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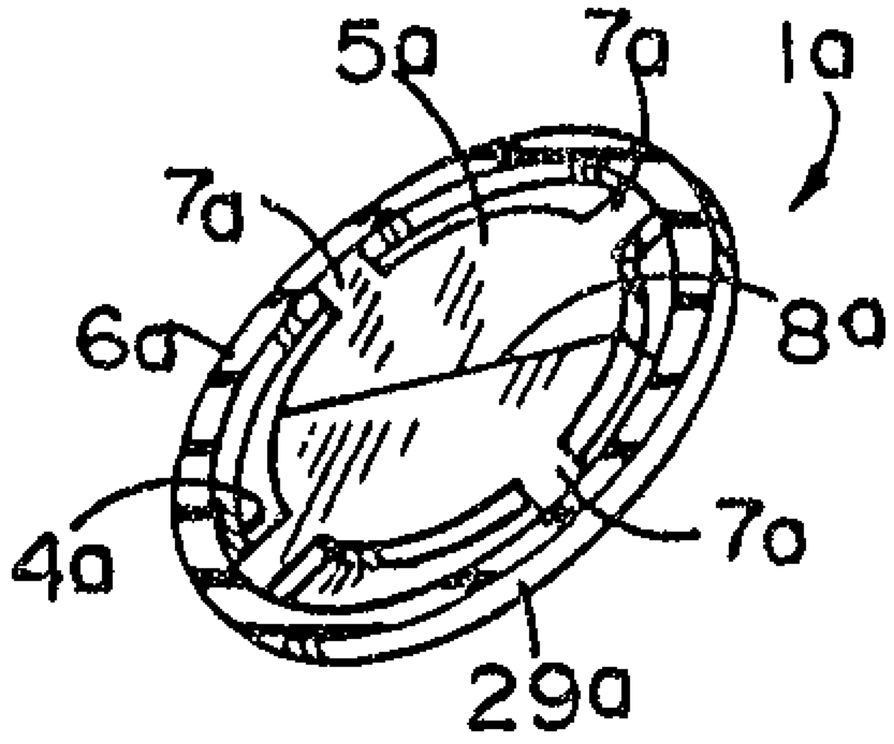

(57) Abrégé/Abstract:
A dispensing package is provided for fluid products, such as liquids, pastes, powders and the like. The package comprises a container in which the product is packaged, and a self-sealing dispensing valve which automatically opens and closes in response to the application and removal of a predetermined threshold pressure. A removable closure may be provided to cover the dispensing valve and prevent inadvertent discharge of the product during transport, storage and other similar conditions.

DISPENSING PACKAGE FOR FLUID PRODUCTS AND THE LIKE

ABSTRACT OF THE DISCLOSURE

A dispensing package is provided for fluid products, such as liquids, pastes, powders and the like. The package comprises a container in which the product is packaged, and a self-sealing dispensing valve which automatically opens and closes in response to the application and removal of a predetermined threshold pressure. A removable closure may be provided to cover the dispensing valve and prevent inadvertent discharge of the product during transport, storage and other similar conditions.

DISPENSING PACKAGE FOR FLUID PRODUCTS AND THE LIKE

BACKGROUND OF THE INVENTION

The present invention relates to product packaging, and in particular to a dispensing package for fluid products, and the like.

Many different types of packages or containers are presently available for storing non-solid products of the type which are capable of flowing, such as fluid or fluidized materials, including liquids, pastes, powders, and the like, which substances are collectively and generically referred to herein as "fluids." Some such packages include a dispenser which permits a selected amount of fluid to be discharged from the package, and then reseals to close the package.

Self-sealing dispensing valves have been used in packaging for certain types of products, such as the container disclosed in U.S. Patent No. 4,728,006 to Drobish et al., which is designed for shampoos, conditioners, and the like. However, such valves can experience sealing problems, and inconsistent dispensing flow rates, particularly when the packages are exposed to significant temperature variations. For instance, in most portions of North America, the ambient temperature varies greatly throughout the year, which results in some degree of temperature changes inside even air-conditioned buildings, particularly between nighttime and daytime. For packages designed for use in special places, such as a household shower or bath, the temperature in the room can shift quite drastically during use. Dispensing packages used in such environments experience difficulty in maintaining consistent flow and sealing characteristics.

Furthermore, valves constructed from most conventional plastic materials cannot be used in certain types of packages, since they either react with or adulterate the product. For instance, in food packaging, care must be taken to avoid valve materials which contain any type of toxins. Furthermore, active ingredients in products can cause the valve to either embrittle or soften, thereby ruining the designed flow rate and/or self-sealing characteristics of the valve.

Another drawback generally associated with prior art dispensing valves is their inability to consistently permit a preselected amount of air to be drawn or sucked back into the container after dispensing, while at the same time, maintaining a tight, secure seal that will prevent leakage even when the container is hung in an inverted orientation. When using containers of the type that have resiliently flexible sidewalls, the lack of sufficient air sucked back through the valve causes the container walls to at least partially collapse, thereby making further dispensing more difficult, and typically preventing, or at least greatly frustrating the user from getting all of the fluid out of the container.

SUMMARY OF THE INVENTION

The present invention provides a dispensing package with a self-sealing valve which securely seals upon the removal of a predetermined threshold pressure, so as to prevent the fluid product from drying out, losing flavor, or otherwise changing the product's original characteristics by virtue of exposure to ambient air. The self-sealing dispensing valve accurately controls the flow rate of product out of the container, so

as to consistently dispense a predetermined amount of product at each use, throughout the life of the package. Preferably, the dispensing valve is constructed from a liquid silicone rubber, which is completely inert, and will not react with or adulterate the product. The opening and closing characteristics of the valve remain unaltered even when the package is exposed to substantial temperature fluctuations. The non-stick nature of the liquid silicone rubber valve prevents the valve from fouling, and assists in cleaning excess product from the same. A unique groove and rib arrangement selectively supports slit orifice portions of the valve in a trampoline-like fashion to insure proper suck back of the air into the container after dispensing, while at the same time providing a secure, leak resistant seal. The valve is efficient in use, economical to manufacture, capable of a long operating life, and particularly well adapted for the proposed uses.

These and other advantages of the invention will be further understood and appreciated by those skilled in the art by reference to the following written specification, claims and appended drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is an exploded, vertical cross-sectional view of a dispensing package embodying the present invention, including a container, a self-sealing dispensing valve, and a closure.

Fig. 2 is a vertical cross-sectional view of the dispensing package illustrated in Fig. 1, wherein the valve is positioned on a lip of the container, and the closure is disassembled.

Fig. 3 is a vertical cross-sectional view of the dispensing package illustrated in Fig. 2, wherein a collar portion of the container has been crimped about a flange portion of the valve to securely mount the valve therein, and the closure is disassembled.

Fig. 4 is a vertical cross-sectional view of the dispensing package illustrated in Fig. 3, with the closure attached to the valve.

Fig. 5 is a fragmentary front elevational view of another embodiment of the present invention, particularly showing a dispensing valve mounted in a bottom portion of the container.

Fig. 6 is an elevational view of another embodiment of the present invention, particularly showing a tube type dispensing package with one end open to fill the tube.

Fig. 7 is an elevational view of the dispensing package illustrated in Fig. 6, wherein the tube has been filled with fluid product through the open end, and the open end has been closed.

Fig. 8 is an exploded vertical cross-sectional view of another embodiment of the present invention, particularly showing a self-sealing dispensing valve crimped into a removable cap.

Fig. 9 is an exploded vertical cross-sectional view of another embodiment of the present invention, comprising a container, a self-sealing dispensing valve, a snap-on retainer ring, and a closure cap.

Fig. 10 is a vertical cross-sectional view of the dispensing package illustrated in Fig. 9, wherein the valve

has been set in place on an upper lip portion of the container.

Fig. 11 is a vertical cross-sectional view of the dispensing package illustrated in Fig. 10, wherein the snap-on retainer ring has been positioned over the valve, but not yet snapped in place.

Fig. 12 is a vertical cross-sectional view of the dispensing package illustrated in Fig. 11, wherein the snap-on retainer ring has been snapped in place on the container, so as to compress a flange portion of the valve therebetween.

Fig. 13 is a vertical cross-sectional view of the dispensing package illustrated in Fig. 12, wherein the closure cap has been snapped in place over the valve.

Fig. 14 is a top plan view of an alternate self-sealing dispensing valve embodying the present invention.

Fig. 15 is a longitudinal cross-sectional view of the the dispensing valve illustrated in Fig. 14, taken along the line XIV-XIX of Fig. 14.

Fig. 16 is a bottom plan view of the dispensing valve illustrated in Fig. 14.

Fig. 17 is a vertical cross-sectional view of another embodiment of the present invention, comprising a container with a pop-up self-sealing dispensing valve crimped therein, shown in an extended operational position, with a closure shown in a disassembled condition.

Fig. 18 is a vertical cross-sectional view of the dispensing package illustrated in Fig. 17, wherein the dispensing valve is shown in a retracted closed position, with the closure disassembled.

Fig. 19 is a vertical cross-sectional view of the dispensing package illustrated in Fig. 18, with the closure assembled on the valve and the container to positively retain the dispensing valve in the retracted closed position.

Fig. 20 is a vertical cross-sectional view of an alternate pop-up self-sealing valve design embodying the present invention.

Fig. 21 is a vertical cross-sectional view of the valve illustrated in Fig. 20, shown in a retracted position and with a shrink wrap closure thereon.

Fig. 1A is an exploded, vertical cross-sectional view of a dispensing package embodying the present invention, including a container, a self-sealing dispensing valve, and a closure.

Fig. 2A is a vertical cross-sectional view of the dispensing package illustrated in Fig. 1A, shown in a fully assembled condition, and with the closure attached for storage.

Fig. 3A is a perspective view of the valve, with a flange portion thereof broken away.

Fig. 4A is an enlarged bottom plan view of the valve.

Fig. 5A is an enlarged top plan view of the valve.

Fig. 6A is a cross-sectional view of the valve, taken along the line VI-VI of Fig. 4A.

Fig. 7A is a cross-sectional view of the valve, taken along the line VII-VII of Fig. 4A.

Fig. 8A is a cross-sectional view of the valve, taken along the line VIII-VIII of Fig. 5A.

Fig. 9A is a partially diagrammatic view of the dispensing package, shown in an inverted condition with the valve orifice in a closed position.

Fig. 10A is an enlarged cross-sectional view of the valve shown in the closed position assumed when the package is in the condition illustrated in Fig. 9A.

Fig. 11A is a partially diagrammatic view of the dispensing package shown in Fig. 9A, but with the sidewalls flexed inwardly to compress the package and dispense fluid product through the valve shifted into an outwardly open position.

Fig. 12A is an enlarged cross-sectional view of the valve shown in the outwardly open position, assumed when the package is in the condition illustrated in Fig. 11A.

Fig. 13A is a partially diagrammatic view of the dispensing package illustrated in Figs. 9A and 11A, but with the dispensing pressure released, so that the sidewalls return to their original position, and thereby shift the valve into the inwardly open position to draw air back into the container.

Fig. 14A is an enlarged cross-sectional view of the valve shown in the inwardly open position assumed when the package is in the condition illustrated in Fig. 12A.

