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(54) **Liquid dispensing tip with reservoir**

(57) The present invention includes devices for containing and dispensing liquid solutions. The devices of the invention increase ease of sample volume control and, hence, application thereof while minimizing any sample spillage or fluid migration up the side of the dispensing tip. Furthermore, the devices provide ensure adequate sample volume.

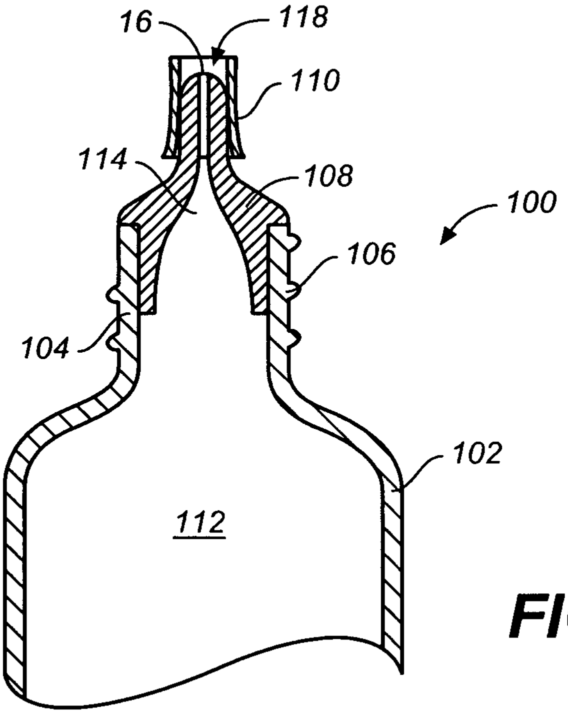

FIG. 6

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Description

Field of the Invention

[0001] The invention relates to devices for containing and dispensing liquids.

Background of the Invention

[0002] In many medical and laboratory applications, it is necessary to provide or administer a single or precisely measured dose of a liquid agent, such as a medication or reagent. One such application in which precise amounts of reagent fluid are required is in the patient use of systems for measuring a bodily analyte in a physiological fluid. Such systems typically include test strips containing a reagent material to which a physiological sample is applied. Meters are configured to receive such test strips and determine the analyte concentration of the sample. Prior to the use of such meters and test strips, they are typically checked by methods in which a monitoring agent, often called a control solution is used to test the accuracy and efficacy of the test strips.

[0003] Control solutions are often packaged in a plastic or glass container with a dispensing end configured with a small opening at the end of a taper through which a relatively imprecise droplet of control solution can be dispensed by squeezing the bottle. It is generally difficult to accurately control the amount of control solution dispensed from such containers. Although advancements are rapidly being made in the development of systems and devices for measuring analyte concentrations, there has been limited advancement in the area of control solution containment and dispensing for use with these advanced systems and devices. Commercially available control solution containers typically have a tapered dispensing tip that performs reliably on diagnostic test strips where a large volume, e.g. 5 to 20 microliters, of control solution is required. However, such containers are less accurate at dispensing smaller volumes required by today's more advanced test strips that use less than one microliter.

[0004] As the sample volume requirement of some commercially available test strips reaches sub-microliter level, an excess amount of control solution may be delivered by the existing tapered dispensing tips, creating inconvenience and annoyance to the user. It can be difficult to aim a large droplet precisely onto the reaction zone of a test strip while also holding the bottle of control solution under pressure. This is particularly true for older patients or those with dexterity problems. Because the strip cannot absorb the excess control solution dispensed, the excess spills. This is particularly problematic because control solutions are typically red in color to realistically mimic blood.

Brief Description of the Figures

[0005]

Figure 1 illustrates an example of a prior art container used for containing and dispensing a control solution.

Figure 2 is a close-up, perspective view of the container of Figure 1, shown with the cap removed.

Figure 3 is a close-up, cross-sectional view through the line A-A' of the container of Figure 2.

Figure 4 is a perspective view of the container of Figures 1 to 3, seen in the inverted position.

Figure 5 is a side-plan view of an example fluid dispensing container according to one embodiment of the present invention.

Figure 6 is a cross-section view seen through line B-B' of Figure 5, showing an example embodiment of an internal structure of a container according to the present invention.

Figure 7 is a similar cross-sectional view to that of Figure 6, showing the container now in an inverted position with control solution in the reservoir.

Figure 8 is a close-up, cross sectional view through a container according to a further embodiment of the present invention.

Figure 9 is a close up, cross-sectional view of a first embodiment of the dispensing tip of Figure 8, according to the present invention.

Figure 10 is a close up, cross-sectional view of a second embodiment of the dispensing tip of Figure 8, according to the present invention.

Figure 11 is a cross sectional view through a container according to a further embodiment of the present invention.

Figure 12 is a close up, cross-sectional view of an example embodiment of a cap designed specifically to cooperate with one embodiment of a fluid dispensing tip of the present invention.

