Summary of the invention:

**[0010]** It is thus an object of this invention to provide an effective airtight function on a compact by using just two elements, namely the compact cover assembly and the compact base, without the need for any additional element to guarantee the airtight function. It is a further object of this invention to provide an airtight compact with only a single cover that need be opened to access the cosmetic. It is a further object of this invention to provide an airtight compact that can be molded out of as few as two molded plastic parts, a cover assembly and a base, although embodiments with three or more molded parts including a cover, a base, and an intermediate ring are also envisioned. Additional elements or internal parts such as a threaded screw and an elevator are also envisioned. It is a further object of this invention to provide an airtight compact case which has a cover assembly which can be secured in a given position. The compact case according to the invention is defined by claim 1.

**[0011]** In some embodiments, the intermediate ring does not form part of the airtight portion of the compact, but by being hinged with the cover and by being assembled with the base, forms a cover assembly that allows the cover to be hinged on the base and allows a degree of rotation between the cover and base permitting the sealing of the cover to the base.

**[0012]** In some embodiments, the base has a center upwardly facing recess forming a receptacle for a cosmetic product, the top open end of the recess engaging the cover to form an airtight seal.

**[0013]** The cover in some embodiments includes a sealing element, which in some embodiments is a semi-flexible valve seal ring protruding off of the inside face of the cover.

**[0014]** In some embodiments, when the cover is closed over the base and tightened, the valve seal ring of the cover engages and wedges itself into the upwardly open end of the base recess creating an effective and efficient airtight chamber between the cover and base. In some embodiments, the cover is tightened onto the base utilizing, eg. threads on the cover which engage matching

threads on the base; a bayonet mount comprising pins on the cover which engage slots on the base or pins on the base which engage slots on the cover; springs or spring clips biased to press the cover onto the base; or any other means known in the art.

**[0015]** In other embodiments, pressure to engage the airtight function can be applied by manually pressing the cover onto the base, and the pressure maintained by use of a fastener or a plurality of fasteners to hold the cover to the base. In some embodiments, such fasteners are rigid in nature and include catches, hooks, or interlocking clips. In other embodiments, the fastener is more flexible, and includes interlocking hook and loop fasteners between surfaces affixed to the cover and base or on a strap or straps affixed to the cover and base. In still other embodiments, spring clips, elastic bands, string ties, or straps with snaps or D-rings are used to maintain the pressure between the cover and the base and thus the airtight function of the compact.

**[0016]** In one embodiment of the invention, the compact consists of five pieces: a cover, a ring, a base, a screw piece, and an elevator. In some embodiments, rotation of the ring causes the elevator and screw piece to engage which pushes the elevator up or down in a vertical direction.

**[0017]** In some embodiments the cover swings back on a pin fitted into a hinge between the cover and the intermediate ring. The cover also tightens onto the base by rotating it through matching threads between the cover downward face and the base upward face. The inside face of the cover has a downwardly facing protruding ring here called the valve seal ring that by engaging and wedging itself into the upwardly facing open end of the base recess creates the airtight product chamber. The intermediate ring, which is hinged to the cover using the hinge pin, is assembled to and retained on the base in a way that allows the now rotationally solid cover assembly to be rotated in relation to and on the base.

**[0018]** In some embodiments, the ring is retained on the base by protrusions extending from the inside of the ring to engage a groove in the wall of the recess. In other embodiments, the ring is retained by a shoulder extended inward from the ring to engage a groove on the wall of the recess. In further embodiments, the ring is retained by protrusions extending from the recess wall to engage a groove on the inner wall of the ring. In some embodiments the groove is provided with one or more risers to lift the ring slightly as the cover is unscrewed, advantageously preventing the ring from jamming on the recess wall. In some embodiments, the ring is retained to the screw piece by the methods discussed above. In some embodiments the ring and base projection interact to lock the cover assembly in a certain position.

**[0019]** In some embodiments, a mirror is assembled to the compact.

**[0020]** In some embodiments, the hinge is provided by a projection extended downward from the cover into an aperture formed in the intermediate ring. A pin extending

through the protrusion and into the sides of the aperture on the intermediate ring acts as a hinge pin. The outer profile of the protrusion is shaped to match the outer profile of the intermediate ring. The internal hinge provided by such an arrangement allows the provision of a compact cosmetic case with a smooth outer profile having no external hinge protrusions which can get caught in the cloth of a pocket or pocketbook.

**[0021]** In some embodiments the intermediate ring is made and molded as part of the cover, attached to the cover by means of a thin diaphragm of flexible material. This thin diaphragm becomes a flexible connecting element, frequently referred to in the art as a living hinge. In some embodiments, an aperture is provided in the intermediate ring for the living hinge to fit into when the cover is closed, allowing the outer surface of the living hinge and the outer diameter of the intermediate ring to form a smooth profile.

**[0022]** This one-piece ring/cover configuration retains and allows all the functions and features as the cover assembly formed from two separate parts previously described, and is advantageous for inexpensive airtight packages such as promotional compacts.

**[0023]** In some embodiments, the cosmetic case further comprises a chamber in vapor contact with the product receptacle. In one embodiment, the chamber is separated from the product receptacle by a perforated disc. In another embodiment, the chamber is separated from the product receptacle by a semi-permeable membrane. This chamber contains a substance intended to further preserve the properties of the product and in exemplary embodiments is selected from a list consisting of a preservative, a bactericide, a biocide, a water source, a solvent, a desiccant, and combinations thereof.

**[0024]** This invention provides an effective and efficient airtight compact with the smallest possible dimensions both horizontally and vertically.

**[0025]** This invention provides an effective and efficient airtight compact with no other parts or elements involved in obtaining the airtight feature.

**[0026]** This invention provides a case whose cover assembly can be secured in a certain position.

**[0027]** This invention provides a very effective airtight compact while reducing the cost to manufacture it and the consequent cost of goods.

#### Brief Description of Drawings:

**[0028]**

**Figures 1 and 2** depict side views of embodiments of an airtight compact in accordance with the invention.

**Figures 3 and 4** depict rear views of the compacts shown in **Figures 1 and 2**.

**Figures 5 and 6** depict side views of the compacts

shown in **Figures 1 and 2** with the covers opened.

**Figures 7 and 8** depict perspective views of the compacts shown in **Figures 1 and 2** with the covers opened.

**Figures 9 and 10** depict top views of the compacts shown in **Figures 1 and 2** with the covers opened.

**Figures 11 and 12** depict rear views of the compacts shown in **Figures 1 and 2** with the covers opened.

**Figures 13 and 14** depict front views of the compacts shown in **Figures 1 and 2** with the covers opened.

**Figures 15 and 16** depict bottom perspective views of the compacts shown in **Figures 1 and 2** with the covers opened.

**Figures 17 and 18** depict sectional views of the compacts shown in **Figures 1 and 2** with covers closed and seal open.

**Figures 19 and 20** depict sectional views of the compacts shown in **Figures 1 and 2** with covers closed and seals formed.

**Figures 21, 22, and 36** depict top views of the intermediate ring of the embodiments of the invention shown in **Figures 1 and 2**.

**Figures 23 and 24** depict upper perspective views of the intermediate ring of the embodiments of the invention shown in **Figures 1 and 2**.

**Figure 25** depicts a lower perspective view of the intermediate ring of the embodiment of the invention shown in **Figure 2**.

**Figures 26 and 30** depict upper perspective views of the cover of the embodiments of the invention shown in **Figures 1 and 2**.

**Figures 27 and 31** depict lower perspective views of the cover of the embodiments of the invention shown in **Figures 1 and 2**.

**Figures 28, 32, and 39** depict side views of the base of the embodiments of the invention shown in **Figures 1 and 2**.

**Figures 29 and 33** depict upper perspective views of the embodiments of the invention shown in **Figures 1 and 2**.

**Figures 34 and 35** depict sectional views of embodiments of the invention shown in **Figures 1 and 2**.

**Figures 37 and 38** depict zoomed in views of the ring protrusion embodiments of the intermediate ring of the embodiments of the invention shown in **Figures 1 and 2**.

**Figure 40** depicts a side view of another embodiment of the invention shown in **Figure 1**, where the compact case in the closed position.

**Figure 41** depicts a side view of another embodiment of the invention shown in **Figure 1**, where the compact case in the open position.

**Figure 42** depicts a top view of another embodiment of the invention shown in **Figure 1**, where the compact case in the opened position.

**Figure 43** depicts an exploded view of another embodiment of the invention shown in **Figure 1**.

**Figure 44** depicts a cross-sectional side view of another embodiment of the invention shown in **Figure 1**, where the compact case in the closed position.

**Figure 45** depicts a cross-sectional side view of another embodiment of the invention shown in **Figure 1**, where the compact case in the open position.

**Figure 46** depicts a zoomed in cross-sectional view of the sealing mechanism of another embodiment of the invention shown in **Figure 1**, where the compact case in the closed position.

**Figure 47** depicts an exploded view of another embodiment of the invention shown in **Figure 43** and **Figure 1**.

**Figure 48** depicts a cross-sectional side view of another embodiment of the invention shown in **Figure 1**, where the compact case in the open position.

**Figure 49** depicts an exploded view of another embodiment of the invention shown in **Figure 1**.

**Figure 50** depicts a cross-sectional side view of another embodiment of the invention shown in **Figure 1**, where the compact case in the closed position.

**Figure 51** depicts a cross-sectional side view of another embodiment of the invention shown in **Figure 1**, where the compact case in the open position.

#### Detailed Description:

**[0029]** The invention relates to airtight compacts or cosmetic cases, which for the purposes of this patent will be used interchangeably to refer to small, portable containers for cosmetics with or without hinged covers, and

with or without affixed mirrors. In particular, the invention relates to airtight compacts in which only a single cover is opened to expose the cosmetic for use. In these compacts, a cosmetic product is stored in a recess (**13**) comprising a base (**5**) and a cover (**1**). When the cover is closed, an airtight seal is formed between the cover and the base. In some embodiments, the recess is sized to fit a standard size cosmetic pan (**41**), advantageously permitting use of the cosmetic case for a variety of colors and compositions of cosmetics. In some embodiments, the recess is sized to contain an industry standard cosmetic pan. In some embodiments the recess is sized to fit longer and narrower objects, such as foundation sticks, lip sticks, or lip balm.

**[0030]** In some embodiments the recess (**13**) is defined by a recess wall (**17**) extending upwardly from an upper surface (**6**) of the base (**5**) having an upwardly facing open end defined by a lip (**19**). In some embodiments cover **1** has a downwardly facing seal (**14**) configured to engage the lip of the recess to form an airtight container for the cosmetic product. In some embodiments, the seal is a flexible or elastomeric material affixed to the cover. Pressure holding the cover to the base provides force to deform the flexible or elastomeric material sufficiently to provide an airtight function between the cover and the lip of the recess. In other embodiments, the cover is made of a flexible or elastomeric material and deforms sufficiently to provide an airtight function without providing an additional seal.

**[0031]** In some embodiments, the seal is a valve seal ring. This is a ring of flexible or elastomeric material extending off of the cover and configured to engage the lip (**19**) of the recess. In some embodiments, as shown in **Figures 17 and 18**, the external periphery (**25**) of the valve ring seal engages the internal periphery (**23**) of the lip of the recess to form an airtight seal when the cover is held down to the base. In other embodiments, the internal periphery of the valve ring seal engages the external periphery of the lip of the recess. In still other embodiments, the bottom surface of the valve ring seal engages the top surface of the lip of the recess. In further embodiments, the valve ring seal is slotted to engage both the internal and external periphery of the lip of the recess.

**[0032]** In many embodiments using a valve seal ring, the engaging surfaces of the valve seal ring and the lip of the recess are chamfered slightly in opposite directions (**63**). In an embodiment in which the external periphery of the valve ring seal engages the internal periphery of the lip of the recess, the external periphery of the valve ring seal tapers slightly from larger at its upward extent to smaller at its downward extent. Conversely, the internal periphery of the lip of the recess is tapered slightly from smaller at its upward extent to larger as it approaches the base, as shown by **63** in **Figures 35 and 46**. This has the advantageous effect of compressing the valve seal ring as it is pressed into the lip of the recess, improving the airtight function of the container. The chamfers provide slight differences in the terminal diameters

of the engaging surfaces which allow a more positive seating of the valve seal ring to the lip of the recess due to the size difference of the terminal diameters of the engaging surfaces as the cover is closed, and the resulting sloped surfaces allow more of the pressure holding the cover to the base to be applied directly to the engaging surfaces.

**[0033]** In some embodiments, the seal is a disc of flexible or elastomeric material affixed to the cover on one surface and configured to engage the top surface of the lip of the recess on the other surface. In some embodiments, the disc is flat, providing advantages in ease of construction. In other embodiments, the disc is convex, the center extending further from the cover than the periphery, providing more positive centering and sealing to an interior periphery of the lip of the recess. In still other embodiments, the seal is concave, the periphery extending further from the cover than the center, providing an enlarged storage space inside the airtight chamber and being less likely to disturb and ornamental upper surface on the product in the receptacle.

**[0034]** In other embodiments, the seal is an annular gasket affixed to the cover.

**[0035]** In some embodiments, a seal is provided on the base, configured to engage a corresponding surface on the cover. In one embodiment, the lip of the recess comprises a flexible or elastomeric material which forms an airtight function when pressed against the cover. In other embodiments, the cover further comprises a downwardly protruding feature configured to engage the flexible portion of the lip to provide the airtight function. In one embodiment, the downwardly protruding feature is a ridge configured to engage one or more of the internal periphery, the external periphery, or the surface of the lip of the recess. In another embodiment, the downwardly protruding feature is a disc with an external periphery configured to engage the internal periphery of the lip of the recess. In different embodiments, the disc is flat, convex, or concave. In some embodiments, the engaging surfaces of the lip of the recess and the downwardly protruding feature of the cover are chamfered slightly in opposite directions, advantageously improving the airtight function of the container.

**[0036]** **Figures 1 and 2** illustrate two embodiments of the airtight compact of the current invention. In **Figure 1**, the hinge is external to the diameter of the compact. In **Figure 2**, the hinge is contained within the external diameter of the compact. These embodiments comprise a cover (1), an intermediate ring (3) and a base (5). They further comprise a hinge (7) of two parts molded into the cover and the intermediate ring, and a hinge pin (9) to maintain the hinged relationship between the cover and the intermediate ring. As can be seen from **Figures 7-8**, the base contains a recess (13) formed from a wall (17) extending upwardly from the base. As shown in **Figures 21-25, 28-33, and 36-39** the intermediate ring (3) is fixed to the cover by protrusions (29) extending inwardly from the inner surface of the intermediate ring, the protrusions

fitting into matching grooves (31) in the wall. This allows the intermediate cover to rotate with respect to the base about the external diameter of the wall, while preventing the ring from being detached from the base. The upward extent of the wall forms a lip (19) defining the opening of the recess.