Fig. 15A is a lateral cross-sectional view of a second embodiment of the valve.

Fig. 16A is a lateral cross-sectional view of a third embodiment of the valve.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

For purposes of description herein, the terms "upper," "lower," "right," "left," "rear," "front," "vertical," "horizontal," and derivatives thereof shall

relate to the invention as oriented in the referenced figures. However, it is to be understood that the invention may assume various alternative orientations, except where expressly specified to the contrary. It is also to be understood that the specific devices and processes illustrated in the attached drawings, and described in the following specification are simply exemplary embodiments of the inventive concepts defined in the appended claims. Hence, specific dimensions and other physical characteristics relating to the embodiments disclosed herein, are not to be considered as limiting, unless the claims expressly state otherwise.

The reference numeral 1 (Fig. 1) generally designates a dispensing package embodying the present invention. The illustrated dispensing package 1 comprises a container 2, a self-sealing dispensing valve 3, and a closure 4.

Container 2 may assume a wide variety of different shapes, sizes and constructions to accommodate various products. One particularly popular application of the present invention relates to the packaging of consumer products, such as foodstuffs, school and art supplies, toilet articles, household lubricants and other similar classes of goods. For example, fluid food items such as cooking oils, salad dressings, catsup, mustard and the like, can be advantageously packaged in the present invention. School and art supplies, such as paints, pastes, etc., as well as toilet articles, such as toothpaste, skin creams and powders, shampoos, conditioners, etc., are also popular items which can be packaged for convenience in the present invention. It is to be understood that the present

invention also contemplates use with many other types of consumer products, as well as commercial, industrial and institutional applications.

In all such cases, container 2 will be shaped, sized and constructed in accordance with the particular characteristics of the product involved. In the example shown in Figs. 1-4, container 2 has a sidewall 7 with a conically shaped top wall 8, and a cylindrically shaped neck 9. In this example, container 2 is integrally molded from a suitable plastic material, so as to form a unitary one-piece structure. The interior of neck 9 is hollow to define discharge opening 10, and the sidewall 7 is preferably elastically deformable or flexible, so that liquid material within container 2 is forced through the discharge opening 10 of neck 9 by flexing the same inwardly. The upper portion of neck 9 includes an annularly shaped recess that defines a marginal lip 13, and a crimpable collar 14 which is upstanding from lip 13.

It is to be understood that while at least some of the various containers 2 disclosed herein employ flexible sidewalls 7 to generate the "threshold pressure" (as discussed below) in the container, other means of pressure generation are also contemplated by the present invention. For example, a plunger or cylinder (not shown) may be mounted in the container 2 to pressurize the interior of the container 2. Alternatively, an outside source of fluid pressure (not shown) may be selectively communicated with the interior of the container 2. In all such cases, it is the application and removal of such pressure at the level of the designed threshold pressure of a particular dispensing

package which causes the associated self-sealing valve to automatically open and close.

The self-sealing dispensing valve 3 illustrated in Figs. 1-5 is generally frustoconical in shape, and includes a flat top wall 17, a conical sidewall 18, and an annularly shaped, radially extending flange 19. The top wall 17 of dispensing valve 3 includes a slit or aperture 20 therethrough which defines an orifice through which the product in container 2 is dispensed. The flange 19 of dispensing valve 3 is resiliently deformable between opposite faces 21 and 22 to facilitate sealingly mounting the same in the neck 9 of container 2 in the various manners described in greater detail hereinafter.

The shape and size of dispensing orifice 20 in conjunction with the thickness and configuration of the adjacent valve walls may be varied in accordance with the viscosity and other physical characteristics of the product being dispensed, as well as the desired flow rate, flow pattern, threshold pressure, sealing pressure, and designed orientation of the container. The term "threshold pressure" as used herein refers to that pressure in the fluid product which will cause the dispensing orifice 20 to shift from the closed position to the open position. In the case of containers with flexible sidewalls that are deformed to create and/or exert the threshold pressure, the force necessary to achieve the same will depend upon the shape, size and rigidity of the container.

All such factors are balanced and adjusted to achieve the correct dispensing orifice 20. For example, in consumer product applications, such as toothpaste and the like, it is important to obtain the desired flow rate and

pattern, without requiring that excessive pressure be applied to the container 2, and without sacrificing the self-sealing closing action of the valve 3. In some applications, the containers 2 are oriented such that the dispensing valve 3 is subjected to a constant hydraulic head, such that the positive valve closure is essential to prevent leakage. In such applications the discharge orifice 20 is preferably configured such that the designed threshold pressure is greater than the maximum hydraulic head pressure of the fluid product in the container 2 when the discharge orifice 20 is oriented downwardly.

The illustrated dispensing valve 3 is integrally molded from an inert, non-toxic plastic material, so as to provide a unitary, one-piece construction. In the preferred embodiments of the present invention, dispensing valve 3 is molded from a liquid silicone rubber, such as the material marketed under the trademark "SILASTIC" by Dow Corning Corporation, the characteristics of which are disclosed in the cited brochure entitled "Silastic LSR - A Guide To Product Performance." With liquid silicone rubber, the walls 17-19 of dispensing valve 3 are flexible, and their physical and/or chemical characteristics do not alter substantially in response to ambient changes, such as temperature fluctuations, or exposure to active ingredients in products. Hence, the designed material flow rate and sealing pressure of any particular self-sealing dispensing valve 3 will remain relatively constant. Furthermore, since liquid silicone rubber is inert and non-toxic, dispensing valve 3 is particularly well adapted for use in conjunction with the packaging and dispensing of food products, including cooking oil, catsup, mustard, and other edible

products that are sold in fluid form. As a result of the inert nature of liquid silicone rubber, dispensing valve 3 will not react with product in container 2 so as to adulterate or otherwise contaminate the product. Dispensing valves 3 constructed from liquid silicone rubber can be easily deformed without taking a set, and can be flexed repeatedly without embrittling or cracking.

Although liquid silicone rubber possesses many attributes for use in conjunction with self-sealing dispensing valves 3, it also has certain other characteristics which render such applications problematic. For example, the surfaces of liquid silicone rubber parts are extremely tacky or sticky, having a very high coefficient of friction. As a result, in attempting to attach a dispensing valve 3 to a container 2 by a conventional threaded collar arrangement, the surfaces of the valve flange 19 will stick tightly to the adjacent surfaces of the container 2 and collar before the collar is tightened securely enough to create a leak resistant seal. Further tightening of the collar will cause the valve flange 19, as well as the entire valve 3, to distort from its designed shape, thereby preventing the formation of a secure seal, and/or ruining the intended dispensing and sealing characteristics of the valve.

Another drawback associated with the use of liquid silicone rubber in dispensing valves is that there is presently no available adhesive capable of connecting the valve 3 to the container 2 in a manner that will withstand the operating pressures to which the valve 3 and container 2 are repeatedly subjected. The unique imperforate nature of the surfaces of the liquid silicone rubber valves 3

precludes the use of conventional adhesives. Hence, the attachment of the liquid silicone rubber valve 3 to the container 2 in a manner that will not leak, and will withstand repeated pressurization and depressurization of the dispensing package is an important aspect of the present invention, as discussed in detail below.

A unique method for mounting dispensing valve 3 in closure 4 is illustrated in Figs. 1-4, and comprises placing dispensing valve 3 on the lip 13 of container 2, as shown in Fig. 2. The collar 14 of container neck 9 is then inelastically deformed in a radially inward direction to envelop the flange 19 of dispensing valve 3, as shown in Fig. 3. That portion of collar 14 which is deformed inwardly defines a rim 27, which is forced downwardly toward container lip 13, thereby compressing the flange 19 of dispensing valve 13 between surfaces 13 and 27, and forming a leak resistant seal therebetween.

In one embodiment of the present invention, container collar 14 is constructed from a thermoplastic material. The crimping operation comprises heating the outer portion of collar 14 to a pliable state, inelastically deforming rim 27 inwardly over valve flange 19, pressing rim 27 against valve flange 19 and container lip 13 to compress valve flange 19 therebetween, and cooling rim 27 while maintaining flange compression until rim 27 returns to a state of sufficient rigidity that the compression of valve flange 19 is permanently maintained. The crimping action of rim 27 serves to securely mount dispensing valve 3 in container 2, while at the same time forming a leak resistant seal by virtue of compressing the faces 21 and 22 of valve flange 19.

It is to be understood that dispensing valve 3 may be mounted in container 2, or a removable valve retainer such as that illustrated in Fig. 8, by other types of related crimping techniques. The term "crimping" as used herein refers broadly to the generic concept of forming collar 14 over and on top of valve flange 19 to create retainer rim 27, and compressing valve flange 19 between container lip 13 and rim 27 in a fashion which permanently retains flange compression to securely mount dispensing valve 3, and simultaneously form a leak resistant seal. For instance, container collar 14 could be constructed from metal, and the rim 27 crimped over valve flange 19 by pressing, stamping, peening, or other similar metal forming processes. Other materials, such as natural silicate compounds, and the like, and their related forming techniques, are also contemplated by the present invention.

Another embodiment of the present invention is illustrated in Fig. 5, and defines a dispensing package 30 comprising a container 31 and a self-sealing dispensing valve 32. Except as to dispensing valve 32, container 31 has a substantially conventional construction, comprising flexible sidewalls 33, and a neck 34 with a standard, non-self-sealing dispensing valve 35. The bottom 36 of container 31 includes a unique recess 37 with a discharge opening 38 therein. The dispensing valve 32 is substantially identical to the previously described dispensing valve 3, and is mounted below discharge opening 38 by a lip 39, a collar 40, and a rim 41, which may be crimped in accordance with the method described above. Dispensing valve 32 is located on the bottom 36 of container 31, such that a preselected amount of product 42 may be dispensed

from container 31 by simply positioning container 31 over the position at which dispensing is desired, and squeezing the sidewall 33 of container 31. Hence, container 31 need not be inverted each time product is to be dispensed from the package through dispensing valve 32.

Another embodiment of the present invention is illustrated in Figs. 6 and 7, and defines a dispensing package 44, comprising a tube shaped container 45, and a self-sealing dispensing valve 46. Container 45 comprises a tube shaped body having flexible sidewalls 47, and is in the nature of those conventional containers in which toothpaste and other similar products are presently packaged. Dispensing valve 46 is mounted in the frustoconical end 48 of tube 45, and is substantially identical in construction to the dispensing valve illustrated in Figs. 35-36, and is discussed in detail below. The opposite end 48 of tube 45 is initially open, as shown in Fig. 6, so as to permit tube 45 to be filled with product through that end. After tube 45 is filled with product, end 49 is folded over and sealed in the manner illustrated in Fig. 7. Dispensing valve 46 may therefore be integrally mounted in tube 45 by means such as the above-described crimping process, before the product is packaged in tube 45.

Another embodiment of the present invention is illustrated in Fig. 8, and defines a dispensing package 52, comprising a container 53, a self-sealing dispensing valve 54, a valve retainer 55, and a closure 56. The illustrated container 53 has a conventional construction with flexible sidewalls 57, and a threaded neck 58. Valve retainer 55 comprises a generally cylindrically shaped collar 59 having interior threads 60 in the lower end thereof which mate with

the threaded neck 58 of container 53. The upper end of valve retainer 55 includes a discharge opening 61, a lip 62, an upstanding collar 63 and a rim 64 which are configured generally similar to the corresponding parts 10, 13, 14 and 27 of dispensing package 1. Dispensing valve 54 is substantially identical to previously described dispensing valve 3 (Figs. 1-4), and is crimped in place in valve retainer 55 in the manner described above. Closure 56 is substantially identical to previously described closure 4, and is attached to dispensing valve 54 in a similar manner. Dispensing package 52 permits container 53 to be filled and refilled through the neck 58 by simply removing and replacing valve retainer 55.

Another embodiment of the present invention is illustrated in Figs. 9-13, and defines a dispensing package 68, comprising a container 69, a self-sealing dispensing valve 70, a valve retainer 71 and a closure 72. Container 69 includes a flexible sidewall 74, a conically shaped top wall 75, and a neck 76 with an uppermost, annularly shaped rim or lip 77. A snap-lock member 78 is formed on the exterior surface of container neck 76, and in the illustrated example is in the form of a frustoconical ring, having an inclined leading edge 79 and a right angled barb or edge 80.

Valve retainer 71 is in the shape of a collar, and comprises a cylindrical sidewall 82, a partial top wall 83 with an opening 84 therein, and an interior snap-lock 85 which, in the illustrated example, is in the form of a radially inwardly protruding, annularly shaped ring. The interior surface of valve retainer top wall 83 defines a rim 86 which abuts dispensing valve 70 in the manner described

below. The exterior surface of valve retainer sidewall 82 includes a groove 87 to facilitate attachment of closure cap 72, as more clearly discussed hereinafter.

Dispensing valve 70 is substantially identical to previously described dispensing valve 3 (Figs. 1-4), and is positioned on the lip 77 of container 69 in the manner illustrated in Fig. 10. Valve retainer 71 is designed to securely attach dispensing valve 70 to container 69 without the application of torsion forces to the valve which will distort the shape of the same. Valve retainer 71 is positioned over dispensing valve 70 and the upper portion of container neck 76, in the manner illustrated in Fig. 11. Next, valve retainer 71 is converged linearly with container 69, such that the leading edge 79 of container snap-lock ring 78 expands valve retainer 71 slightly, so that snap-ring 85 on valve retainer 71 slides over mating container snap-ring 78 and abuts stop surface 80, thereby securely interconnecting the same, without any rotational motion. Snap-rings 78 and 85 are positioned so that when they are fully engaged, as shown in Fig. 12, the flange 86 of dispensing valve 70 is compressed between the lip 77 of container 69 and the rim 87 of valve retainer 71, thereby forming a leak resistant seal therebetween. Hence, although the surfaces of the liquid silicone rubber from which dispensing valve 70 is constructed are rather sticky or tacky, the lineal or in-line snapping action between valve retainer 71 and container 69 prevents the flange 86 of valve 72 from distorting, as would occur with a conventional type of twist lock action.

Closure 72 comprises a relatively hard cap which is formed from a conventional, transparent plastic material,

and includes an inwardly facing snap-ring 89 at its lower end which mates with the similarly shaped groove 87 in valve retainer 71 to interconnect the same with a snap action. The engagement between cap snap-ring 89 and valve retainer groove 87 forms a leak resistant seal. As best illustrated in Fig. 13, closure cap 72 is shaped so that when it is attached to valve retainer 71, the interior surface of the cap upper wall 90 abuts the top wall 91 of dispensing valve 70. This abutment tends to positively prevent the orifice 92 of dispensing valve 70 from opening.

Another dispensing valve 165 embodying the present invention is illustrated in Figs. 14-16, and comprises a sidewall 166, a top wall 167, and a flange 168. The sidewall 166 of valve 165 has a lower cylindrical portion 166a, and a frustoconically shaped upper portion 166b. The top wall 167 of valve 165 is substantially flat, and includes a pair of slits 169 and 170 which define an orifice which opens and closes in response to the application and removal of a predetermined threshold pressure. The frustoconical portion 116a of sidewall 116 selectively stiffens the valve to insure complete and timely closure of the orifice upon removal of the threshold pressure. Dispensing valve 165 is particularly adapted to dispense viscous fluids such as toothpaste, and the like.

Another embodiment of the present invention is illustrated in Figs. 17-19, and defines a dispensing package 175, comprising a container 176, a self-sealing dispensing valve 177, and a closure 178. Container 176 is substantially identical to previously described container 2 (Figs. 1-4), and dispensing valve 177 is substantially identical to previously described dispensing valve 3 (Figs.

1-4). Dispensing valve 177 may be integrally crimped into container 176 in the manner previously described. Dispensing valve 177 has a conically shaped sidewall 179, and a substantially flat top wall 180 through which a single slit 181 is disposed to define an orifice that opens and closes in response to the application and removal of a predetermined threshold pressure. The valve sidewall 179 is elastically deformable or flexible for shifting between the extended operational position illustrated in Fig. 14, and the retracted storage position illustrated in Figs. 15 and 16. In the extended operational position (Fig. 17) the top wall 180 of valve 177 is extended, spaced outwardly apart from the rim 182 of container 176 a predetermined distance to permit slit 181 to open, and allow the fluid product to be dispensed from container 176. In the retracted storage position (Figs. 18 and 19) the top wall 180 of valve 177 is disposed generally flush with the rim 182 of container 176, and the sidewall 179 is doubled over or folded, which generates forces in the valve which tend to prevent the orifice slit 181 from inadvertently opening.

The closure 178 illustrated in Figs. 17-19 comprises an imperforate patch with a pressure sensitive adhesive 184 on the lower side thereof, somewhat similar to closure 4 (Figs. 1-4), except that it is larger in diameter. Closure 178 is designed to adhere to the top wall 180 of valve 177, and also to the rim 182 of container 176, so as to positively retain valve 177 in the retracted storage position.

Another embodiment of the present invention is illustrated in Figs. 20-21, and defines a dispensing package 188, comprising a container 189, a self-sealing dispensing

valve 190, and a closure 191. Container 189 is generally similar to previously described container 176, and retains dispensing valve 190 therein in a similarly crimped fashion. Dispensing valve 190 also has a pop-up type of construction similar to previously described dispensing valve 177 (Figs. 17-19), except that it has an arcuately shaped sidewall 192, with a flat top wall 193 that is somewhat larger than the top wall 180 of dispensing valve 177. A single slit 194 is formed through the top wall 193 of valve 190, and defines an orifice that opens and closes in response to the application and removal of a predetermined threshold pressure. In a manner similar to dispensing valve 177 (Figs. 17-19), dispensing valve 190 shifts between an extended operational position, as illustrated in Fig. 20, and a retracted storage position, as illustrated in Fig. 21. In the retracted storage position (Fig. 21), the folded over portions of the valve sidewall 192 generate forces which retain orifice slit 194 in the closed position.

The present invention also contemplates dispensing packages wherein the various containers, dispensing valves, valve retainers and closures illustrated herein may be arranged in alternative combinations, as would be apparent to those skilled in the art.

The reference numeral 1a (Fig. 1A) generally designates another self-sealing dispensing valve embodying the present invention. Valve 1a is particularly adapted for use in conjunction with fluid dispensing packages, and the like of the type which are compressed and decompressed to dispense liquids, pastes, powders, and other similar flowable materials or "fluids". One such dispensing package is the illustrated package 10a, which includes a container

2a, with a removable cap or closure 3a. Valve 1a has a marginal groove 4a (Fig. 3A) extending along one face thereof in a closed pattern to define a center area 5a inside groove 4a, and an outer area 6a outside groove 4a. Ribs 7a extend between the center area 5a and outer area 6a of valve 1a to bridge groove 4a, and selectively support the center valve area 6a in a fashion somewhat similar to or reminiscent of a trampoline. A slit 8a extends through the center valve area 5a, and preferably into at least a portion of groove 4a to form an orifice 9a (Fig. 14A) that shifts between outwardly open, closed and inwardly open positions (Figs. 9A-14A) in response to compressing and decompressing container 2a.

Container 2a may assume a wide variety of different shapes, sizes, and constructions to accommodate various fluid products. In the example illustrated in Fig. 1A, container 2a has a cylindrically shaped sidewall 15a, a circular bottom 16a, and a tapered top portion 17a with a cylindrically shaped neck 18a. The upper portion of container neck 18a includes an annularly shaped recess 20a that defines a marginal lip 21a, and a crimpable collar 22a which is upstanding from lip 21a for purposes of attaching valve 1a, as discussed below.

The self-sealing dispensing valve 1a illustrated in Figs. 1A-14A is generally hat-shaped, and includes a flat, circular top wall 28a, a cylindrical side wall 29a, and an annularly shaped, radially extending flange 30a. The flange 30a of self-sealing valve 1a is resiliently deformable between opposite faces 31a and 32a to facilitate sealingly mounting the same in the neck 18a of container 2a

in one of a variety of different manners, as disclosed in the related application noted here-in-above.

As best shown in Figs. 1A-2A, the illustrated valve 1 is mounted in container 2a by positioning valve 1 on the lip 21 of container 2. The collar 22 of container neck 18 is then inelastically deformed or crimped in a radially inwardly direction in the manner described hereinabove. The illustrated valve 1a is also integrally molded from liquid silicone rubber.

In the illustrated example, valve 1a has a unique trampoline-like construction which permits air to be sucked back into the container 2a after dispensing, yet maintains a secure type seal when closed. As best illustrated in Figs. 3A-8A, the top wall 28a of valve 1a has a substantially flat or planar outerface 40a while the innerface 41a has a unique, trampoline-like configuration. The trampoline-like valve configuration is defined by the groove 4a which extends along the innerface 41a of valve top wall 28a in a closed pattern to define the center and outer areas 5a and 6a respectively of valve 1a. In the illustrated example, groove 4a has an annular plan configuration, as defined by circular sidewalls 42a and 43a, and top wall 44a. The center valve area 5a is a flat disc-shaped pad, with ribs 7a extending radially therefrom to bridge groove 4a. In one working embodiment of the present invention, the width of groove 4a, as defined by the distance between sidewalls 42a and 43a, is in the range of 1 to 3 times the thickness of center valve area 5a. In this same example, the depth of groove 4a, as defined by the distance between outer valve face 40a and top groove wall 44a, is in the range of 1/4 - 3/4 of the thickness of center valve area 5a.

In the illustrated example, slit 8a extends substantially continuously along center valve area 5a at a medial portion thereof. Slit 8a is preferably formed through top valve wall 28a by simply slicing top wall 28a or otherwise severing the material of top wall 28a without removing any material therefrom, such that the mating slit edges 47a and 48a closely abut one another when valve 1a is in the closed position. In the illustrated example, slit 8a is straight or linear, with the opposite ends 49a and 50a of slit 8a positioned in the middle of groove 4a, at diametrically opposite portions thereof. The extension of slit 8a into the opposite areas of groove 4a contributes to the unique flexing action achieved by valve 1a.