**[0037]** In some embodiments, the grooves are defined by an upper and lower edge, each parallel to the upper surface of the base, the groove being wider than the thickness of the protrusions. This allows the ring to move axially with respect to the base within the groove, the protrusions free to move perpendicular to the groove to an extent limited by the edges of the groove. This limited freedom of axial movement aids in engaging the threads on the cover and base and eases the requirement for machining to tight tolerances. Because the cover is attached to the ring by a hinge, a slight opening of the hinge permits the threads to engage even if there is some variation between manufactured parts.

**[0038]** In some embodiments, a riser (33) is provided at the terminus of the groove. This advantageously lifts the ring away from the surface of the base at the extent of the ring's rotation, preventing any separation of the cover from the ring during rotation from wedging the ring against the recess wall as the cover is unscrewed. In one embodiment, the riser is a portion of the lower edge of the groove that slopes upward in relation to the upper surface of the base. In some embodiments riser 33 is provided on base 5 without a corresponding groove on the base.

**[0039]** **Figures 21-22 and 36-39** show different embodiments of ring protrusions 29. In some embodiments not according to the invention ring protrusion 29 is made up of just ledge 44. In some embodiments ring protrusion 29 is made up of bump 42, gap 43 and ledge 44. In some embodiments the bump, gap, and ledge are placed in the listed order clockwise and in other embodiments the order is reversed, having the ledge, then gap then bump in clockwise order. This bump, gap, ledge motif interacts with base protrusion 49 to secure the cover assembly in a certain position, depending on the location of the protrusions. In some embodiments ring protrusion 29 is a ledge 44 and hook 45 which also interacts with base protrusion 49 to secure the cover assembly in a certain position. In some embodiments the ledge is followed by the hook in clockwise order, and in other embodiments the hook precedes the ledge in clockwise order. In some embodiments ledge 44 is approximately the size shown in **Figure 36**, while in other embodiments ledge 44 is smaller than depicted in **Figure 36** and in other embodiments ledge 44 is larger than depicted in **Figure 36**. In some embodiments ledge 44 is less than 0.5 centimeters, in some embodiments ledge 44 is 0.5-1 cm, and in other embodiments ledge 44 is 1-2 cm. The different sizes of ledge 44 are required for different functions. If ledge 44 is being used to guide ring 3 through groove 31 and riser 33 a larger ledge 44 is required. However, if ledge 44 is being used simply as a locking or movement halting

piece, the smaller embodiments of ledge 44 are adequate. In this way the minimum amount of material is used to effect the desired function of ledge 44. In some embodiments, the cover assembly is secured in an open position. This embodiment is useful for ensuring the cover does not rotate and interfere with the use of the contents of the compact case. In other embodiments the cover assembly is secured in a closed position. This embodiment is useful for determining when the cover assembly is in the fully closed position as a means of avoiding content leakage or spoilage, and also aids in securing the cover assembly in said closed position. In yet other embodiments, the cover assembly is secured in an intermediary position.

[0040] As seen in Figure 39, in some embodiments, the bump, gap, and ledge motif is located on the base, as seen with bump 47, gap 48 and ledge 49. This motif interacts with protrusion 46 on the ring to secure the cover assembly in a certain position, depending on the location of the protrusions. As discussed above, in some embodiments the order of the bump, gap, and projection is reversed from what is depicted in Figure 39. In other embodiments, the hook 50 and ledge 51 motif is located on the base. As discussed above, in some embodiments the order of the hook and projection is reversed from what is depicted in Figure 39. In some embodiments, the cover assembly is secured in an open position. This embodiment is useful for ensuring the cover does not rotate and interfere with the use of the contents of the compact case. In other embodiments the cover assembly is secured in a closed position. This embodiment is useful for determining when the cover assembly is in the fully closed position as a means of avoiding content leakage or spoilage, and also aids in securing the cover assembly in said closed position. In yet other embodiments, the cover assembly is secured in an intermediary position.

[0041] Figures 40-51 illustrate other embodiments of this invention, where ring 3 is located inside of cover 1 when closed. This can be seen comparing Figure 40, which shows the closed structure of one embodiment of this invention, and Figure 41 which shows the opened structure of the same embodiment. In many of these embodiments, elevator 52 is provided which moves the product within the case vertically. This has the beneficial effect of only exposing only a desired amount of the product to the air, keeping the rest of the contents protected within ring 3 and increasing the longevity of the product. As only the portion of the contents which are above ring 3 are exposed to air on all sides, this allows the contents to last longer than if significantly more surface area was exposed to air each time the case was opened. In different embodiments, elevator 52 is moved vertically via different mechanisms, which are discussed in more detail below.

[0042] Figures 43-45 and 47-48 show a first elevator embodiment where base 5 contains screw piece 54 and ring 3 sits on the top (59) of the ring (58) on screw piece 54. In some of these embodiments, screw piece 54 and

elevator 52 are contained within recess 13, as seen in exploded Figure 43 and cross-sectional Figure 44. In some embodiments, elevator 52 is contained within ring 3 and projects through the bottom of ring 3 into screw piece 54. In some embodiments cover 1 fully covers ring 3. In some of these embodiments, no hinge is provided and cover 1 is fully removed when not secured to base 3.

[0043] In some embodiments, elevator 52 has threads (57) which match the threads (56) on screw piece 54. In this embodiment, as ring 3 is rotated with respect to base 5 (or as base 5 is rotated with respect to ring 3), the matching threads 56 and 57 engage and push elevator 52 up or down, depending on the direction of the rotation. In this embodiment ring 3 does not move in a vertical direction. In some embodiments, threads are located on the inside of ring 3. In some embodiments, both ring 3 and elevator 52 have threads and move in a vertical direction when rotated with respect to base 5. In some embodiments only ring 3 and not elevator 52 moves in a vertical direction when rotated with respect to base 5. In other embodiments ring 3 moves in a vertical direction and no elevator is provided as a means of reducing the amount of components in the device.

[0044] In some embodiments, such as the one shown in Figure 43, screw piece 54 contains a number of threads 56 which move elevator 52 along the length of base 5. In other embodiments, such as the one shown in Figure 47, elevator 52 contains the numerous threads 57 and screw piece 54 facilitates the rising of threads 57. These embodiments beneficially move elevator 52 in a vertical direction through a number of rotations. The numerous threads keep elevator 52 from getting inadvertently pushed up or down without the rotation of base 5. This is useful as the contents of the case can be jostled during transit or have pressure exerted on them when applying, and during all of these activities elevator 52 should stay in the desired position. In most embodiments where screw piece 54 contains the numerous threads, screw piece 54 is designed to extend to the bottom of base 5, and thus base 5 is not empty when elevator 52 is fully extended as seen in Figure 44. These embodiments beneficially balance out the weight of elevator 52 and its contents when extended. In most embodiments where elevator 52 contains the numerous threads, screw piece 54 does not extend to the bottom of base 5, and thus base 5 is empty when elevator 52 is fully extended, as seen in Figure 48. These embodiments beneficially limit the amount of material required to make screw piece 54, and thus reduce the complexity of the device. In some embodiments a weight is provided in base 5 to balance out the weight of elevator 52 and its contents when extended.

[0045] In some embodiments, the bottom of elevator 52 is kept from rising above the bottom of ring 3 by projection 60. As seen in Figure 46, in some embodiments, ring 3 is substantially restrained from moving in the vertical direction by groove 61 on ring 3 and shoulder 62 on screw piece 54. In some embodiments, two rings are

present, one that makes up the cover assembly, as in **Figure 1**, and one that is engaged in the screwing mechanism discussed in the preceding paragraph. These embodiments are useful as they combine the benefits of having a cover assembly fixed to the base with a ring or elevator system which protects the contents of the case by limiting the amount of air exposure on all sides.

**[0046]** **Figures 49-51** show a second elevator embodiment where no screw piece is provided and base **5** is mostly empty when elevator **52** is extended or contracted. As seen in **Figure 47**, in some of these embodiments, base **5** is equipped with projecting sleeve **66** which is secured to the inside of base **5**. In many embodiments, sleeve **66** is equipped with vertical track **67** which the projection **68** on elevator **52** fits within. Track **67** guides elevator **52** up and down within track **67** without requiring rotation of ring **3**. In many embodiments, ring **3** is equipped with inner sleeve **65** which is secured to the inside of ring **3**. In some embodiments sleeve **65** is equipped with spiral track **69** which the projection **68** on elevator **52** fits within. Track **69** rotates elevator **52** up and down within track **69**. In some embodiments both sleeve **65** and **66** are provided and in other embodiments only one is provided. Embodiments with both sleeve **65** and **66** are beneficial as it allows spiral track **69** to rotate with the movement of ring **3** which pulls elevator up and down within tracks **69** and **67**. This setup beneficially efficiently moves elevator **52** fully up or down with about one full rotation of ring **3** as opposed to the previous embodiments which take multiple rotations of ring **3**. Additionally, elevator **52** is able to move up and down within track **67** without rotation of ring **3**.

**[0047]** In some embodiments, track **67** is further equipped with locking area **70**. Locking area **70** beneficially locks elevator **52** in the fully opened or closed position. As discussed above, elevator **52** is able to move up and down within track **67** without rotation of ring **3** which could affect the usage of elevator **52**. When elevator **52** is placed into locking area **70**, however, the vertical movement is halted by these areas, thus elevator **52** in these embodiments be safely used when locked open. Similarly, in these embodiments the rising of elevator **52** is halted when closed, keeping the contents from rising into cover **1** when not in use.

**[0048]** In some embodiments, elevator **52** is beveled inwards which helps secure the contents of elevator **52**. In other embodiments, ring **3** is equipped with beveled ring **71** which secures the contents within ring **3**.

**[0049]** In some embodiments, the cover (**1**) further comprises a valve seal ring (**14**) on the internal surface (**15**). The external periphery (**25**) of the valve seal ring is chamfered slightly, as shown in **Figures 17-20, 34, 35, and 46**. The internal periphery (**23**) of the lip of the recess is also chamfered slightly as shown in **Figures 17-20, 34, 35, and 46**, and configured to engage the external periphery of the valve seal ring (**63**). As the cover is pressed against the base, the valve seal ring is compressed into the lip of the recess, forming an airtight func-

tion in the recess.

**[0050]** In some embodiments, threads (**21**) are provided on the cover (**1**) to engage threads (**11**) provided on the wall (**17**) extended upwardly from the base. The cover is pressed against the base by engaging the threads on the cover and the threads on the base and rotating the cover and the base with respect to each other. This pressure is sufficient to engage the valve seal ring and the lip of the recess to form an airtight seal.

**[0051]** As shown in **Figures 15-20**, in some embodiments a mirror (**27**) is attached to the bottom of some embodiments of the invention. This has the dual purpose of providing the largest possible reflective surface without increasing the size of the compact, and hiding the openings formed at the bottom of the base. In addition, a mirror on the outside surface allows its use without having to open the case and unnecessarily expose the contents to air. In other embodiments, a mirror is affixed to internal surface **15**. This embodiment is ideal for using the mirror while the case is opened, such as when applying makeup contained inside of the case. In other embodiments, a mirror is affixed to the top of the cover (**64**). This embodiment is useful as it combines the benefits of having a large surface area, the ability to use the mirror while using the contents of the case, and the ability to use the mirror without opening the case.

**[0052]** To open some embodiments of the invention, the cover and base are rotated with respect to each other until the threads on the cover disengage from the threads on the base, and then the cover is lifted to open the hinge between the cover and the intermediate ring. To close these embodiments, the cover is lowered and the cover and base are rotated with respect to each other until the threads engage and the cover is pressed sufficiently against the base to form an airtight seal between the valve seal ring and the lip of the recess.

**[0053]** In some embodiments, the function and structure of the hinge (**7**) and hinge pin (**9**) are replaced by a living hinge. This advantageously permits the cover (**1**) and the intermediate ring (**3**) to be molded or machined from a single piece of material, retaining a thin flexible diaphragm between the two. The cover and intermediate ring are folded together at the center of the diaphragm, leaving the diaphragm as a living hinge. This embodiment advantageously reduces the cost and complexity of manufacturing and is especially suited in smaller applications such as providing compacts for promotional samples of cosmetics. In some embodiments the living hinge remains external to the outer profile of the intermediate ring and the cover when the cover is closed. In other embodiments, the intermediate ring is provided with a depression into which the living hinge fits when the cover is closed, advantageously allowing a smooth external profile on the cosmetic case. In other embodiments, the cover is provided with a depression into which the living hinge fits when the cover is closed, while in still other embodiments, both the intermediate ring and the cover are provided with a depression, advantageously allowing a wider

range of hinged motion between the intermediate ring and the cover while preserving a smooth profile to the outer surface of the cosmetic case when the cover is closed.

**[0054]** In other embodiments, the invention utilizes bayonet mounts rather than threads to press the cover to the base. In one embodiment, one or more lugs are formed on the inside of the cover, configured to engage corresponding slots formed in the base. Engaging the lugs with the slots and rotating the cover and base with respect to each other has the effect of tightening the cover onto the base. In another embodiment, the one or more lugs are formed on the base to engage corresponding slots in the cover. Other mechanisms for pressing the cover to the base including latches and spring clips can be envisioned without departing from the spirit of the invention.

**[0055]** In some embodiments, a manual vacuum break is provided. This is especially advantageous when the contents are fine dry powders. In these cases, the process of unscrewing the cover can form a vacuum inside the receptacle as the airtight seal is broken, and the in-rushing air can scatter the contents. In other cases, the process of screwing down the cover to form the airtight seal compresses the air inside the container, leading to higher pressure inside the container than outside and potentially leading to blowing about of the powder as the pressure is released when the cover is open. By manually breaking the seal using a vacuum break before the cover is turned, such scattering is avoided. In some embodiments, the vacuum break is a channel through the cover of the case, held closed by spring tension and opened by depressing an actuator on the outside of the case. In some embodiments, the vacuum break is formed as an integral part of the cover and the spring tension is provided by the resilience and elasticity of the material from which the cover is formed.

**[0056]** In other embodiments, a one-way valve is provided. This can advantageously reduce the increase in pressure caused by screwing down the cover to form an airtight seal by allowing the air to escape as the cover is screwed down. The one-way valve allows air to escape from inside the container when the pressure inside is higher than the pressure outside, but prevents outside air from entering the container, thus preserving the contents. In some embodiments the one way valve is provided on cover **1**, in others it is provided on base **3**, and in others it is provided on both cover **1** and base **3**.