Each of the illustrated valves 1a (Figs. 3A-8A) includes four ribs 7a which extend between the center and outer areas 5a and 6a of valve 1a, and are spaced equadistantly about groove 4a. The illustrated ribs 7a are oriented in a non-aligned, yet symmetrical fashion with respect to slit 8a, such that slit 8a bisects center valve area 5a at an angle of approximately 45 degrees from the next adjacent pair of ribs 7a. In the illustrated example, ribs 7a each have a generally square plan configuration, with a thickness substantially equal to the center valve area 5a. The additional thickness of ribs 7a selectively stiffens the center valve area 5a in a trampoline-like manner to facilitate shifting valve orifice 9a between the outwardly open, closed and inwardly open positions. In the example illustrated in Figs. 1A-13A, the outer sidewall 43a of groove 4a is positioned coincident with the interior surface of valve sidewall 29a, which positioning also

contributes to the selective opening and closing of valve orifice 9a.

From an operational viewpoint, ribs 7a selectively resiliently support the center pad area 5a of valve 1a, and contribute to controlling the flexure of the same, as well as associated orifice 9a, when container 2a is shifted between the compressed and decompressed conditions. Ribs 7a also assist in the molding of valve 1a by providing air gates or vents within the mold which insure complete filling of the mold cavity.

Similar to the other valve embodiments of the present invention, the size and shape of valve orifice 9a, in conjunction with the thickness and configuration of the adjacent valve walls, may be varied in accordance with the viscosity, and other physical characteristics of the product being dispensed, as well as the desired flow rate, flow pattern, threshold pressure, sealing pressure, and designed orientation of the container. Valve orifice 9a is also configured such that the designed threshold pressure is greater than the maximum hydraulic head pressure of the fluid product in the container 2a when container 2a is inverted with orifice 9a oriented downwardly.

With container 2a oriented in the inverted orientation illustrated in Figs. 8A-13A, valve 1a operates in the following manner. When container 2a is fully decompressed or unpressurized, as illustrated in Figs. 9A and 10A, orifice 9a is closed, and the top wall 28a of valve 1a assumes a generally planar or flat orientation, as shown in Figs. 1A-8A. If container 2a retains a slight vacuum, as may sometimes be experienced, particularly in dispensing viscous liquids, the top wall 28a of valve 1a may assume a

slightly convex orientation, as shown in Figs. 9a & 10a. Ribs 7a serve to selectively stiffen the center valve area 5a, and retain orifice 9a securely closed against the hydraulic pressure generated by the fluid product 55a in container 2a.

To dispense product 55a from container 1a, the user simply flexes the opposite sidewalls 15a of container 2a inwardly in the manner illustrated in Fig. 10A. This flexing action compresses the air trapped above the free surface 56a of fluid product 55a and forces the fluid product 55a out through the orifice 9a, which is thereby simultaneously shifted into the outwardly open position illustrated in Fig. 12A. When orifice 9a is in the outwardly open position, the center valve area 5a bulges slightly outwardly in an arcuate manner, and the mating edges 47a and 48a of orifice 9a are separated into a double-convex configuration; as illustrated in Fig. 5A, and permit fluid product 55a to flow therebetween. Valve groove 4a permits each half of the center valve area 5a to flex from the thinned area of top wall 28a above groove 4a to achieve the desired flow rate and pattern.

To cease dispensing, the user simply removes the force or pressure applied to the sidewall 15a of container 2a in the manner illustrated in Fig. 13A, such that the resiliency of the sidewall 15a tends to return them to their original shape. When the force on container 2a is thusly removed, the air above the free surface 56a of fluid product 55a is decompressed to a level below atmospheric, thereby shifting the valve orifice 9a from the outwardly open position illustrated in Figs. 11A & 12A through the closed position, into the inwardly open position illustrated in

Figs. 13A & 14A. The mating edges 47a and 48a of orifice 9a are again drawn into a double-convex configuration, somewhat similar to the outwardly open position shown in Fig. 5a and the center valve area 5a bulges slightly inwardly in an arcuate manner. Air 57a (Fig. 13A) is then drawn through orifice 9a into container 2a to substantially equalize the pressure within container 2a, and thereby return orifice 9a to the closed position illustrated in Figs. 9a & 10a. The groove 4a and ribs 7a on the innerface 41a of valve 1a permit sufficient inward flexure of the two halves of center valve area 5a to draw air back into the container 2a, yet securely reseal orifice 9a as the pressure within container 2a reaches equality with ambient pressure.

To facilitate storage and transport, closure 3a has a threaded interior, and is attached to the threaded neck portion of container 2a. As best illustrated in Fig. 2A, closure 3a is configured so that its interior surface 58a is substantially flush with the outer face 40a of valve 1a when fully secured, thereby preventing orifice 9a from being shifted into the outwardly open position.

The various dispensing packages disclosed herein are adaptable for all types of fluid products, including liquids, pastes, powders, and the like. The specific flow rate and sealing pressure desired for any particular dispensing package can be easily adjusted in accordance with the viscosity and other physical characteristics of the fluid product being dispensed. The preferred liquid silicone rubber valve provides accurate and reliable dispensing of the product, without reacting with or adulterating the product itself. The closures disclosed herein may be provided to positively prevent the dispensing

valve from opening, so as to prevent the inadvertent discharge of product during transport, storage and/or other similar conditions.

In the foregoing description, it will be readily appreciated by those skilled in the art that modifications may be made to the invention without departing from the concepts disclosed herein. Such modifications are to be considered as included in the following claims, unless these claims by their language expressly state otherwise.

CLAIMS:

1. A dispensing package for fluid materials and the like, comprising:

a container shaped to retain a preselected fluid product therein, and including a discharge opening with a marginal lip, and manually elastically deformable walls for selectively moving the fluid product in said container through said discharge opening;

a self-sealing dispensing valve positioned to communicate with the discharge opening of said container, and including a central portion having a slit defining an orifice which automatically opens in response to a predetermined threshold pressure, and automatically closes upon removal of the predetermined threshold pressure; the dispensing valve including a retainer flange disposed marginally about the orifice, and being resiliently deformable between opposite faces thereof; one of the faces of said retainer flange being positioned on the lip of the container, and oriented such that the orifice communicates with said discharge opening; a retainer ring formed integrally in the container adjacent the discharge opening thereof and forming a rim which abuttingly engages the other faces of said retainer flange and compresses said retainer flange between the lip of said container and the rim of said retainer ring to securely mount said dispensing valve on said container, and simultaneously form a leak resistance seal therebetween; wherein: the valve central portion is constructed such that said predetermined threshold pressure is greater than the maximum hydraulic head pressure of the fluid produced in said container when said discharge

opening is oriented downwardly; said retainer ring includes a crimpable collar constructed from a plastic which is heated and inelastically deformed about said retainer flange of said dispensing valve to form the said rim; and the dispensing valve has a one-piece, integral construction moulded from liquid silicone rubber, whereby said retainer flange is elastically compressible, yet will not inelastically deform during heat setting of said crimpable collar.

2. A self-sealing dispensing package according to claim 1 in which the container includes a bottom wall with a base portion adapted to abuttingly support said container on a surface, and a recessed portion in which said discharge opening is disposed; the dispensing valve being mounted in the recessed portion of the container bottom wall.

3. A self-sealing dispensing package according to claim 1 or claim 2 wherein the container is constructed from a thermosetting plastic and the collar is crimped about the dispensing valve by heat setting.

4. A self-sealing dispensing package according to any one of claims 1 to 3 in which the valve includes a sidewall interconnecting said retainer flange and the central portion, the valve sidewall being elastically flexible for shifting between an extended operational position wherein said central portion is spaced apart from said retainer flange a predetermined distance to permit the fluid product to be dispensed from the container, and a retracted storage position wherein said central portion is disposed generally flush with

said retainer flange and said sidewall is doubled over to generate forces in said valve which prevent said orifice from inadvertently opening.

5. A self-sealing dispensing package according to any one of claims 1 to 4 in which the valve includes a valve wall having a marginal groove extending along one face thereof in a closed pattern to define the centre portion area inside the groove, and an outer valve area outside the groove; at least one rib extending between said centre portion and said outer valve area to bridge said groove and selectively stiffen said valve; the slit extending substantially continuously along said centre portion, and into at least a portion of said groove, whereby shifting the flexible wall portion of said container from the decompressed condition to the compressed condition shifts said orifice into an outwardly open position, and forces the fluid product therethrough to dispense the same from said container, and shifting the flexible wall portion of said container from the compressed condition to the decompressed condition shifts said orifice from the outwardly open position, through a closed position, into an inwardly open position, and draws air therethrough to substantially equalise the pressure withing said container, and thereby return said orifice to the closed position.

6. A self-sealing dispensing package according to claim 5 in which the valve includes a pair of said ribs positioned mutually in-line at diametrically opposite portions of said valve wall in a non-aligned relationship with said slit to selectively support said centre region in a trampoline-like

fashion, and ensure complete and timely closure of said orifice.

7. A method for packaging fluid materials and the like, comprising:

providing a container shaped to retain a preselected fluid product therein of the type having a discharge opening with a marginal lip, and a manually elastically deformable wall for selectively moving the fluid product in said container through said discharge opening;

providing a self-sealing dispensing valve of the type having (1) a one-piece, integral construction molded from liquid silicone rubber, (2) a slit central portion defining an orifice which automatically opens and closes in response to the application and removal of a predetermined threshold pressure, and (3) an elastically compressible retainer flange which is disposed marginally about the orifice and is resiliently deformable between opposite faces thereof, said central portion being constructed such that said predetermined threshold pressure is greater than the maximum hydraulic head pressure of the fluid product in said container when said discharge opening is oriented downwardly;

forming a retainer ring from plastic integrally in the container adjacent to the discharge opening with a crimpable collar projecting outwardly of the container lip;

positioning the valve on the container lip with one of the faces of said dispensing valve flange being positioned on the lip of said container, and with said valve oriented such that said orifice communicates with said discharge opening;

crimping the collar of the retainer ring inwardly by

heating the collar and inelastically deforming the collar about said flange to form a rim which abuttingly engages the other face of the dispensing valve flange and compresses the dispensing valve flange between the lip of the container and the rim of the retainer ring to securely mount the dispensing valve on the container, and simultaneously form a leak resistant seal therebetween without inelastically said flange during heat setting of said retainer ring collar.

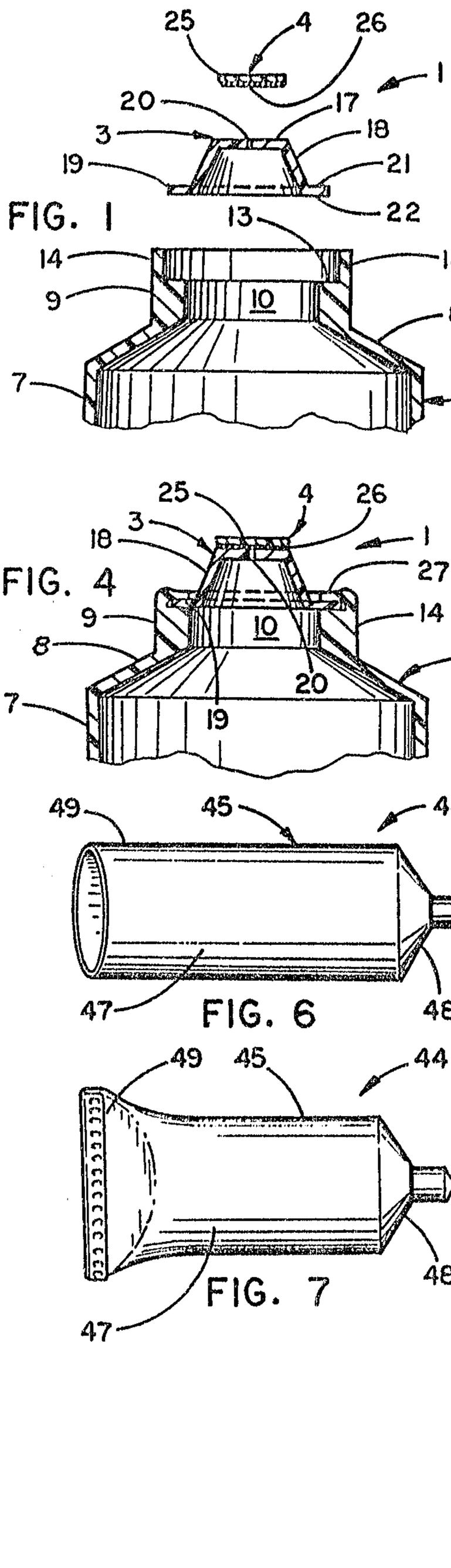

FIG. 1

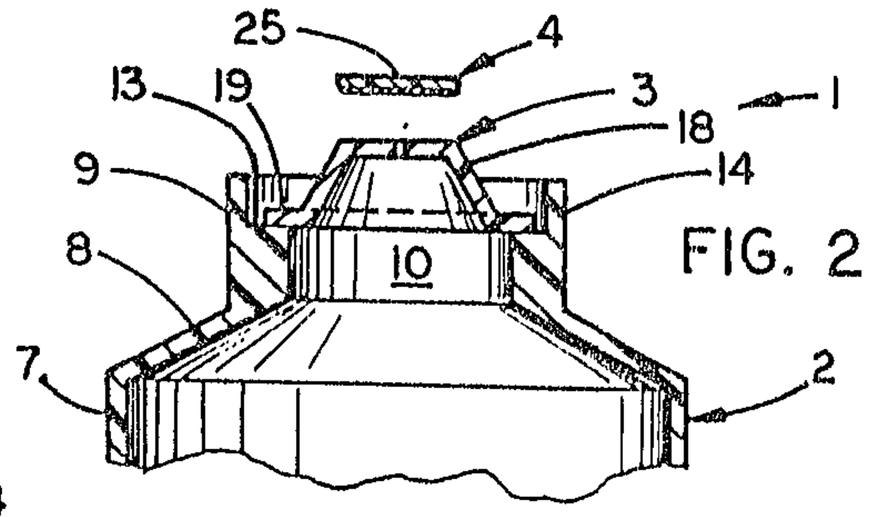

FIG. 2

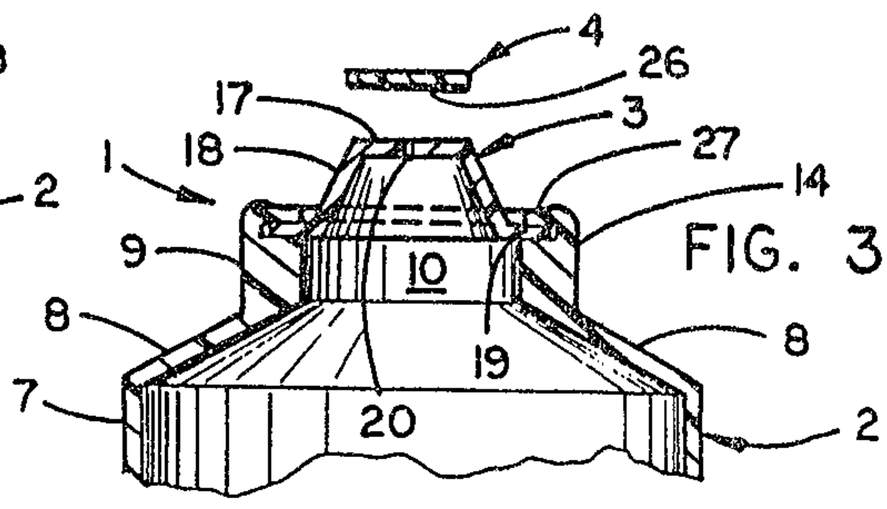

FIG. 3

FIG. 4

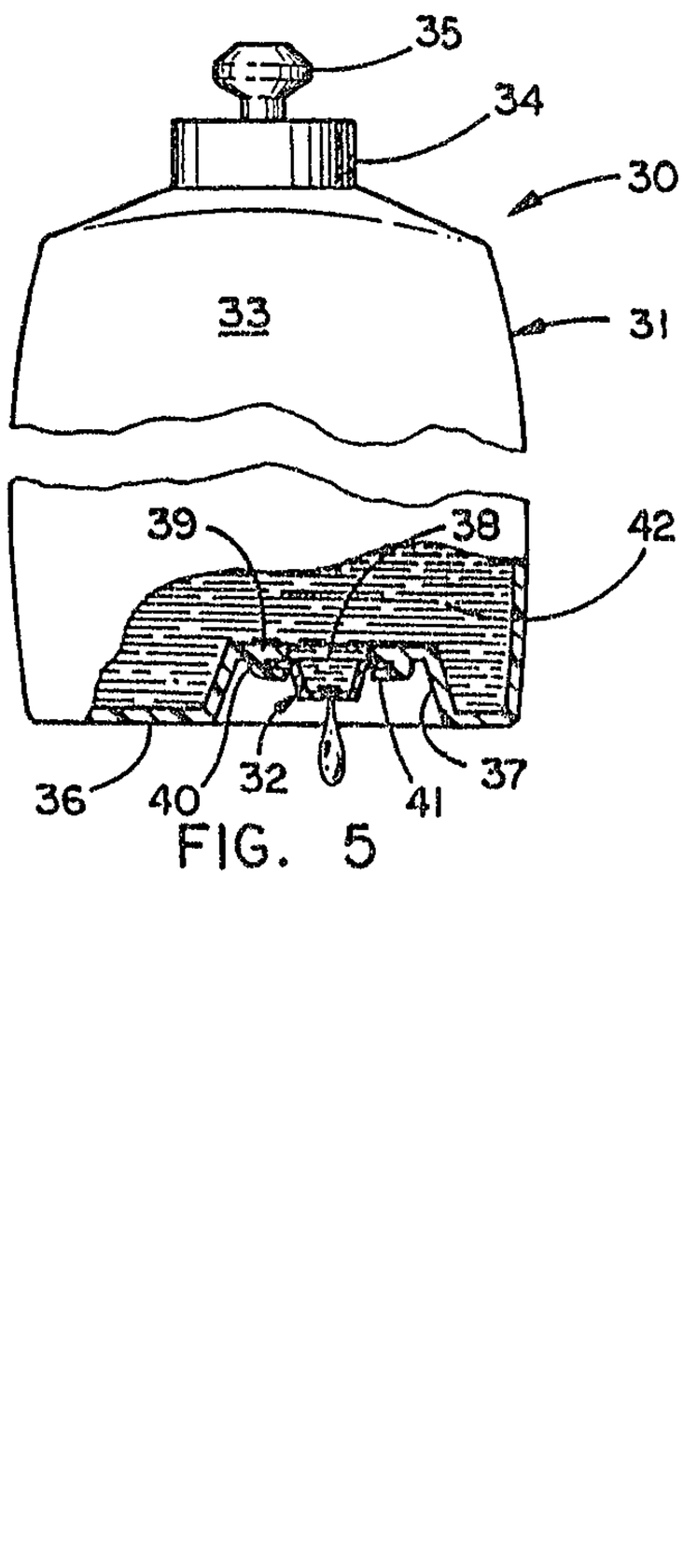

FIG. 5

FIG. 6

FIG. 7

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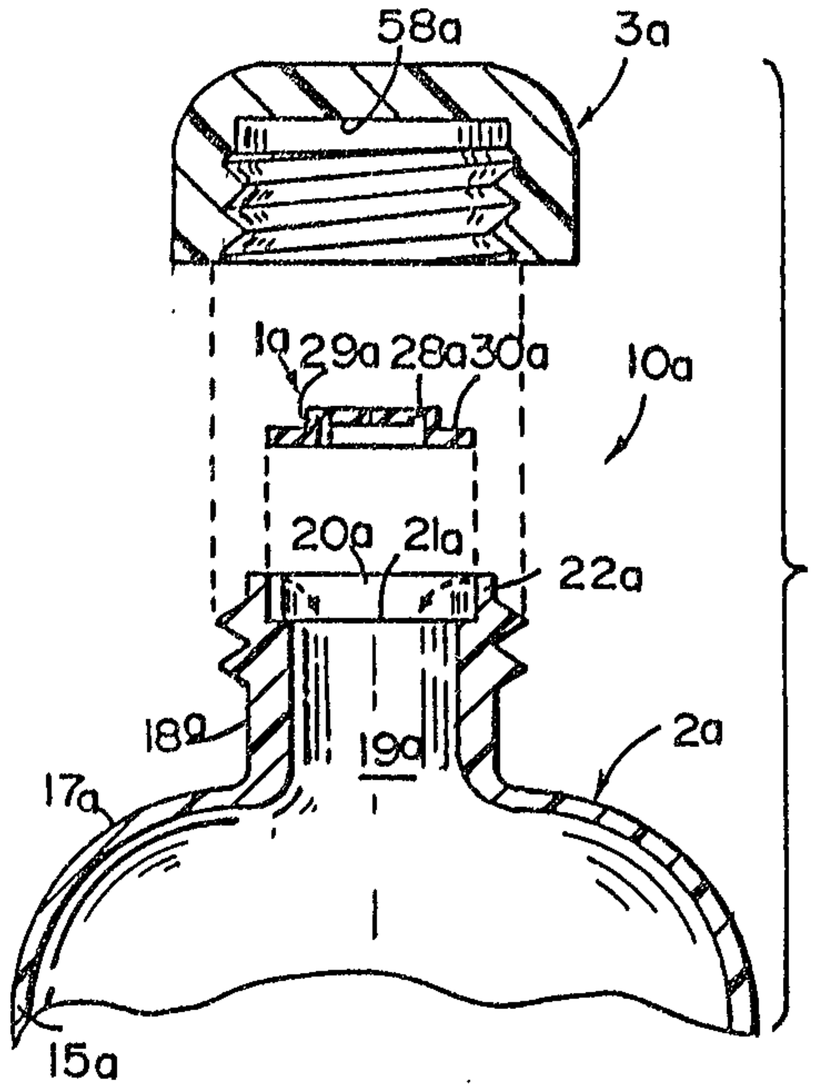