**[0057]** In other embodiments, a chamber (**35**) is provided in vapor contact with the recess when the airtight seal is engaged. In one exemplary embodiment, as shown in **Figure 34**, the chamber is located in the base of the cosmetic case, beneath the recess containing the product. In a second exemplary embodiment, as shown in **Figure 35**, the chamber is located in the cover, above the recess containing the product when the cosmetic case is sealed. This chamber is charged with a substance (**37**) for preserving the contents contained in the recep-

tacle. In some embodiments, especially advantageous when the contents are in a dry powdery form, the chamber is charged with a desiccant. In varying embodiments, the desiccants are alternatively silica gel, magnesium sulfate, and sodium sulfate. The desiccant advantageously absorbs any water entering the cosmetic case when it is opened, preventing the cosmetic from absorbing water and caking up.

**[0058]** In other embodiments, especially advantageous when the cosmetic product is an aqueous paste, the substance is a water source, advantageously preventing the contents from drying out as water is lost when the container is opened. In one embodiment, the water source is water absorbed onto a suitable absorbent material such as cotton, cellulose, or hydrophilic sponge. In another embodiment the water source is a hydrated hydrophilic gel. In yet another embodiment, the water source is a solid such as clay, zeolite, calcium carbonate, or magnesium sulfate, the solid being in a hydrated form.

**[0059]** In still further embodiments, especially advantageous when the contents contain a volatile organic solvent such as hexane, ethyl acetate, ethyl alcohol, or isopropyl alcohol, the substance is a solvent compatible with that of the contents, the solvent absorbed onto a suitable absorbent material such as foam, cloth, or paper. In still further embodiments, the substance is alternatively a biocide, a bactericide, a fungicide, or combinations thereof, advantageously preventing biological contamination of the cosmetic product.

**[0060]** In some embodiments, cover **1** and base **5** consist of one material and in other embodiments cover **1** and base **5** consist of more than one material. In some embodiments, cover **1** and base **5** consist of one layer, and in other embodiments cover **1** and base **5** consist of more than one layer. In some embodiments the different layers are the same material, and in other embodiments the different layers are different materials. An example of the embodiment with different material layers is shown in **Figure 43** where cover **1** has an external layer **53**, and base **5** has an external layer **55**. The embodiments with different material layers are useful for allowing flexibility in the materials contained in the cosmetic case. Some of the solvents listed above are corrosive or damaging to certain types of materials. Thus, it is beneficial to be able to line the inside of the container with a material which is more durable, but may be more expensive or not as aesthetically pleasing, while maintaining a cheaper and more aesthetically pleasing external material.

**[0061]** In some embodiments, the substance is separated from the recess by a perforated divider (**39**) to prevent loss of the contents of the recess into the chamber. In some embodiments divider **39** is placed between recess **13** and chamber **35**. In other embodiments, especially advantageous when the contents are finely divided powders which might pass through a perforated divider, the substance is separated from the recess by a membrane (**43**) permeable to vapors but impermeable to finely divided solids, to prevent entry of the contents of the re-

cess into the chamber.

**[0062]** These descriptions and drawings are exemplary of specific embodiments only and are not intended to be limiting to the scope of the invention defined in the claims.

## Claims

### 1. A cosmetic case **characterized by:**

a base (5) having a recess (13) defined by a recess wall (17);  
 a ring (3) free to rotate about said recess wall (17) and retained by said base (5);  
 a cover (1);  
 a hinge (7) affixing said cover (1) to said ring (3) to form a cover assembly;  
 wherein rotation of said cover assembly about said recess wall (17) forms an airtight seal between said base (5) and said cover (1);  
 wherein said ring (3) further comprises at least one ring protrusion (29);  
 wherein said base (5) further comprises at least one base protrusion (49);  
 wherein at least one of said at least one ring protrusion (29) engages with at least one of said at least one base protrusion (49) to secure said cover assembly in a secured position;  
**characterised in that** said at least one base protrusion (49) comprises a bump (47), gap (48), and ledge (49) or a hook (50) and a ledge (51), or wherein said at least one ring protrusion (29) comprises a bump (42), gap (43), and a ledge (44) motif or a ledge (44) and hook (45) motif.

2. A cosmetic case according to claim 1, where said secured position denotes an opened or closed position.

3. A cosmetic case according to claim 1, wherein said base (5) further comprises at least one riser (33) such that during rotation of said cover assembly said at least one ring protrusion (29) engages with said at least one riser (33) and moves said cover assembly in a vertical direction.

4. A cosmetic case according to claim 1, wherein said cover (1) and said recess wall (17) each further comprise mating threads (21) such that engagement of said threads (21) and rotation of said cover assembly draws said cover (1) towards said base (5) to form said airtight seal.

5. A cosmetic case according to claim 1, further comprising:

a sealing element affixed to said cover (1), said

sealing element having a chamfered perimeter; a chamfer on said recess wall (17) configured to mate with said chamfered perimeter on said sealing element to form said airtight seal.

6. A cosmetic case according to claim 5, wherein said sealing element is selected from the group consisting of an annular gasket, a valve seal ring (14), a disc, and combinations thereof.

7. A cosmetic case according to claim 1, wherein said case further includes a mirror (27) affixed to said case.

8. A cosmetic case according to claim 1, wherein said hinge (7) has an outer profile which substantially matches a profile of an outer diameter of said ring, and said hinge (7) in the closed position is contained within said outer perimeter of said ring.

9. A cosmetic case according to claim 1, wherein said cover (1) and said base (5) are made of at least two layers, wherein each layer is made of a material different than another layer.

10. A cosmetic case according to claims 4 and 5, wherein said drawing said cover (1) towards said base (5) engages said chamfered perimeters on said cover (1) and said recess wall (17) and forms an airtight seal between said base (5) and said cover (1).

11. A cosmetic case according to claim 1, further comprising a first, second, and third ring protrusion.

12. A cosmetic case according to claim 1 and 11, wherein said secured position is when said at least one base protrusion (49) interacts with the bump (42), gap (43), and a ledge (44) motif or a ledge (44) and hook (45) motif of the ring protrusions.

13. A cosmetic case according to claim 3, wherein said at least one base protrusion (49) is located at the same height as said riser (33).

14. A cosmetic case according to claim 1, wherein said hinge (7) is a living hinge and said ring (3) and said cover (1) further comprise a depression.

## Patentansprüche

### 1. Kosmetikkoffer, **gekennzeichnet durch:**

einen Sockel (5) mit einer Aussparung (13), die durch eine Aussparungswand (17) begrenzt ist; einem Ring (3), der sich frei um die Aussparungswand (17) drehen kann und von der Basis (5) gehalten wird;

- ein Deckel (1);  
 ein Scharnier (7), das den Deckel (1) an dem Ring (3) befestigt, um eine Deckelanordnung zu bilden;  
 wobei die Drehung der Abdeckungsanordnung um die Aussparungswand (17) eine luftdichte Abdichtung zwischen der Basis (5) und der Deckel (1) bildet;  
 wobei der Ring (3) außerdem mindestens einen Ringvorsprung (29) aufweist;  
 wobei die Basis (5) außerdem mindestens einen Basisvorsprung (49) aufweist;  
 wobei mindestens einer der mindestens einen Ringvorsprünge (29) in mindestens einen der mindestens einen Basisvorsprünge (49) eingreift, um die Abdeckungsanordnung in einer gesicherten Position zu sichern;
- dadurch gekennzeichnet, dass**  
 der mindestens eine Basisvorsprung (49) eine Erhebung (47), eine Lücke (48) und eine Leiste (49) oder einen Haken (50) und eine Leiste (51) aufweist, oder wobei der mindestens eine Ringvorsprung (29) eine Erhebung (42), eine Lücke (43) und ein Leistenmotiv (44) oder ein Leisten-(44) und Hakenmotiv (45) aufweist.
2. Kosmetikkoffer nach Anspruch 1, wobei die gesicherte Position eine geöffnete oder geschlossene Position bezeichnet.
  3. Kosmetikkoffer nach Anspruch 1, wobei die Basis (5) ferner mindestens einen Steigbügel (33) umfasst, so dass während der Drehung der Abdeckungsbaugruppe der mindestens eine Ringvorsprung (29) mit dem mindestens einen Steigbügel (33) in Eingriff kommt und die Abdeckungsbaugruppe in vertikaler Richtung bewegt.
  4. Kosmetikkoffer nach Anspruch 1, wobei der Deckel (1) und die Aussparungswand (17) jeweils ein passendes Gewinde (21) aufweisen, so dass der Eingriff des Gewindes (21) und die Drehung der Deckelanordnung den Deckel (1) in Richtung der Basis (5) zieht, um die luftdichte Abdichtung zu bilden.
  5. Kosmetikkoffer nach Anspruch 1, ferner umfassend: ein an der Deckel (1) befestigtes Dichtungselement, wobei das Dichtungselement einen abgeschrägten Umfang aufweist;  
 eine Abschrägung an der Aussparungswand (17), die so gestaltet ist, dass sie mit dem abgeschrägten abgeschrägten Umfang des Dichtungselements zu passen, um die luftdichte Abdichtung zu bilden.
  6. Kosmetikkoffer nach Anspruch 5, wobei das Dichtungselement aus der Gruppe ausgewählt ist, die aus einer ringförmigen Dichtung, einem Ventildich-
- tring (14), einer Scheibe und Kombinationen davon besteht.
7. Kosmetikkoffer nach Anspruch 1, wobei der Koffer außerdem einen Spiegel (27) enthält, der an dem Koffer befestigt ist.
  8. Kosmetikkoffer nach Anspruch 1, wobei das Scharnier (7) ein Außenprofil aufweist, das im Wesentlichen mit einem Profil eines Außendurchmessers des Rings übereinstimmt, und das Scharnier (7) in der geschlossenen Position innerhalb des Außenumfangs des Rings enthalten ist.
  9. Kosmetikkoffer nach Anspruch 1, wobei der Deckel (1) und der Boden (5) aus mindestens zwei Schichten bestehen, wobei jede Schicht aus einem anderen Material als eine andere Schicht besteht.
  10. Kosmetikkoffer nach den Ansprüchen 4 und 5, wobei das Ziehen des Deckels (1) in Richtung der Basis (5) an den abgeschrägten Umfängen des Deckels (1) und der Aussparungswand (17) angreift und eine luftdichte Abdichtung zwischen der Basis (5) und dem Deckel (1) bildet.
  11. Kosmetikkoffer nach Anspruch 1, der außerdem einen ersten, zweiten und dritten Ringvorsprung aufweist.
  12. Kosmetikkoffer nach Anspruch 1 und 11, wobei die gesicherte Position diejenige ist, in der der mindestens eine Basisvorsprung (49) mit dem Höcker (42), dem Spalt (43) und dem Motiv einer Leiste (44) oder dem Motiv einer Leiste (44) und eines Hakens (45) der Ringvorsprünge zusammenwirkt.
  13. Kosmetikkoffer nach Anspruch 3, wobei der mindestens eine Basisvorsprung (49) auf der gleichen Höhe wie der Steigbügel (33) angeordnet ist.
  14. Kosmetikkoffer nach Anspruch 1, wobei das Scharnier (7) ein lebendes Scharnier ist und der Ring (3) und der Deckel (1) außerdem eine Vertiefung aufweisen.

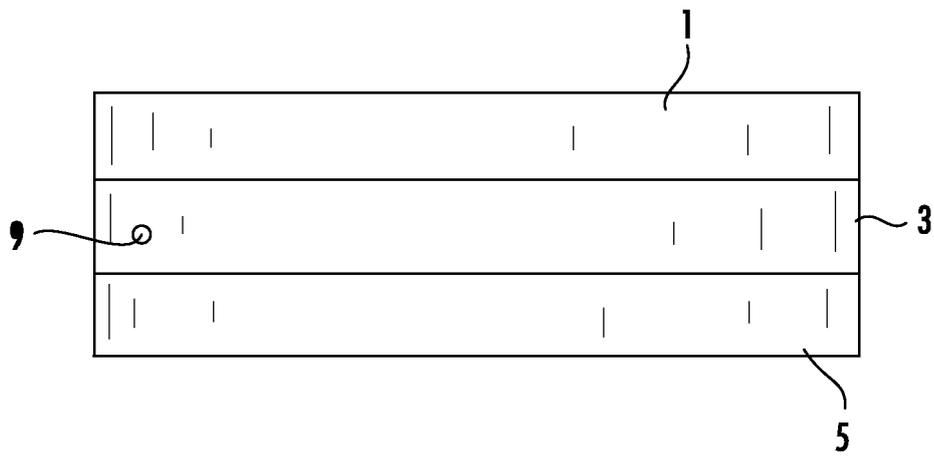
## Revendications

1. Boîtier cosmétique **caractérisé par** :  
 une base (5) comportant un renforcement (13) défini par une paroi de renforcement (17) ;  
 une bague (3) libre de tourner autour de la paroi de renforcement (17) et retenue par la base (5) ;  
 un couvercle (1) ;  
 une charnière (7) fixant ledit couvercle (1) à ladite bague (3) pour former un ensemble de

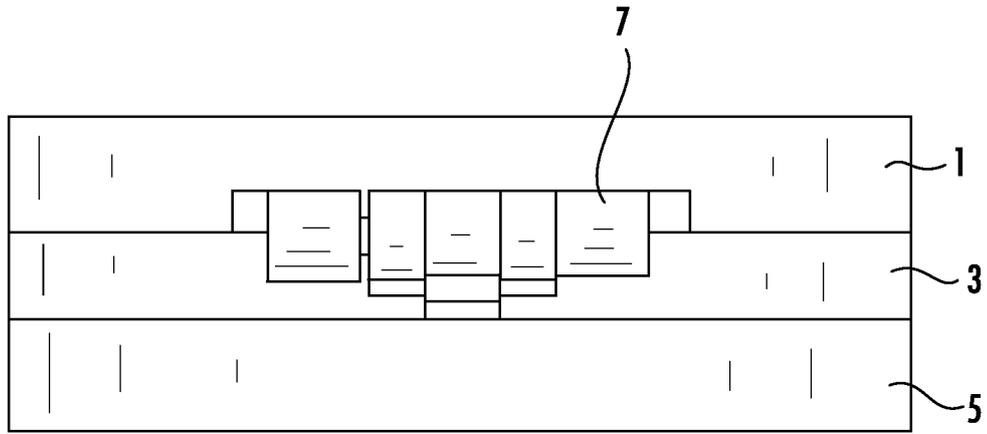
- couvercle ;  
dans lequel la rotation dudit ensemble de couverture autour de ladite paroi de renforcement (17) forme un joint étanche à l'air entre ladite base (5) et ledit couvercle (1) ;  
dans lequel ladite bague (3) comprend en outre au moins une protubérance de bague (29) ;  
dans laquelle ladite base (5) comprend en outre au moins une protubérance de base (49) ;  
dans lequel au moins une de ces protubérances de bague (29) s'engage avec au moins une de ces protubérances de base (49) pour fixer l'ensemble du couvercle dans une position sécurisée ;
- caractérisé par le fait que**  
ladite au moins une protubérance de base (49) comprend une bosse (47), un espace (48) et un rebord (49) ou un crochet (50) et un rebord (51), ou dans laquelle ladite au moins une protubérance de bague (29) comprend une bosse (42), un espace (43) et un motif de rebord (44) ou un motif de rebord (44) et un motif de crochet (45).
2. Boîtier cosmétique selon la revendication 1, où ladite position sécurisée désigne une position ouverte ou fermée. 25
3. Boîtier cosmétique selon la revendication 1, dans lequel ladite base (5) comprend en outre au moins une contremarche (33) de sorte que, pendant la rotation de l'ensemble du couvercle, ladite au moins une protubérance de bague (29) s'engage dans ladite au moins une contremarche (33) et déplace l'ensemble du couvercle dans une direction verticale. 30
4. Boîtier cosmétique selon la revendication 1, dans lequel ledit couvercle (1) et ladite paroi de renforcement (17) comprennent chacun en outre des filets d'accouplement (21) de sorte que l'engagement desdits filets d'accouplement (21) et la rotation dudit assemblage de couvercle attirent ledit couvercle (1) vers ladite base (5) pour former ledit joint étanche à l'air. 40
5. Boîtier cosmétique selon la revendication 1, comprenant en outre 45
- un élément d'étanchéité fixé audit couvercle (1), ledit élément d'étanchéité ayant un périmètre chanfreiné ; 50
- un chanfrein sur ladite paroi de renforcement (17) configuré pour s'accoupler avec ledit périmètre chanfreiné sur ledit élément d'étanchéité pour former ledit joint étanche à l'air. 55
6. Boîtier cosmétique selon la revendication 5, dans lequel l'élément d'étanchéité est choisi dans le groupe constitué d'un joint annulaire, d'une bague d'étanchéité de valve (14), d'un disque et de leurs combinaisons.
7. Boîtier cosmétique selon la revendication 1, dans laquelle ledit boîtier comprend en outre un miroir (27) fixé audit boîtier. 5
8. Boîtier cosmétique selon la revendication 1, dans lequel ladite charnière (7) a un profil extérieur qui correspond sensiblement au profil d'un diamètre extérieur de ladite bague, et ladite charnière (7) en position fermée est contenue dans ledit périmètre extérieur de ladite bague. 10
9. Boîtier cosmétique selon la revendication 1, dans lequel ledit couvercle (1) et ladite base (5) sont constitués d'au moins deux couches, chaque couche étant constituée d'un matériau différent de celui d'une autre couche. 15
10. Boîtiers cosmétique selon les revendications 4 et 5, dans lequel ladite traction dudit couvercle (1) vers ladite base (5) engage lesdits périmètres chanfreinés sur ledit couvercle (1) et ladite paroi de renforcement (17) et forme un joint étanche entre ladite base (5) et ledit couvercle (1). 20
11. Boîtier cosmétique selon la revendication 1, comprenant en outre une première, une deuxième et une troisième protubérances de bague. 30
12. Boîtier cosmétique selon les revendications 1 et 11, dans lequel ladite position sécurisée est atteinte lorsque ladite au moins une protubérance de base (49) interagit avec la bosse (42), l'espace (43) et un motif de rebord (44) ou un motif de rebord (44) et de crochet (45) des protubérances de bague. 35
13. Boîtier cosmétique selon la revendication 3, dans lequel ladite au moins une protubérance de base (49) est située à la même hauteur que ladite contremarche (33). 40
14. Boîtier cosmétique selon la revendication 1, dans lequel ladite charnière (7) est une charnière vivante et ladite bague (3) et ledit couvercle (1) comportent en outre une dépression. 45