FIG. 1A

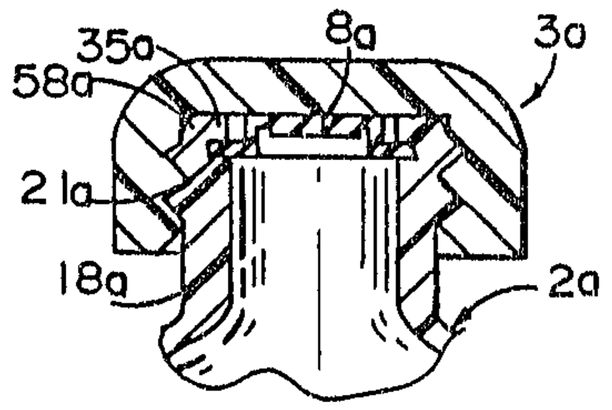

FIG. 2A

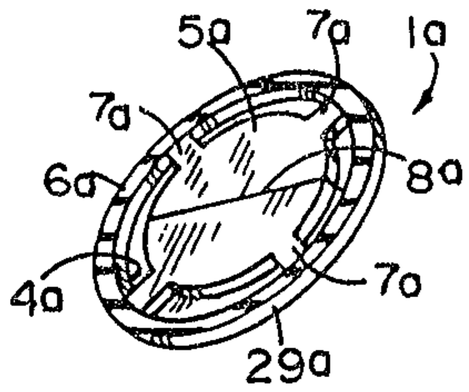

FIG. 3A

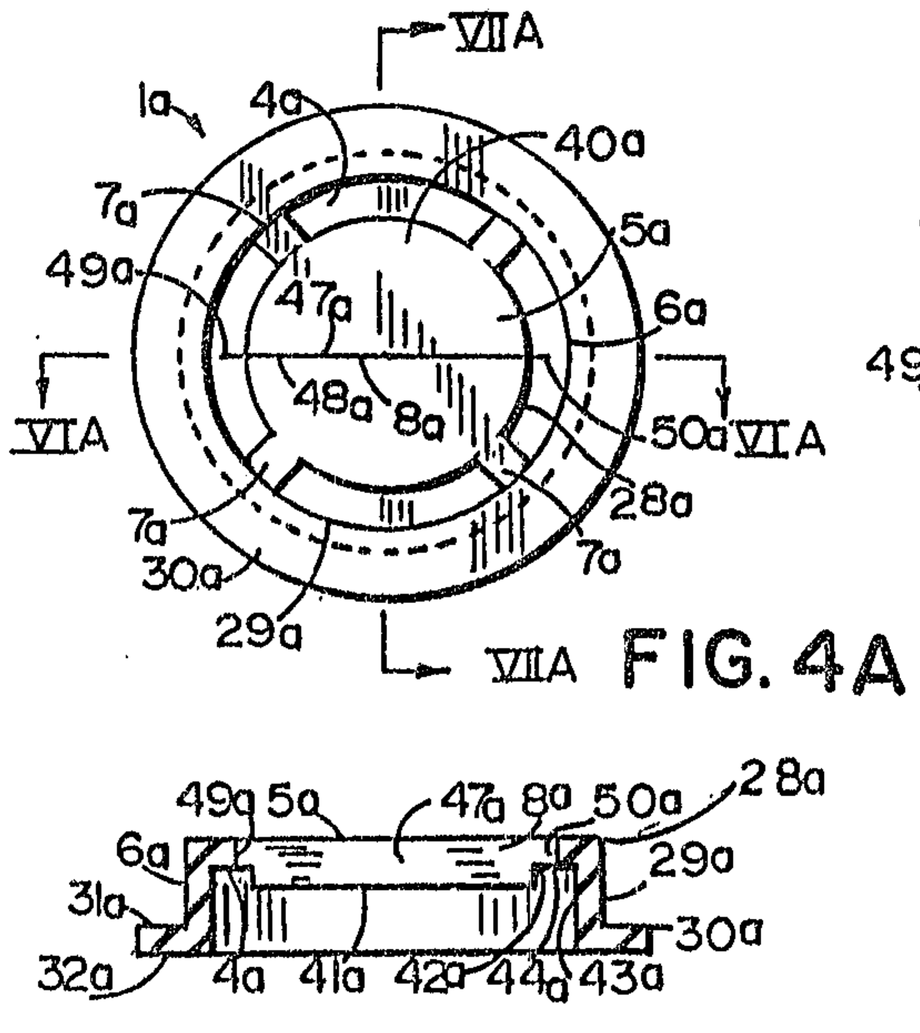

FIG. 4A

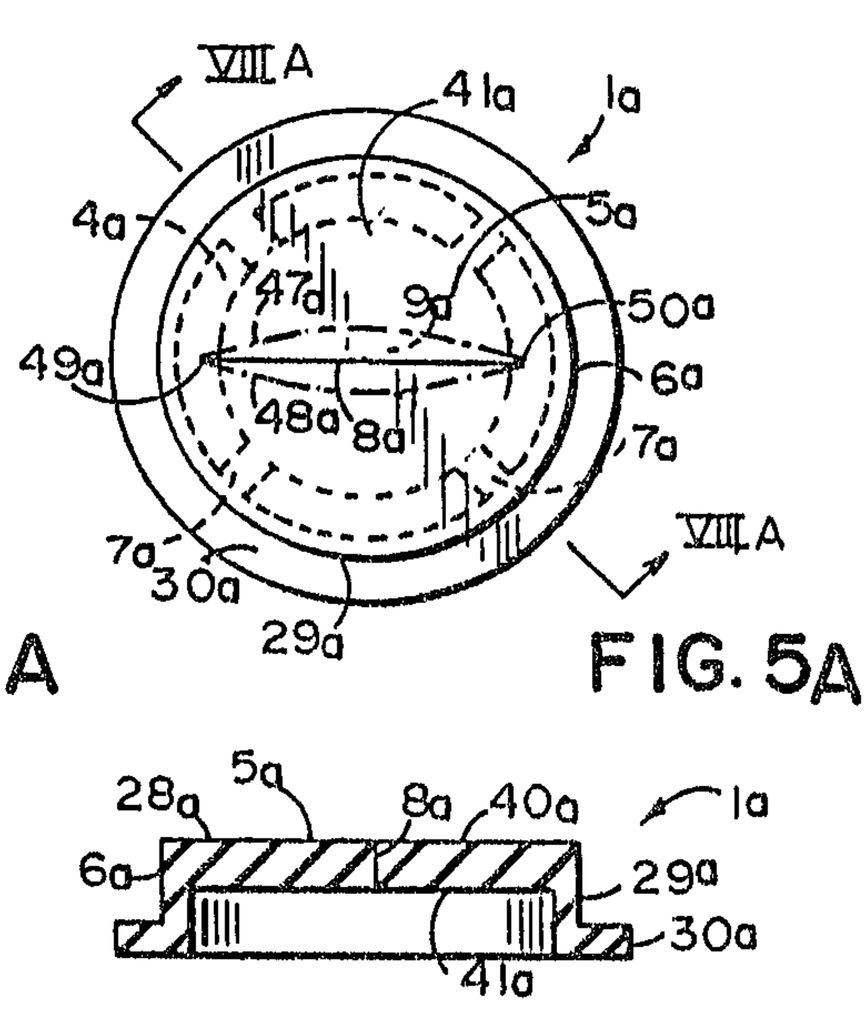

FIG. 5A

FIG. 6A

FIG. 8A

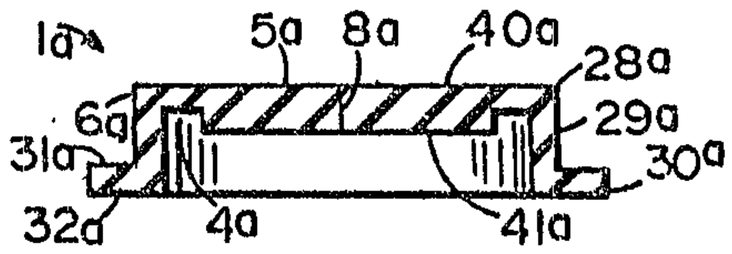

FIG. 7A

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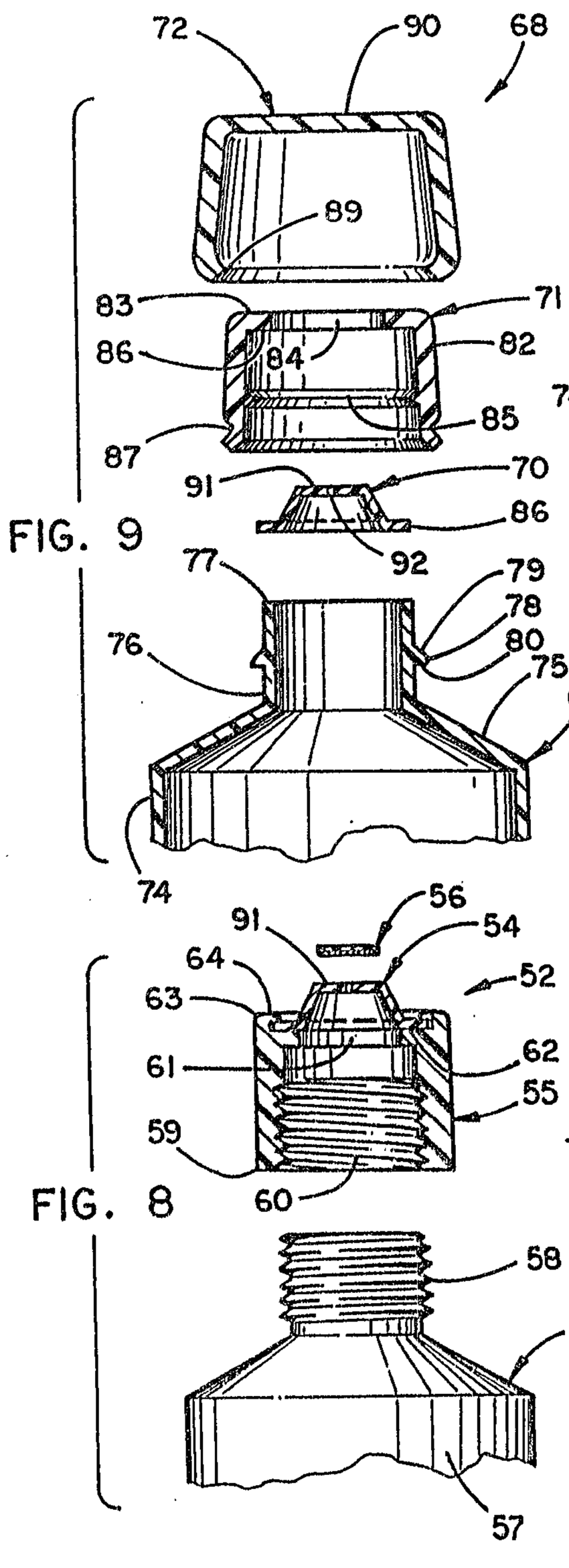