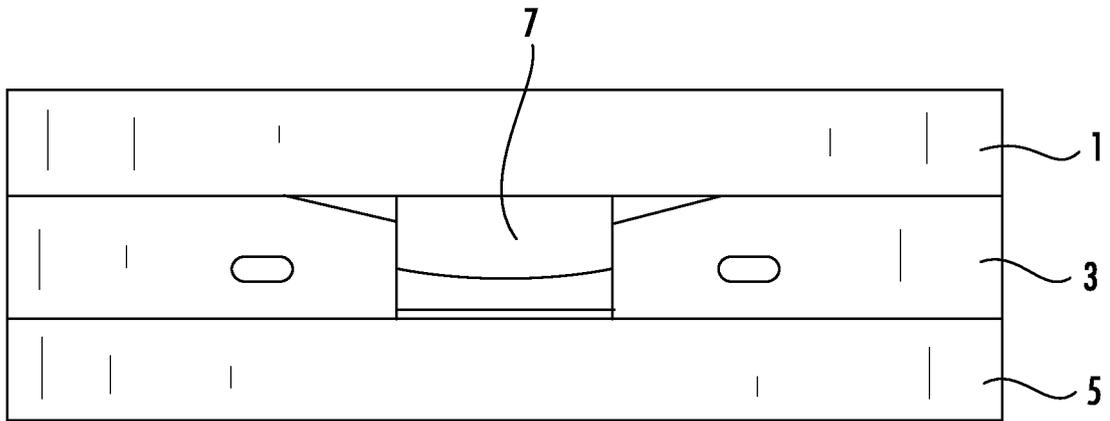
**FIG. 1**



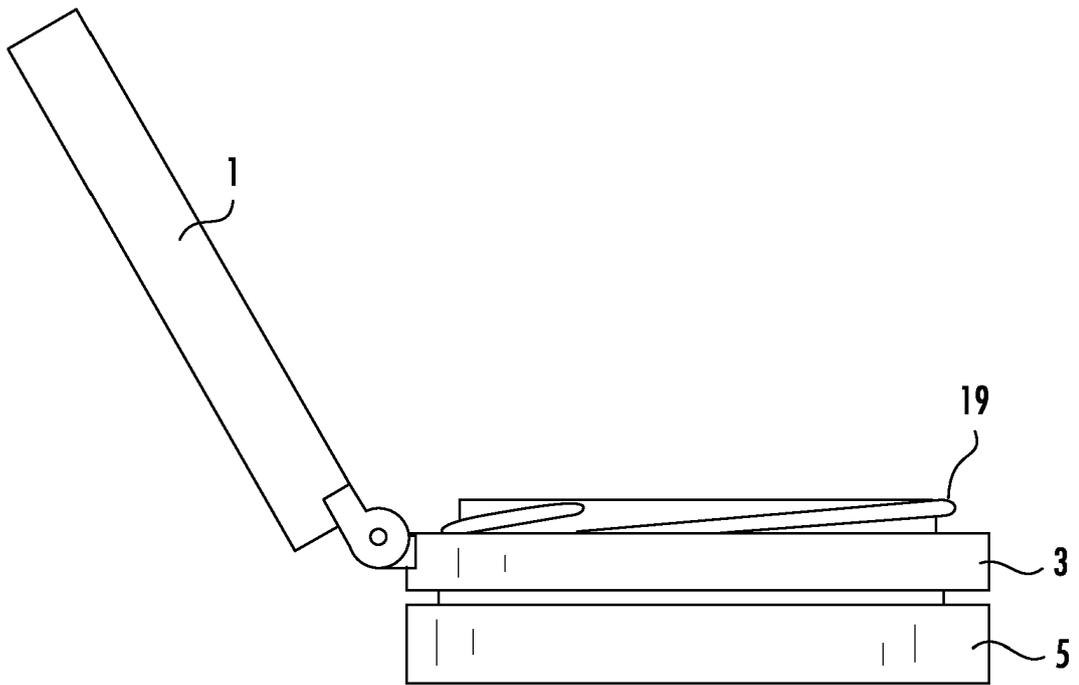
**FIG. 2**



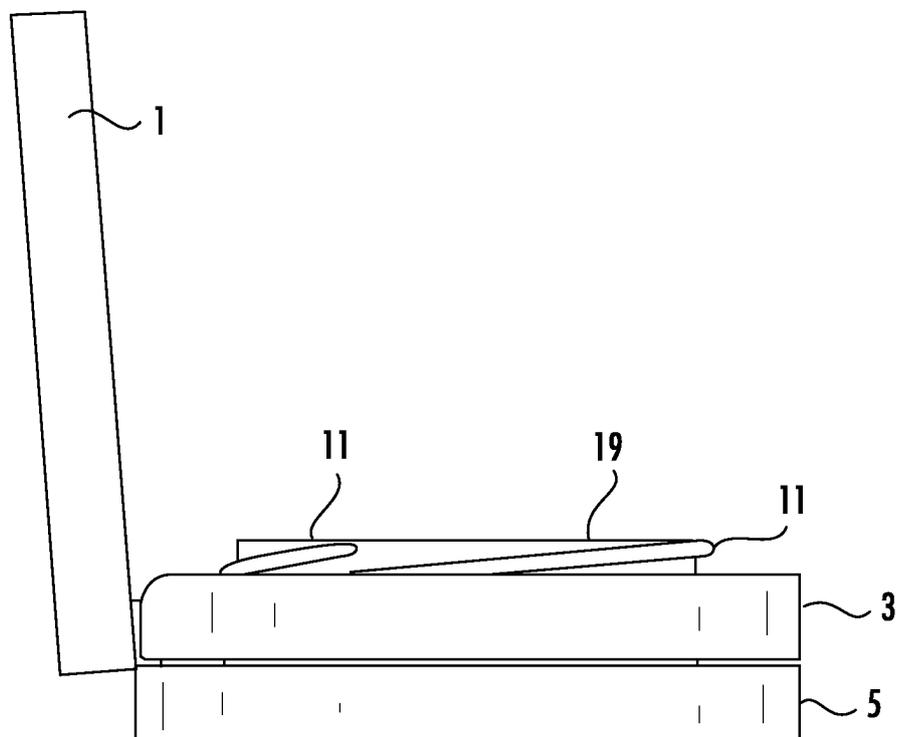
**FIG. 3**



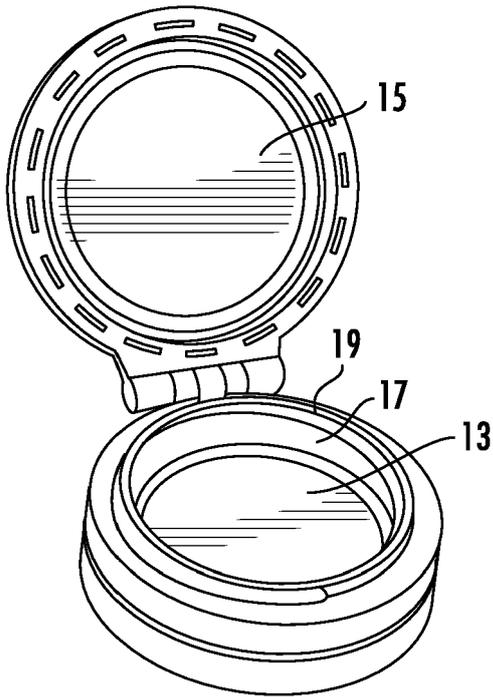
**FIG. 4**



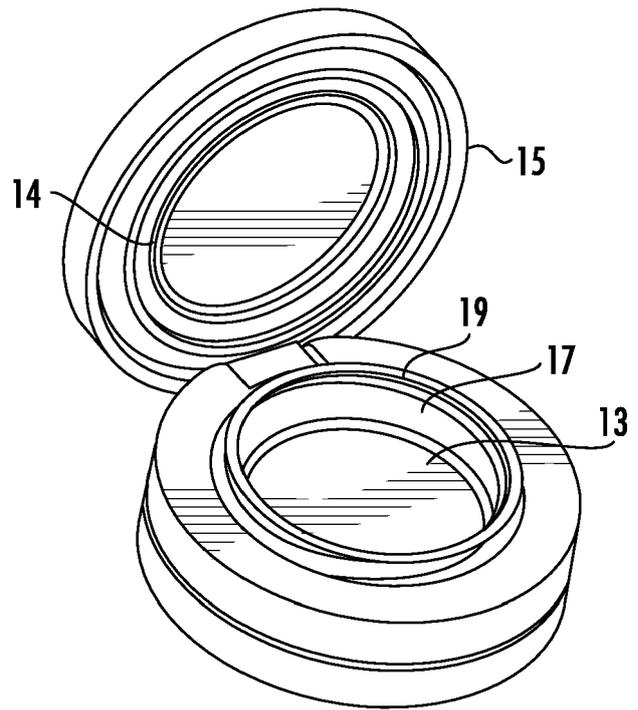
**FIG. 5**



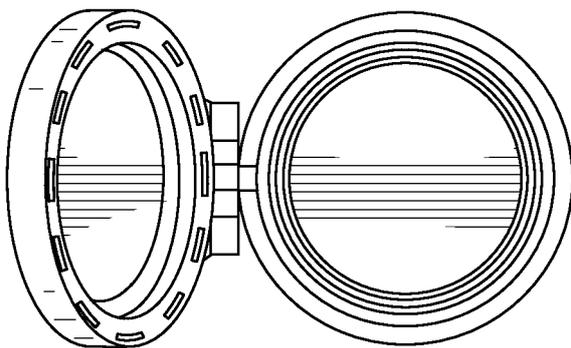
**FIG. 6**



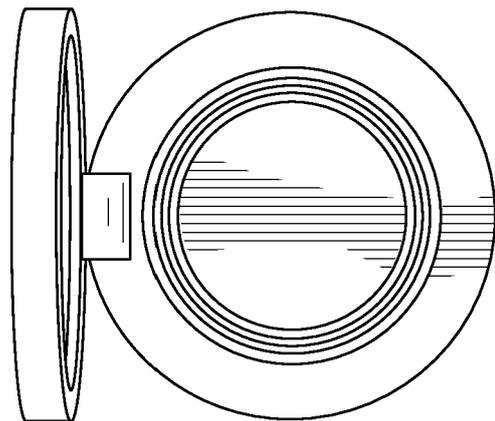
**FIG. 7**



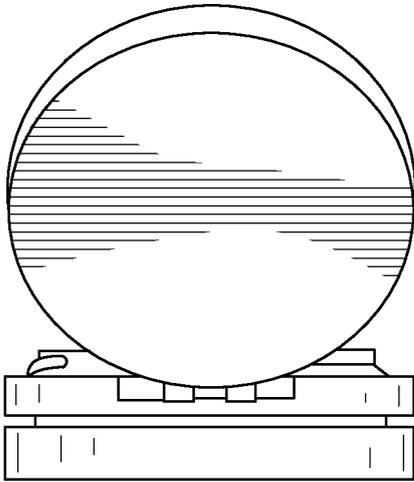
**FIG. 8**



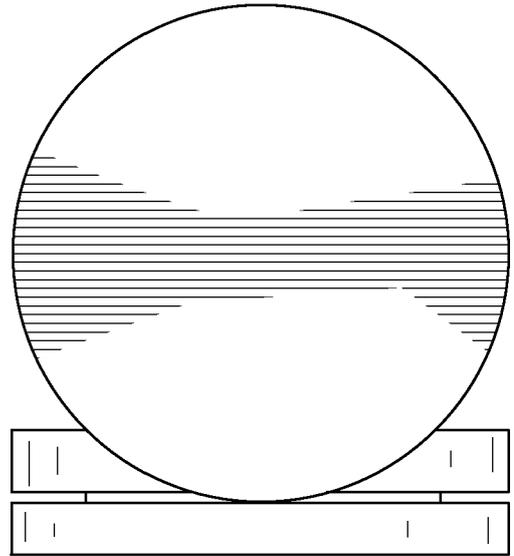
**FIG. 9**



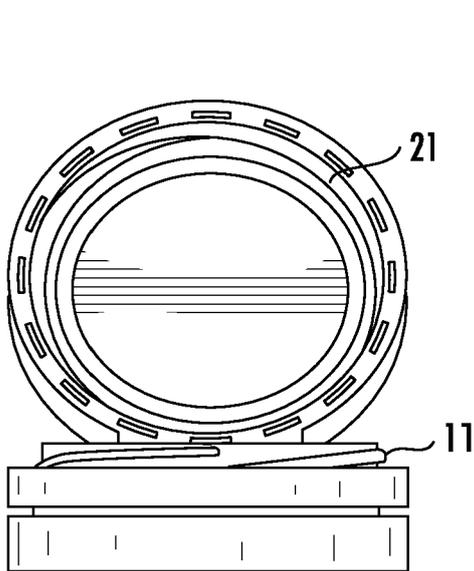
**FIG. 10**



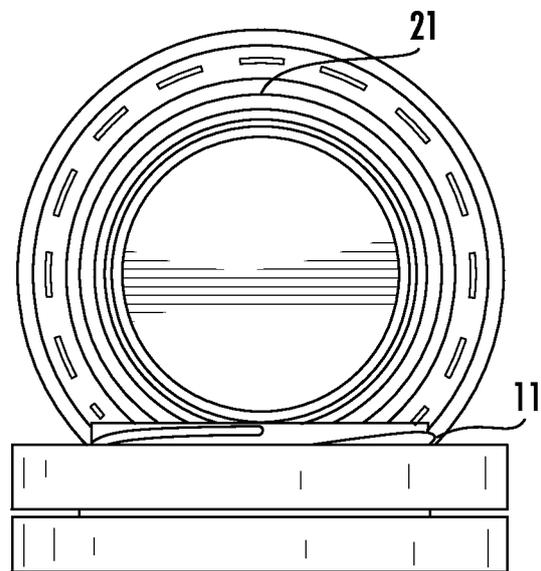
**FIG. 11**



**FIG. 12**



**FIG. 13**



**FIG. 14**

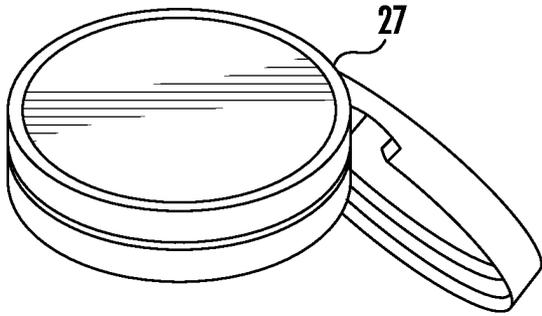


FIG. 15

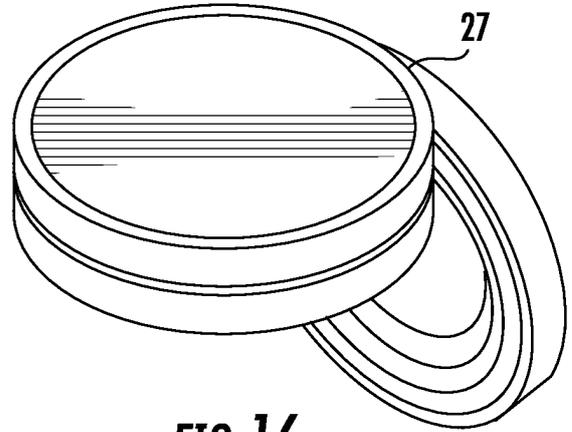


FIG. 16

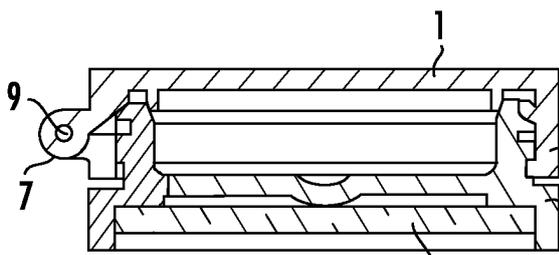


FIG. 17 27

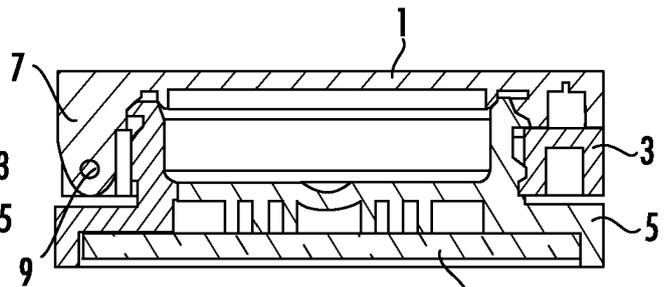


FIG. 18 27

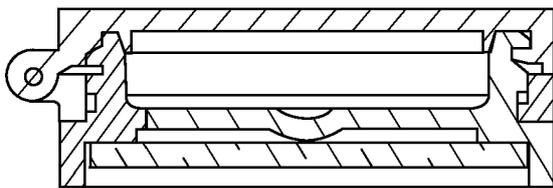


FIG. 19

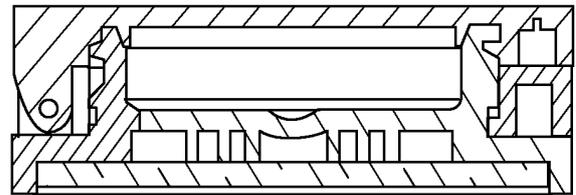
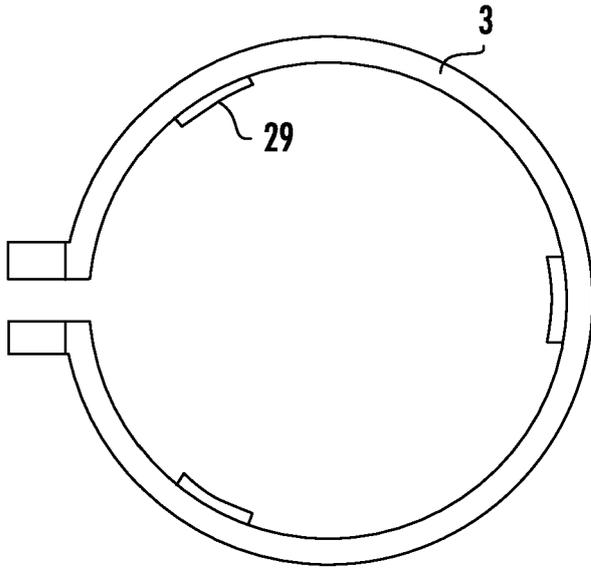
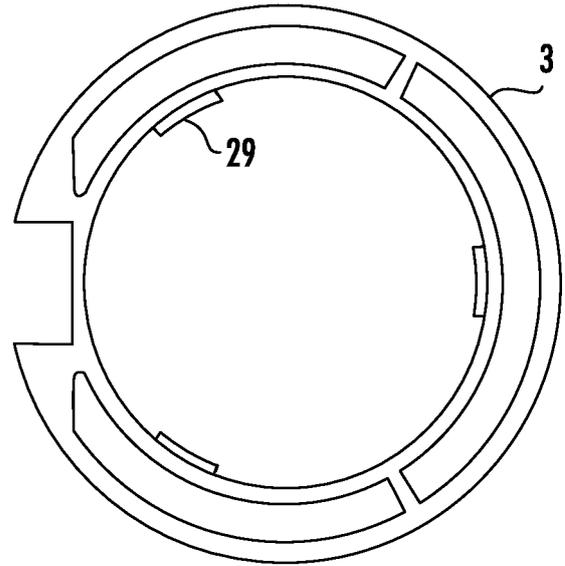


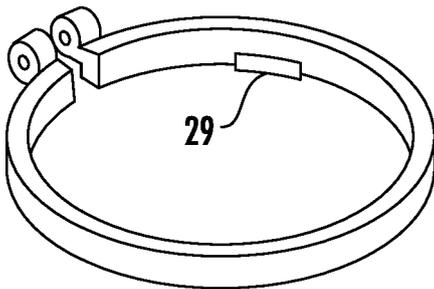
FIG. 20



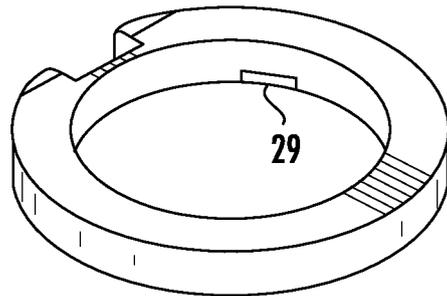
**FIG. 21**



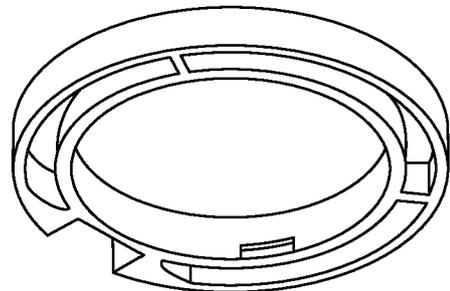
**FIG. 22**



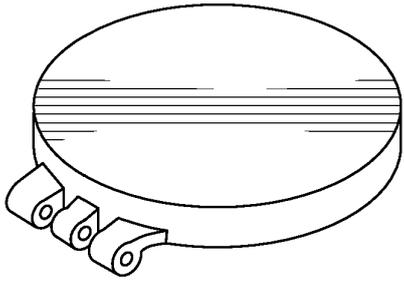
**FIG. 23**



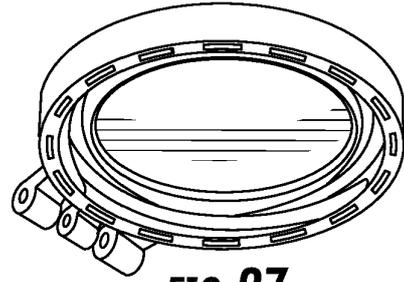
**FIG. 24**



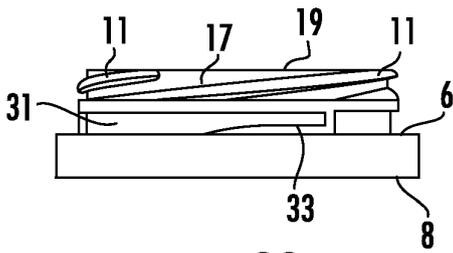
**FIG. 25**



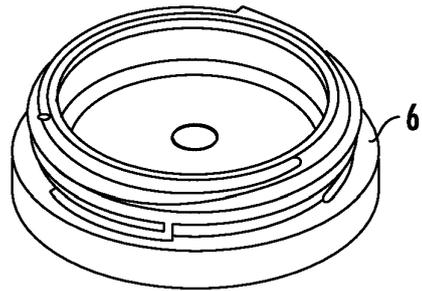
**FIG. 26**



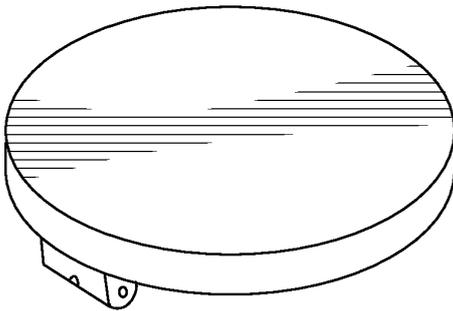
**FIG. 27**



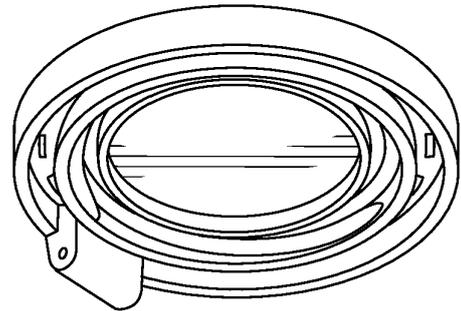
**FIG. 28**



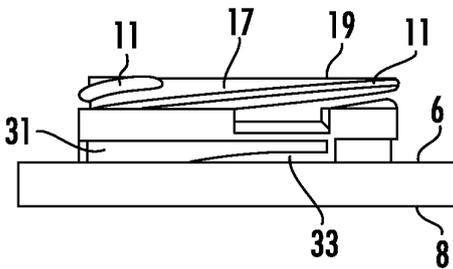
**FIG. 29**



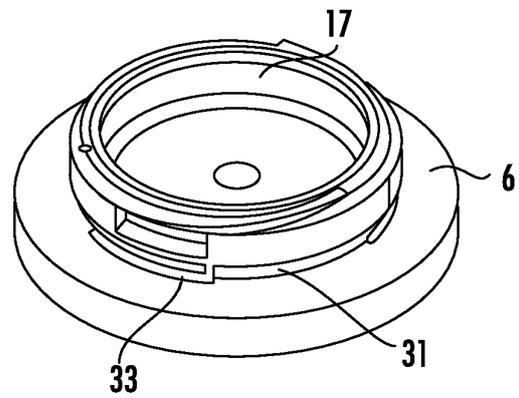
**FIG. 30**



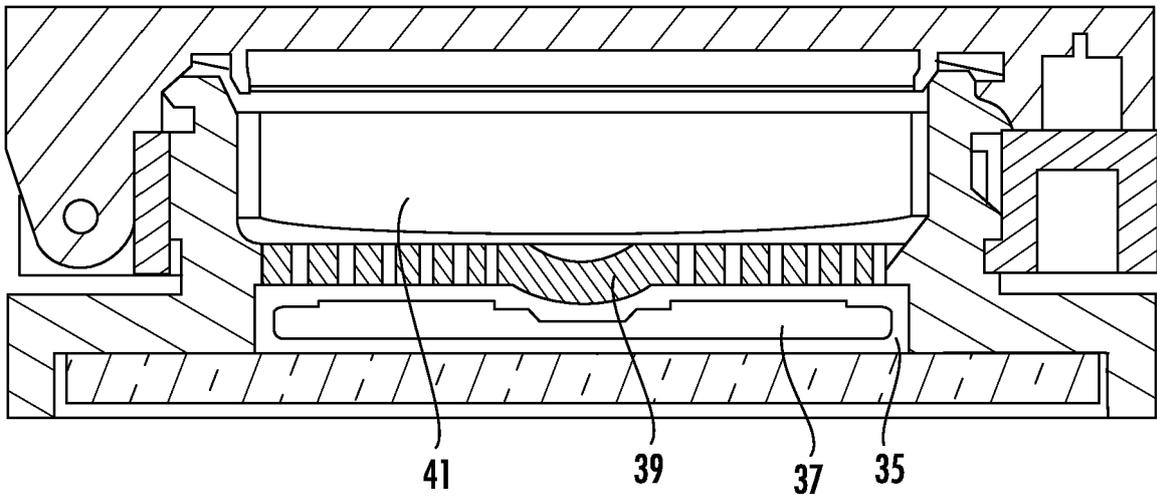
**FIG. 31**



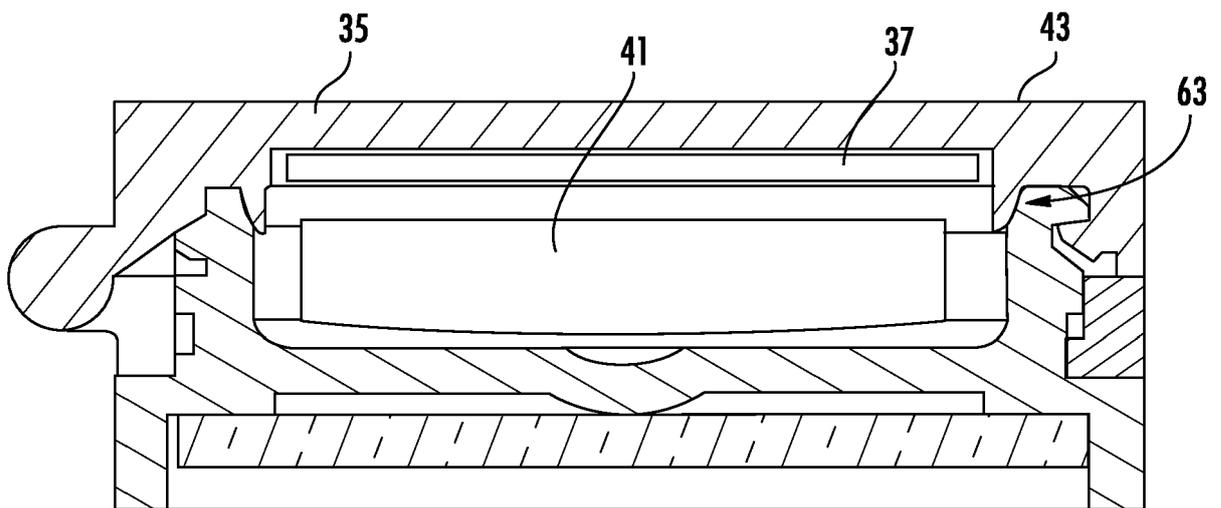
**FIG. 32**



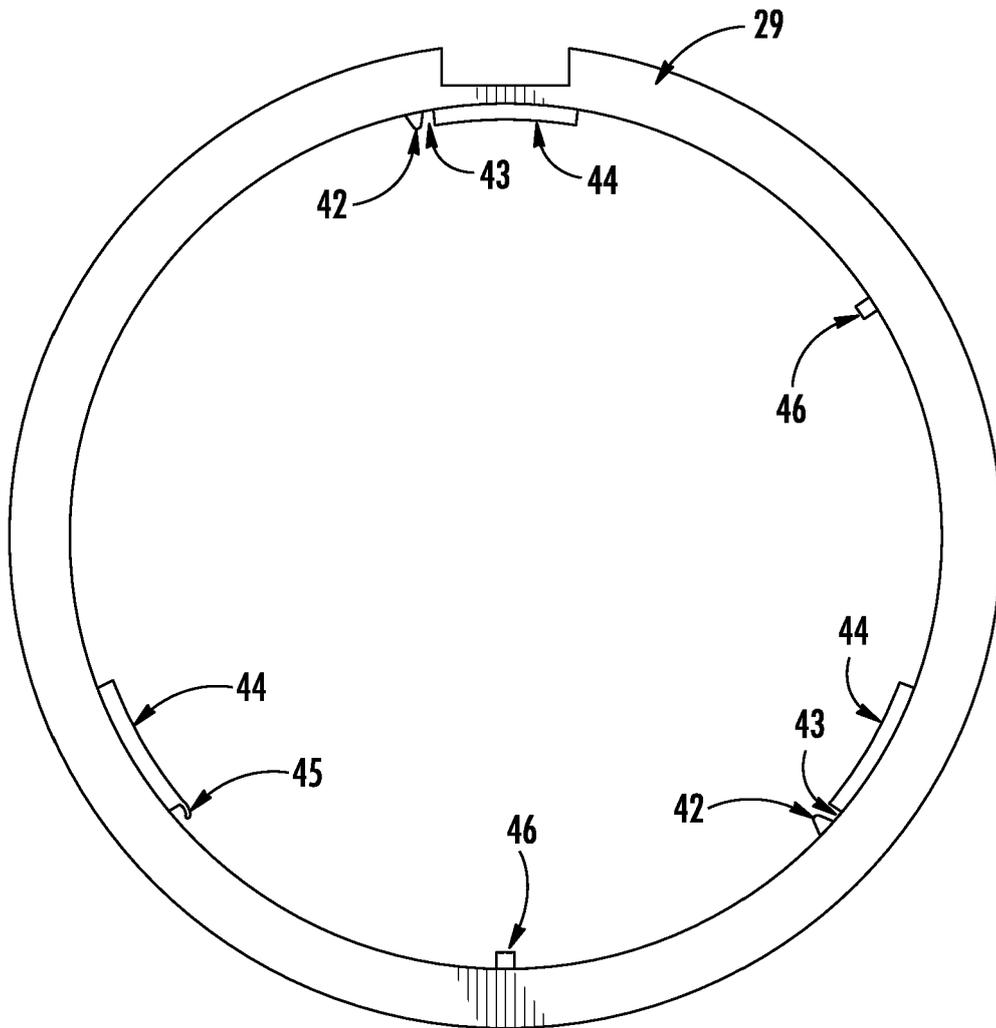
**FIG. 33**



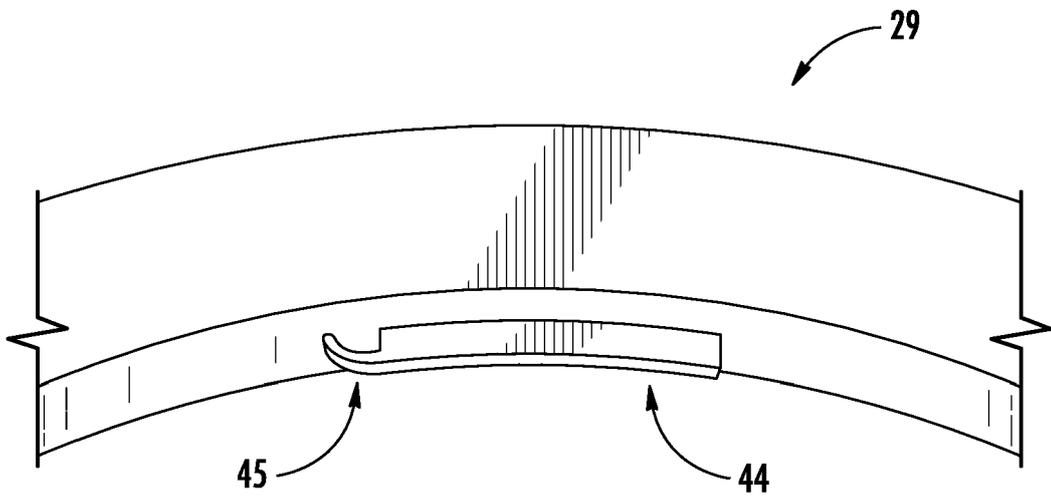
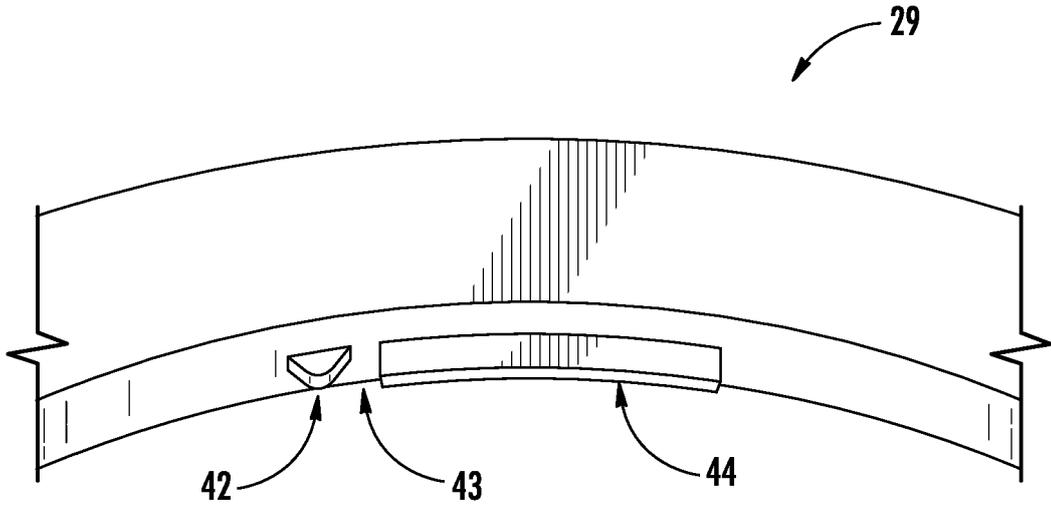
**FIG. 34**