FIG. 9

FIG. 8

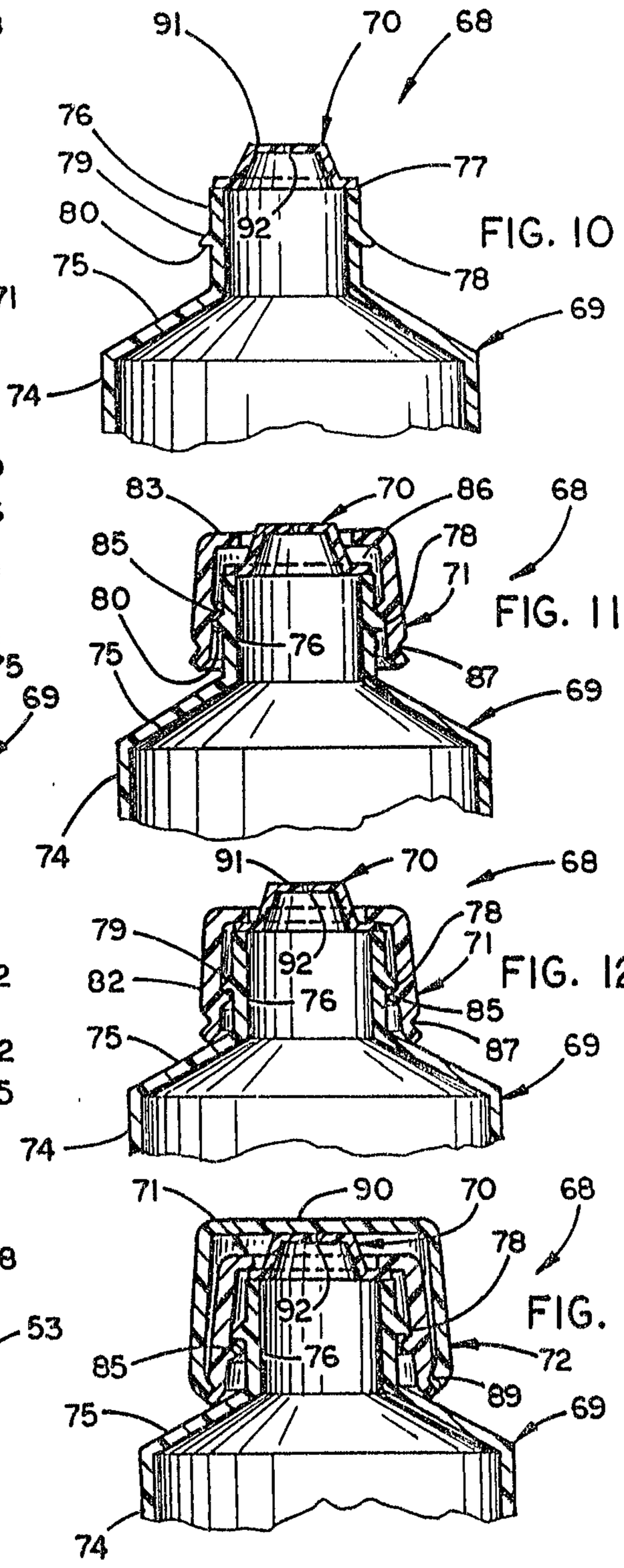

FIG. 10

FIG. 11

FIG. 12

FIG. 13

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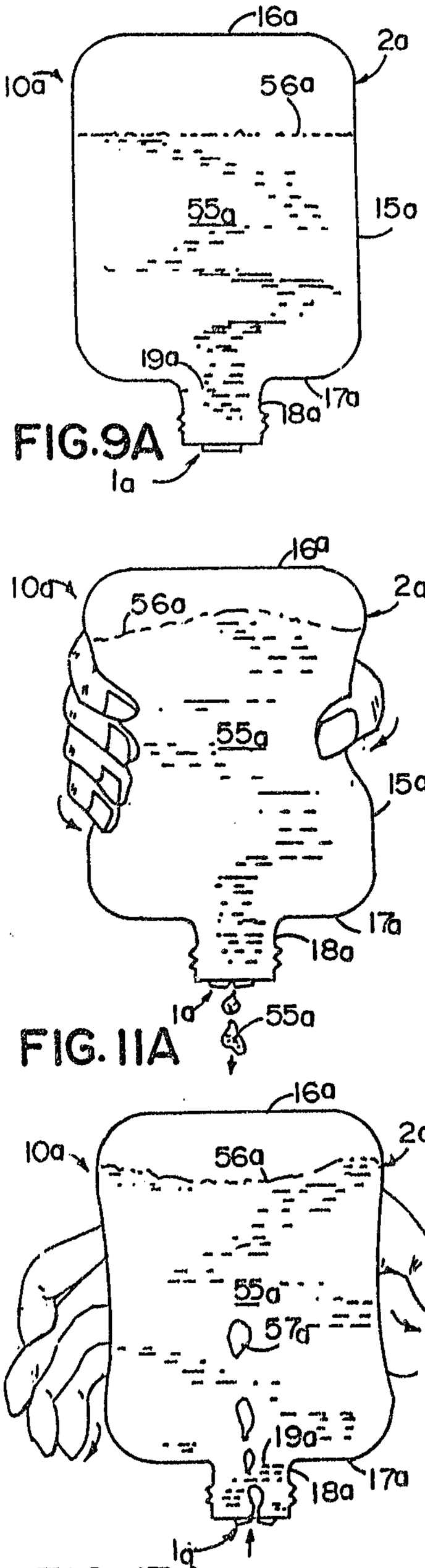

FIG. 9A

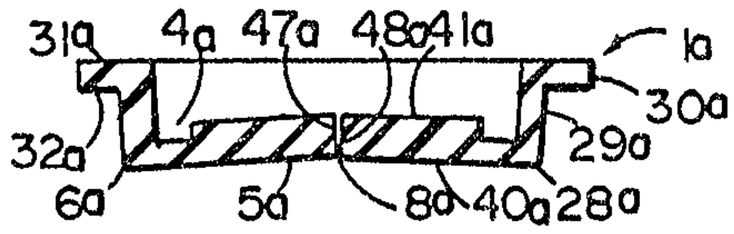

FIG. 10A

FIG. 11A

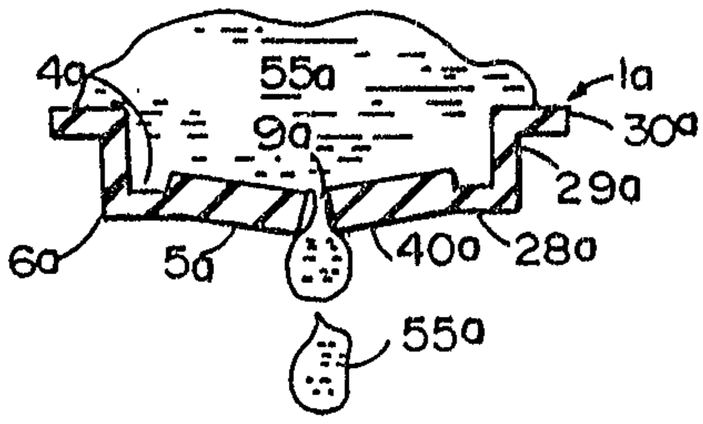

FIG. 12A

FIG. 13A

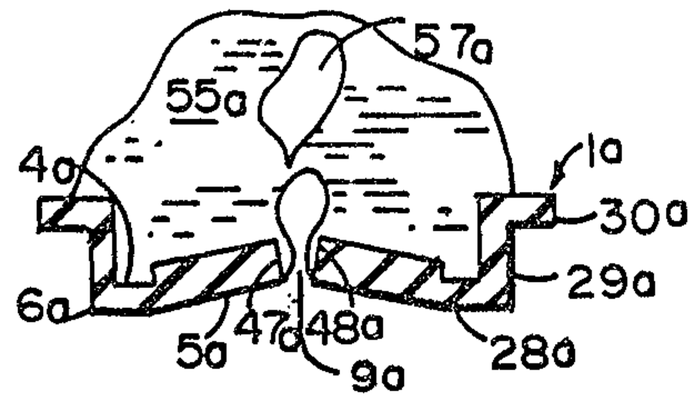

FIG. 14A

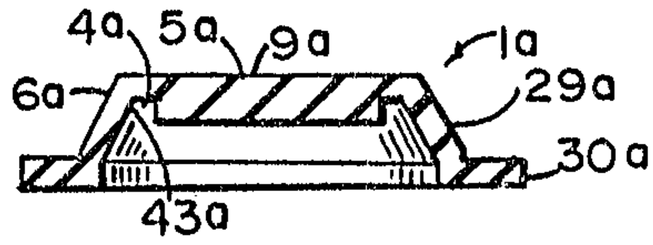

FIG. 15A

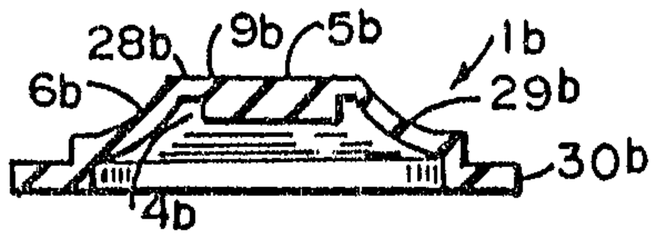

FIG. 16A

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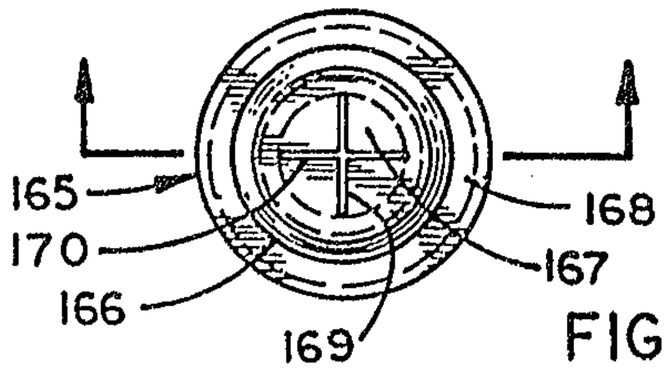