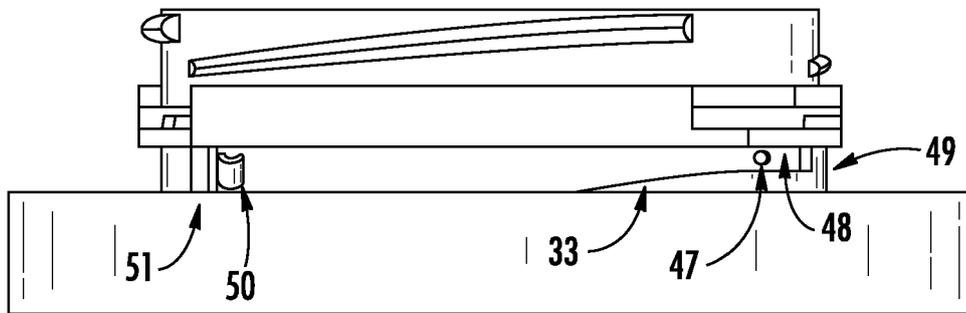


**FIG. 35**

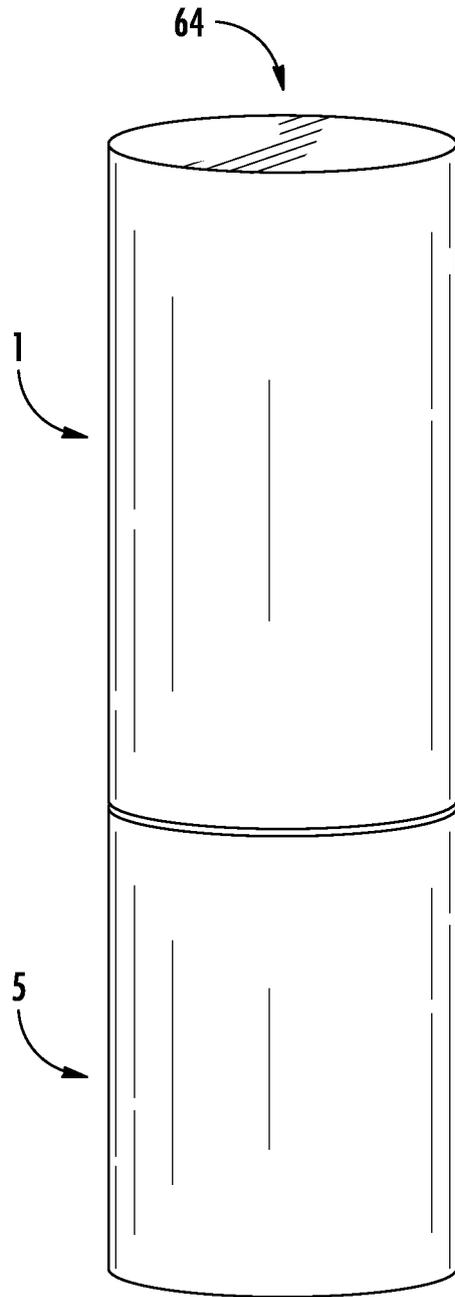


**FIG. 36**

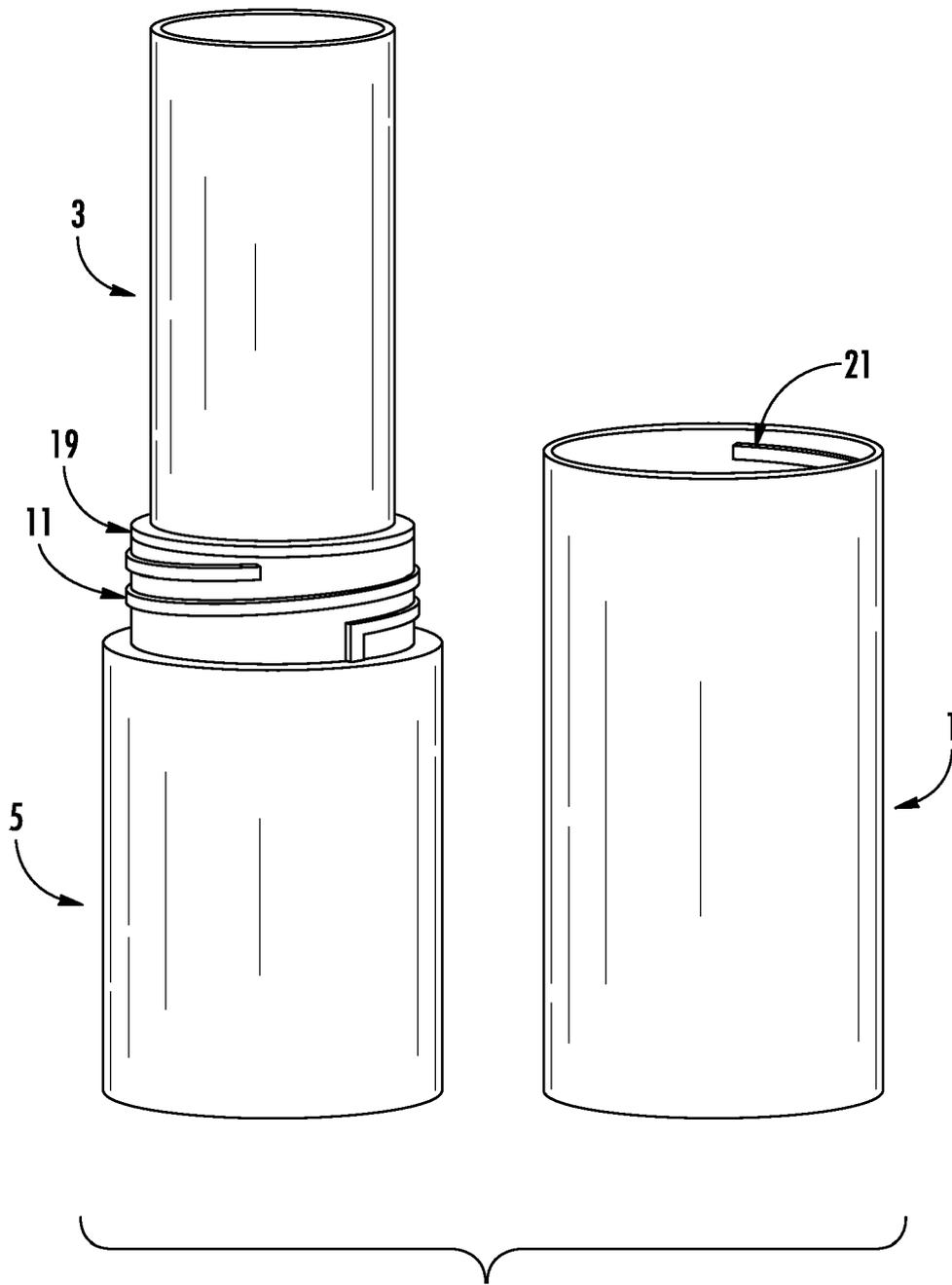




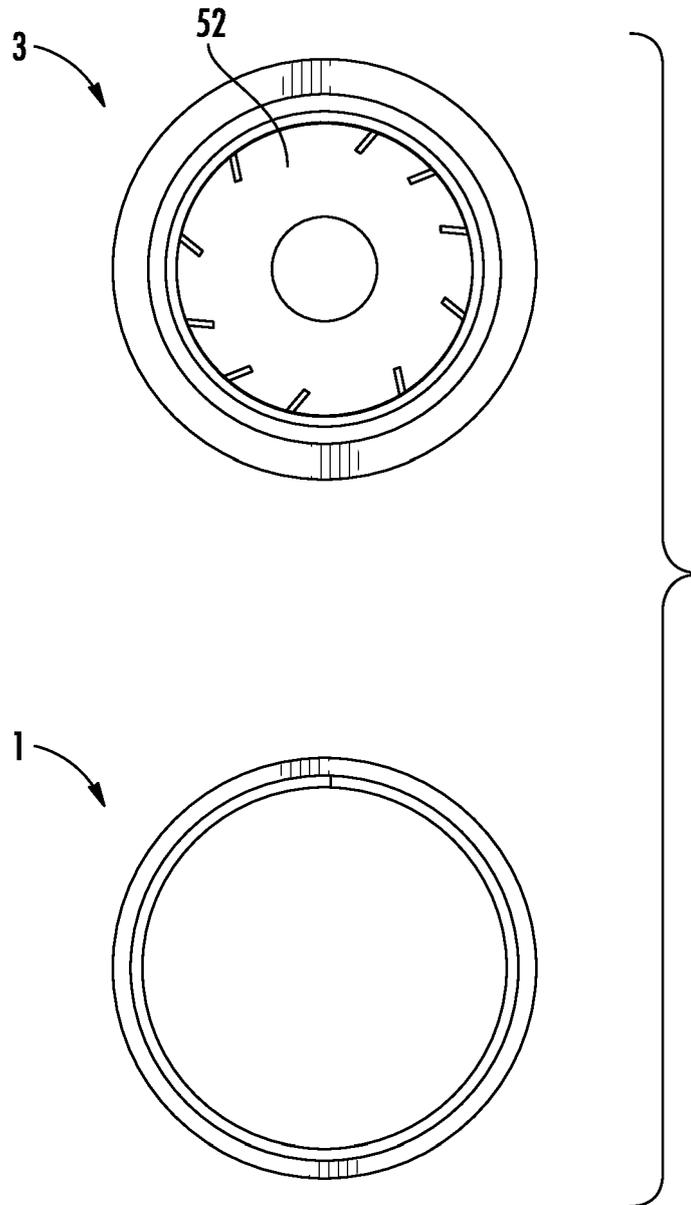
**FIG. 39**



**FIG. 40**

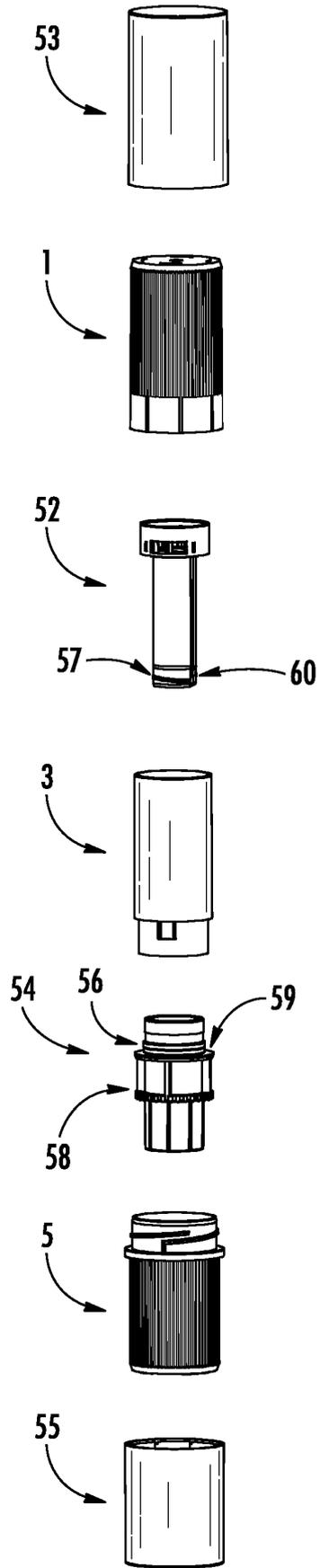


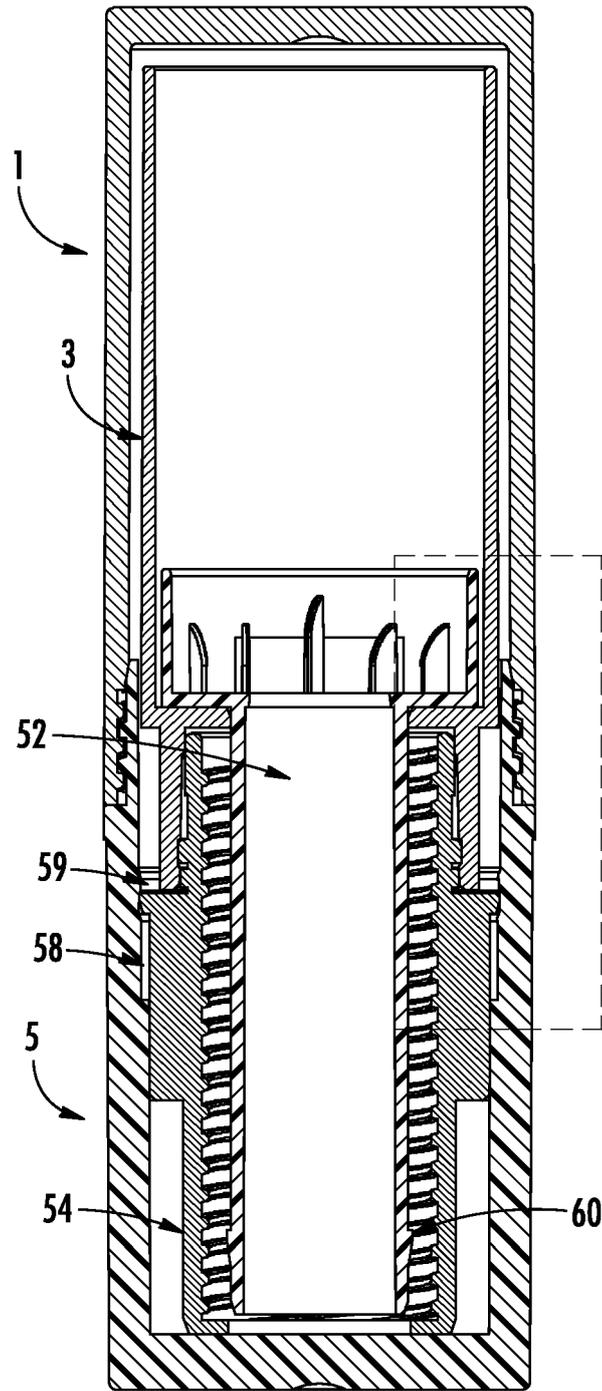
**FIG. 41**



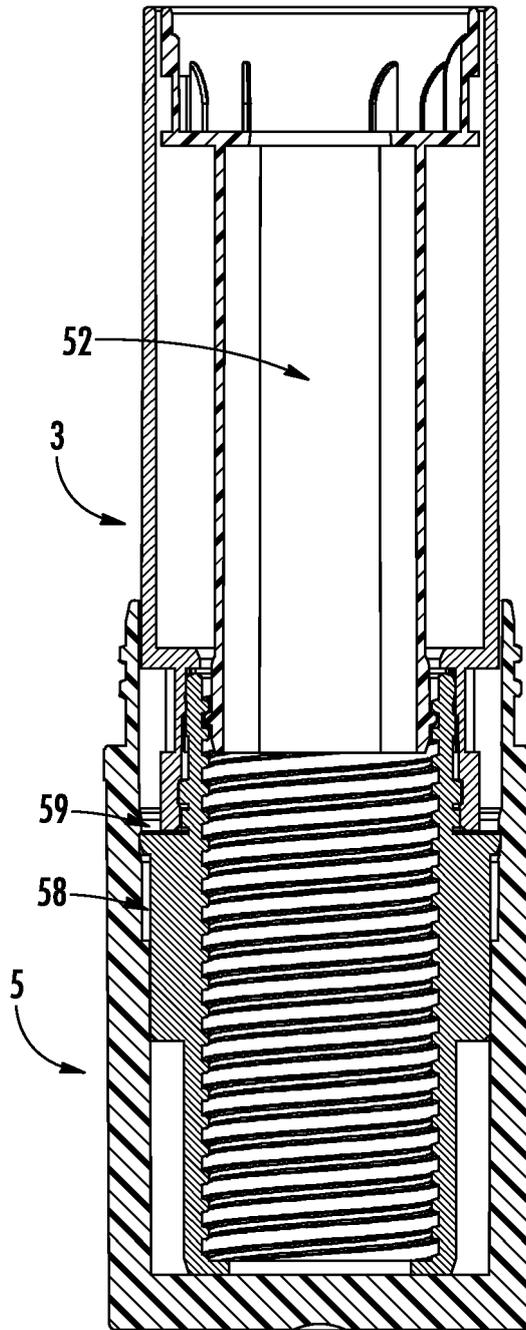
**FIG. 42**

**FIG. 43**

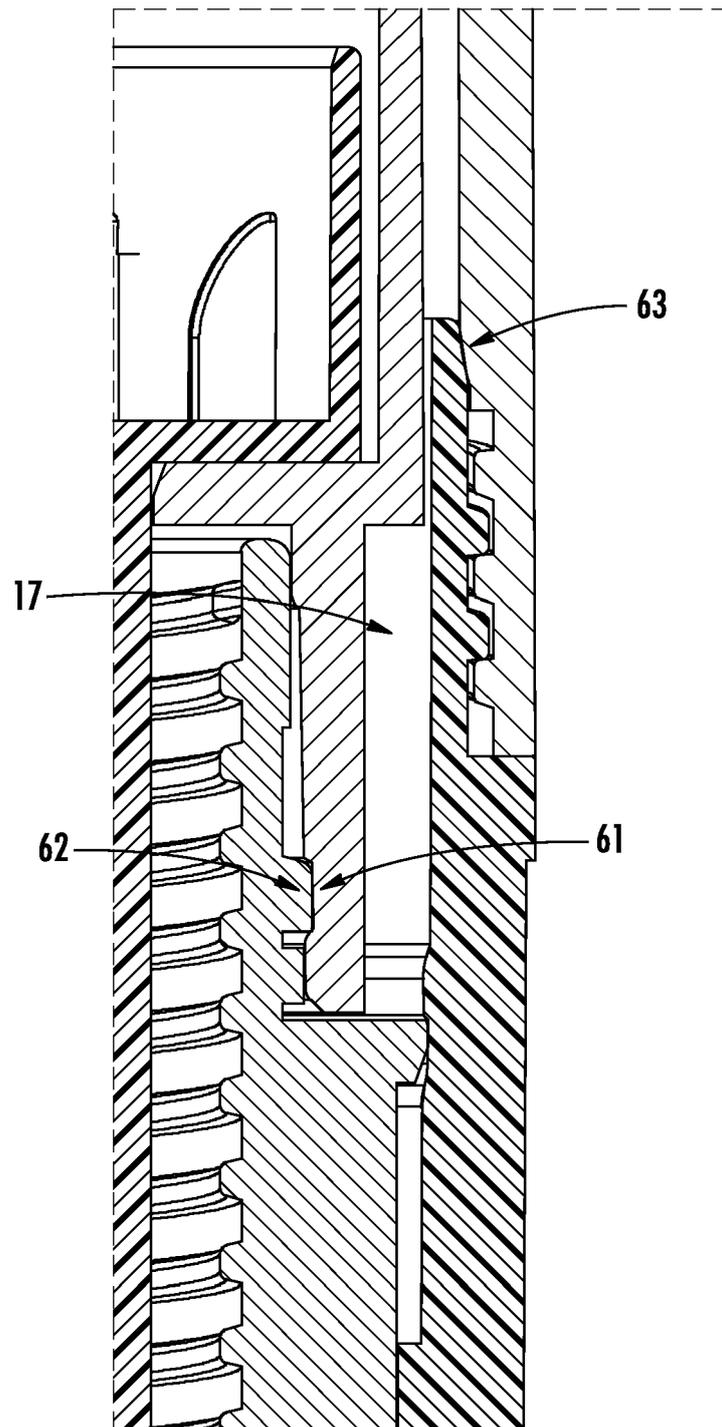




**FIG. 44**



**FIG. 45**



**FIG. 46**

FIG. 47

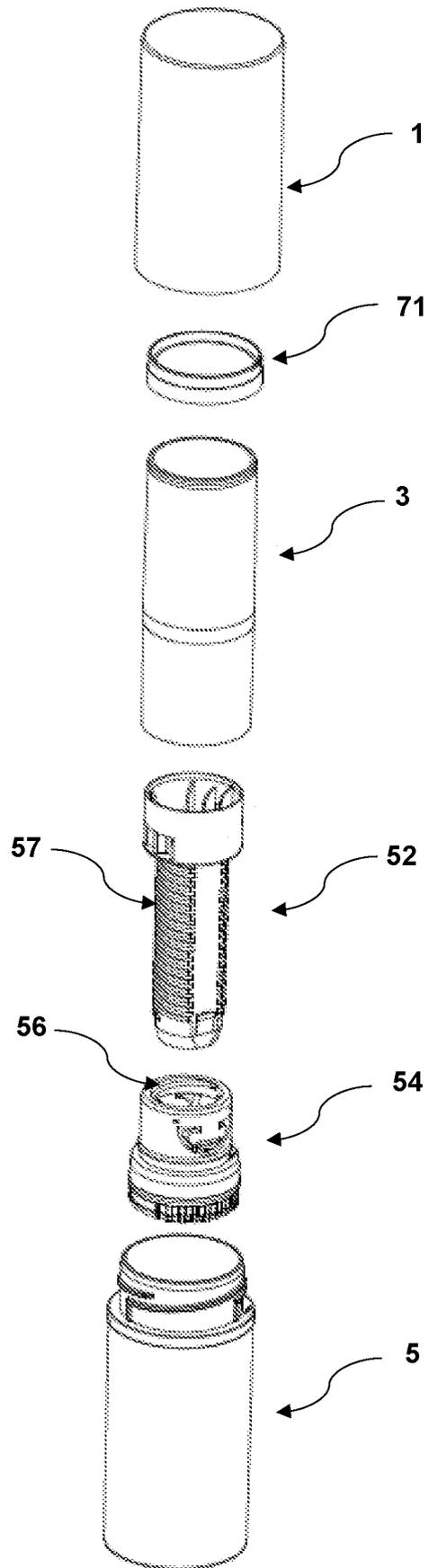


FIG. 48

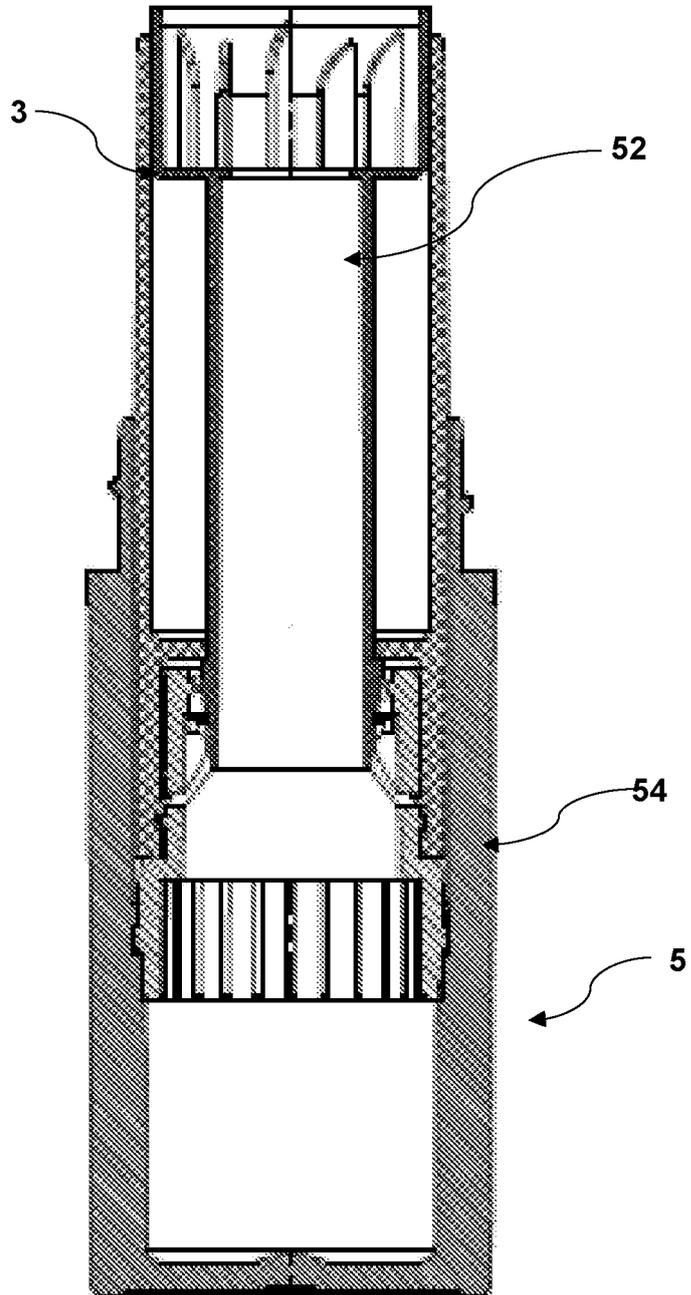


FIG. 49

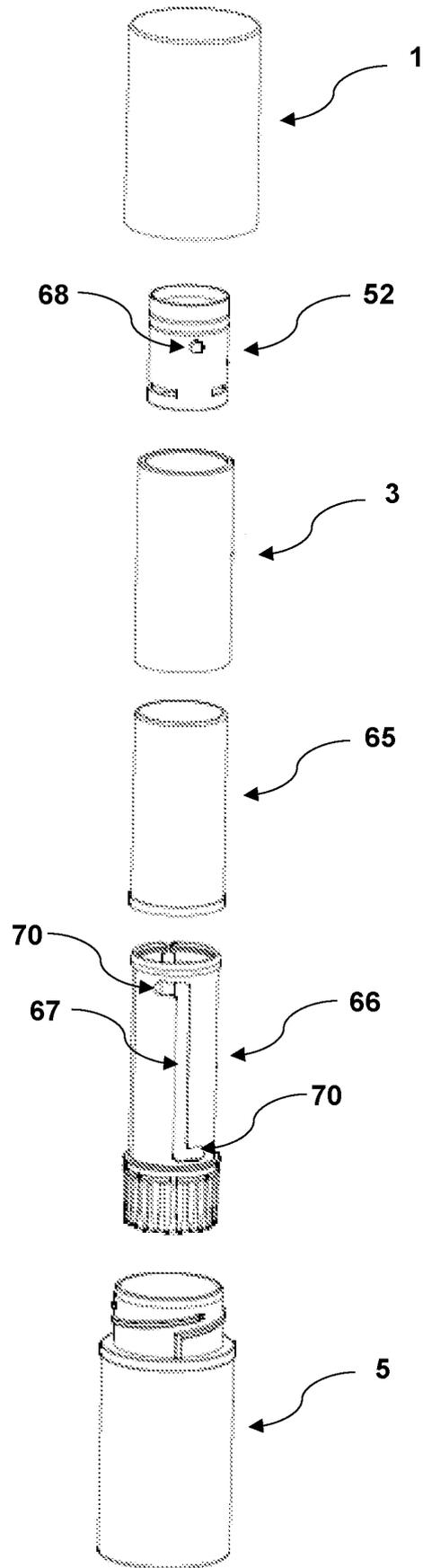
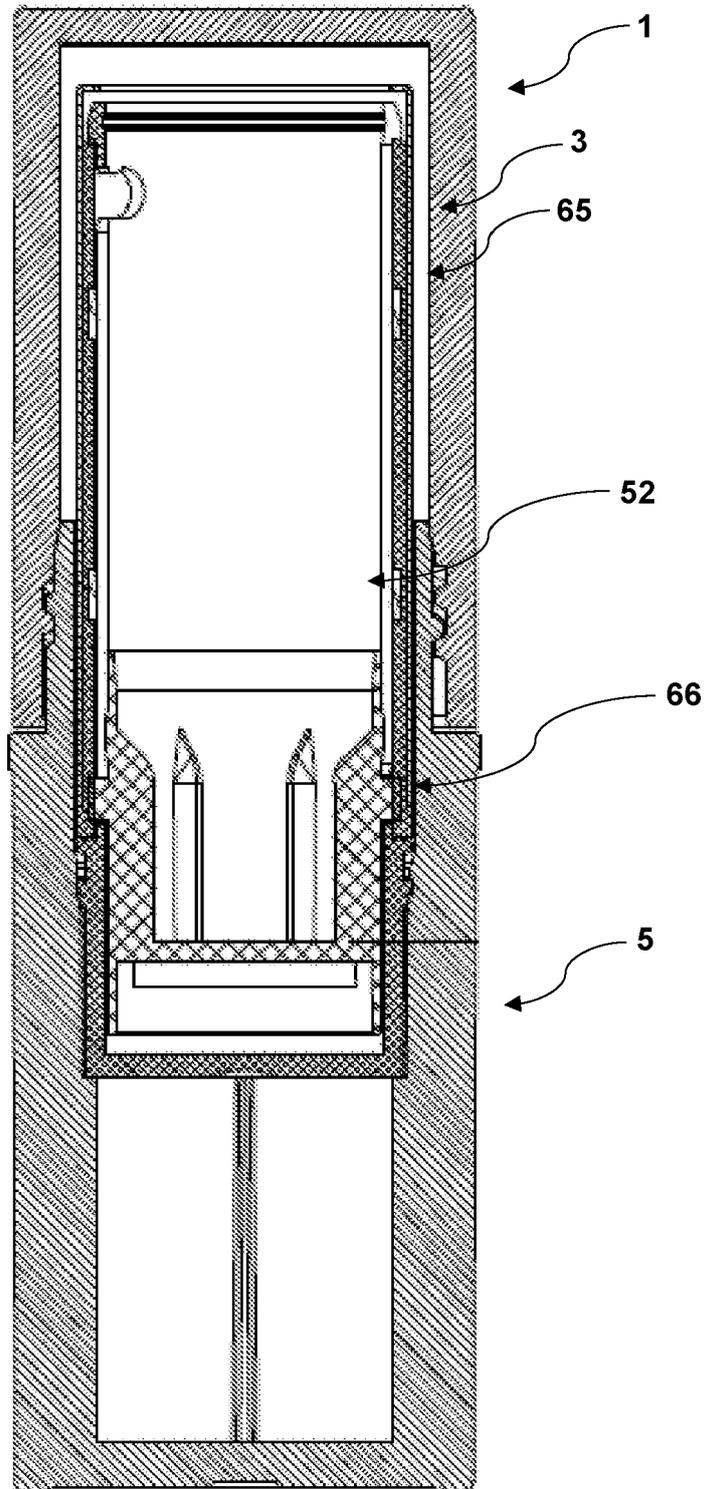
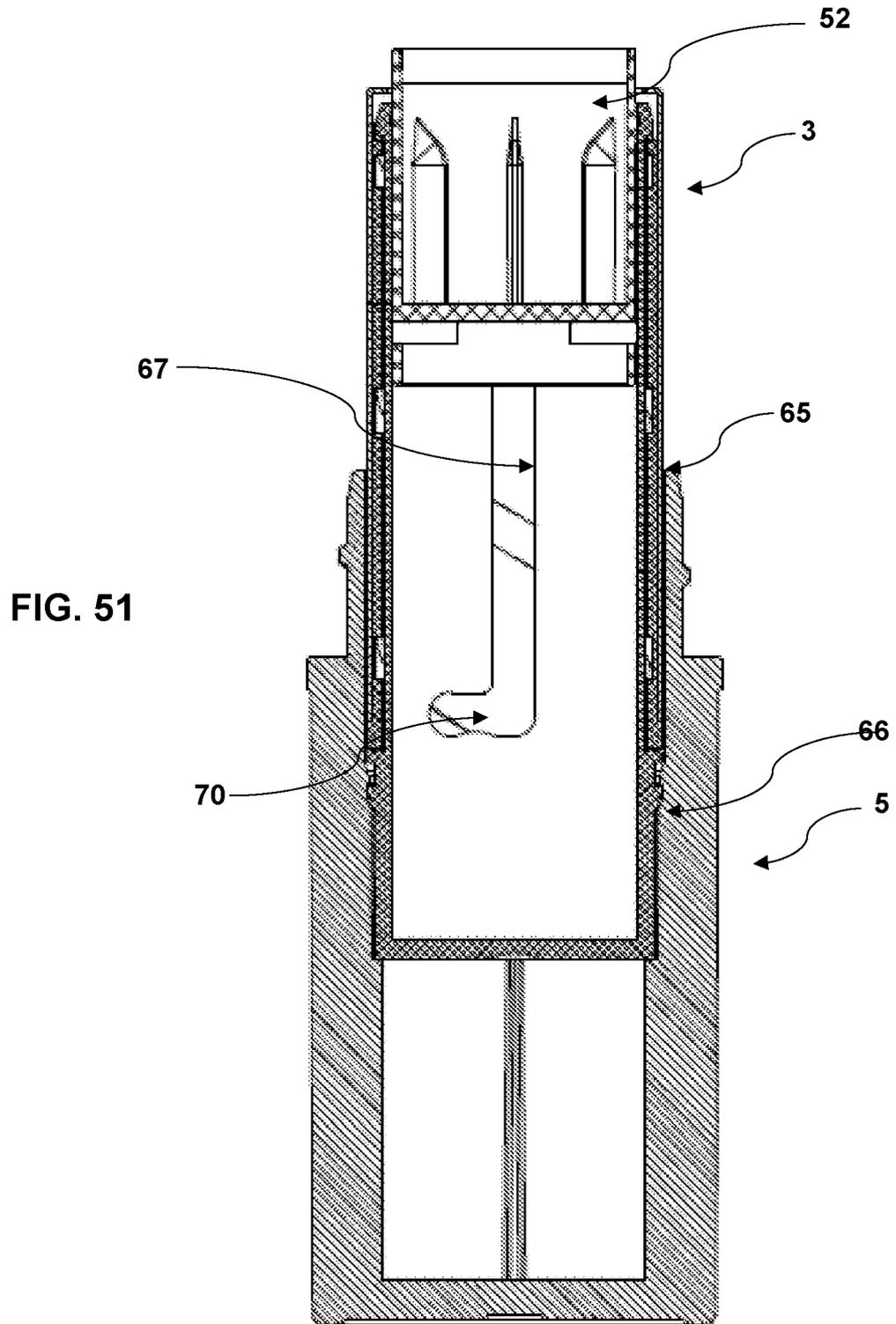


FIG. 50





**REFERENCES CITED IN THE DESCRIPTION**

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