FIG. 14

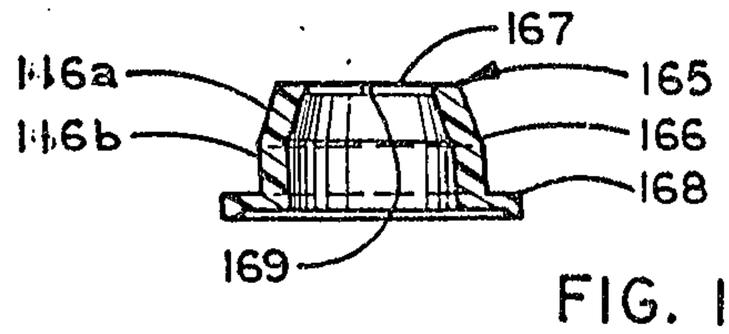

FIG. 15

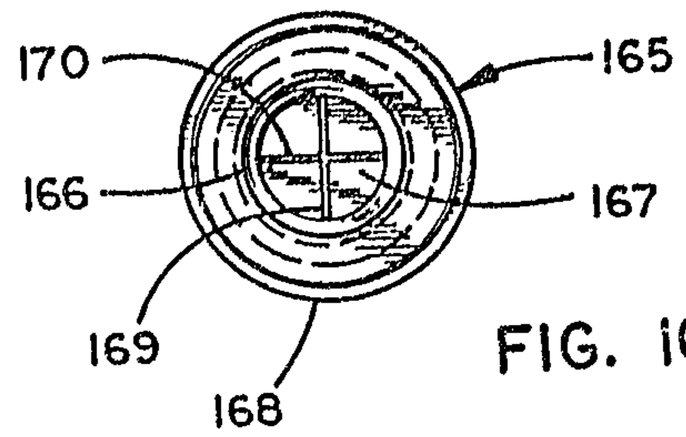

FIG. 16

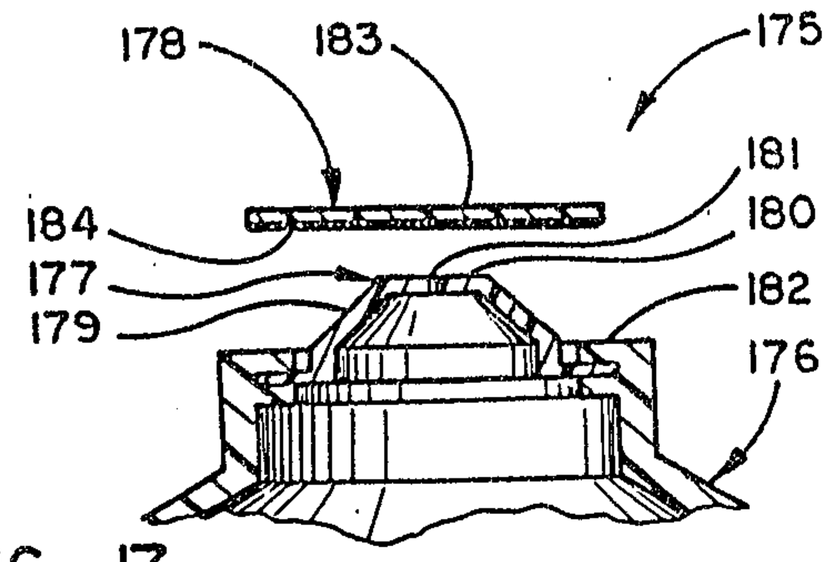

FIG. 17

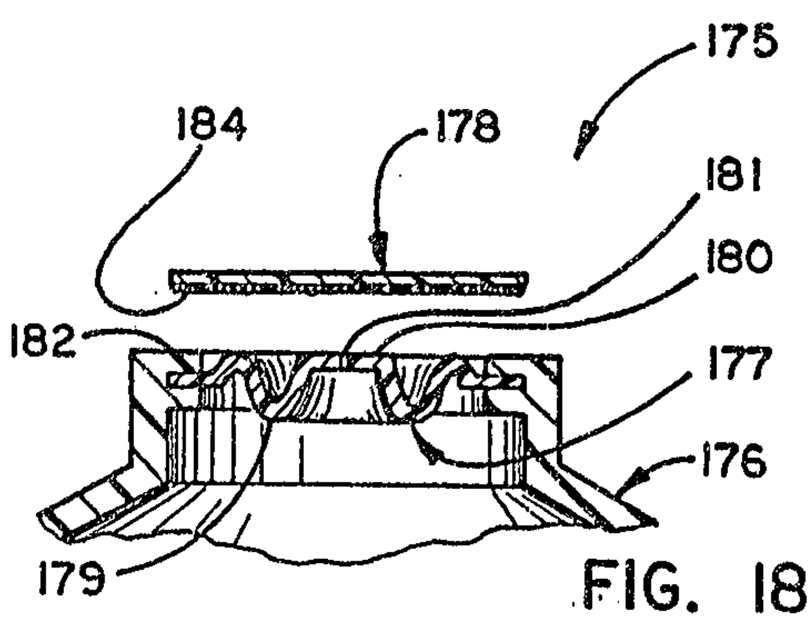

FIG. 18

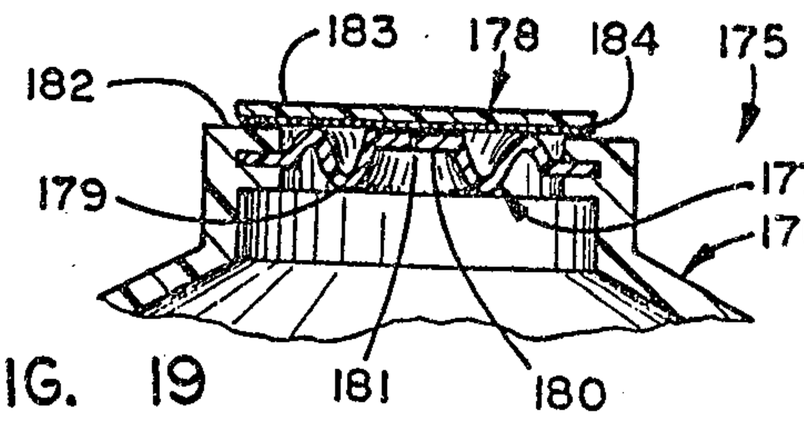

FIG. 19

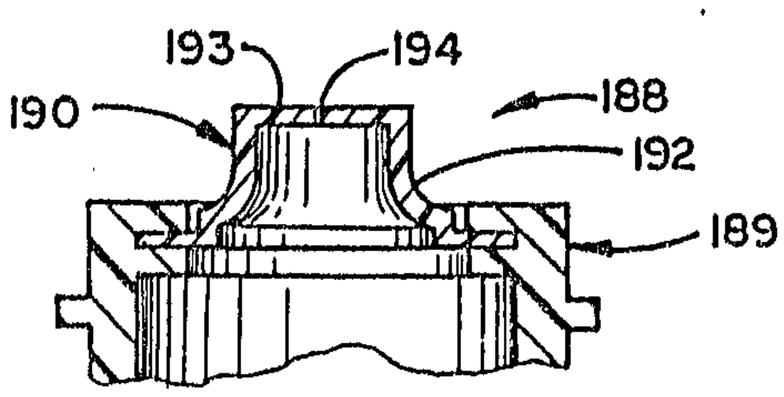

FIG. 20

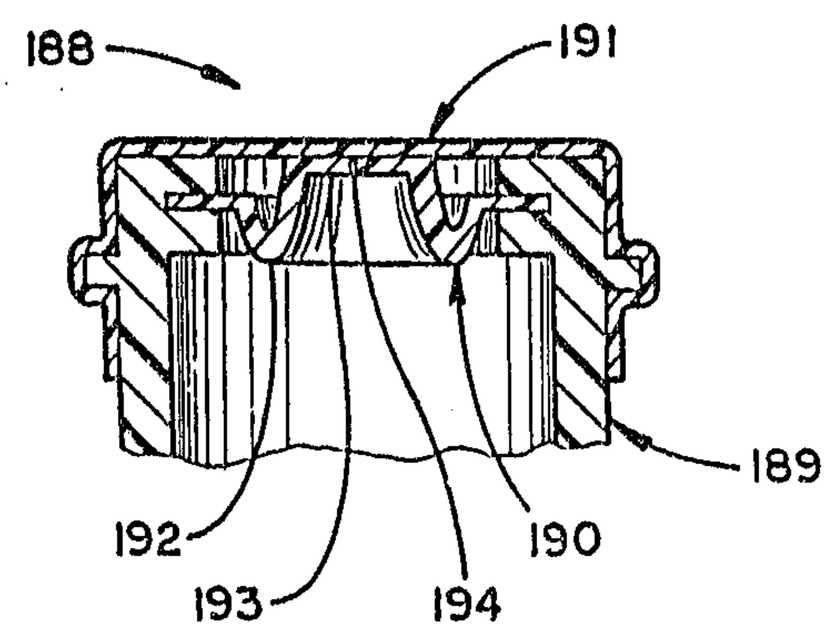

FIG. 21

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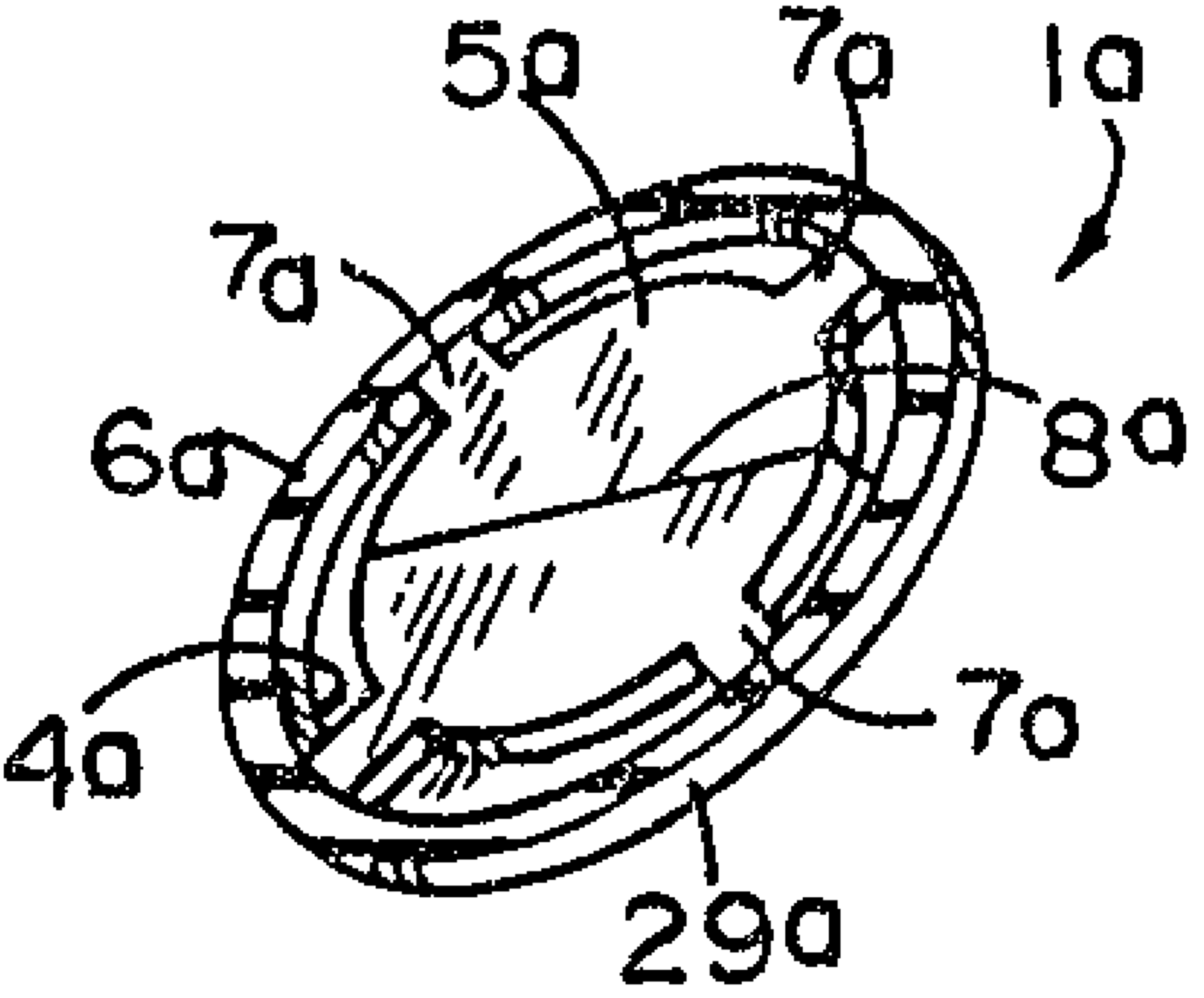
5a
7a
1a
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4a
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