Figure 13 is a close up, cross-sectional view of a further example embodiment of a cap designed specifically to cooperate with a further embodiment of a dispensing tip of the present invention;

[0006] Detailed Description of the Invention and Preferred Embodiments

[0007] In the following description, the present invention will be described in the context of analyte concentration measurement applications, and particularly in the context of glucose concentration in blood. However, it is not intended to be limiting and those skilled in the art will appreciate that the subject devices, systems and methods are useful in the measurement of other physical and chemical characteristics including, without limitation, blood cholesterol level, or other biological substances including, without limitation, urine, saliva, etc., involving the use of a reagent. Likewise, the present invention may be used in relation to other substances or agents that also require the convenient provision of a precise dose.

[0008] Figure 1 is a simplified, perspective view of a commercially available fluid-dispensing container 2 including a body 4 and a removable cap 6. Cap 6 may optionally screw or snap onto body 4 while not in use to keep the dispensing tip, not seen in Figure 1, clean. Cap 6 also helps to prevent spillage or leakage of fluid from the container during storage or transportation. Container 2 holds a volume of liquid control solution, typically in the range of about 3 to 5 ml, providing approximately 100 to 200 doses, typically lasting a user approximately 3 months.

[0009] Container body 4 may be composed of a deformable plastic. However, other suitable container materials, such as glass for example, are conceivable for container body 4 and are therefore intended to be included. Although the term "container" will be used throughout, other terms such as bottle or vial may also be used interchangeably and are therefore intended to be encompassed by the term "container" for the purpose of this application. It will also be apparent to one skilled in the art that such containers may be used to dispense a liquid other than control solution, although use for dispensing control solution will primarily be described herein.

[0010] Figure 2 is a close-up perspective view of container 2 of Figure 1, shown now with cap 6 removed from container body 4 to reveal a protruding neck portion 10 with optional screw threads 12 designed to receive cap 6, a nozzle-shaped dispensing tip 8 including a small dispensing outlet 14 located at the tip. Figure 3 is a close-up cross-sectional view through the line A-A' of prior art container 2 of Figure 2, showing container body 4 including an interior cavity 16 which houses the fluid to be dispensed, a neck portion 10 with optional screw threads 12, a dispensing tip 8 now revealing an internal, frusto-conical structure 18 forming a progressively narrowing channel 20 leading to a small outlet 14 that provides direct fluid communication between storage cavity 16 and the external environment.

[0011] Figure 4 is a further perspective view of container 2 of Figures 1 to 3, now shown in the inverted position as would be typical during normal use to dispense a drop of control solution liquid from therein. Figure 4 includes many of the same features already described in relation to Figures 2 and 3, and further includes a liquid droplet 22 shown emerging from outlet 14 in nozzle-shaped dispensing tip 8. A simplified example test strip 24 with a sample-receiving region 26 is also shown in Figure 4.

[0012] Referring now to Figures 1 to 4, when a patient intends to use the control solution cap 6 is first removed from container body 4, typically using a screw action or alternative such as a push-pull action for example. Container body 4 is then tilted so that the dispensing tip 8 is held several millimeters over the sample-receiving area 26 of a new test strip 24, such as the position depicted by Figure 4. The user may then be required to apply a slight squeeze pressure to container body 4 to dispense a droplet 22 of the control solution out of the container 2 via outlet 14 that provides fluid communication with the exterior environment. Droplet 22 first emerges from outlet 14, then accumulates and subsequently suspends from the external surface area of dispensing tip 8 immediately surrounding outlet 14 due to the inherent capillary attraction of the liquid to the surface. This suspended, or hanging drop, may be problematic because a single such drop may contain a relatively large volume of liquid that itself is problematic when a very small amount is desired to be dispensed.

[0013] To perform the control solution test, the user then brings the droplet 22 closer to the sample-receiving area 26 of the test strip 24. When contact is made the fluid is taken up by capillary action into the reaction chamber of the test strip 24.

[0014] Container 2, and the steps for dispensing a fluid such as control solution therefrom, is disadvantageous. First, the container is repeatedly opened over an extended period of time, thereby repeatedly exposing the control solution to contaminants in the air and on surfaces, such as the user's fingers for example, which can carry contaminants. Because the users of control solutions often have poor dexterity they may fumble the cap 6 and/or drop it, potentially further contaminating the control solution stored therein and causing erroneous test results. If it is determined that the control solution has become contaminated, the entirety of the control solution container must be thrown away, and a new container opened: adding to the cost to the user.

[0015] Additionally, such prior art control solution containers 2 can be problematic in that, because such a relatively large volume of the control solution is provided, the efficacy of the control solution may expire well before the majority of the control solution is used, which also adds to the cost of treating the patient. The shelf life of the control solution sealed within its original containment is usually about 1

[0016] to 2 years, but once the user opens the container 2 the shelf life quickly drops to only a few months due to the contamination problems mentioned above. Furthermore, the user may not replace the cap 6 back onto container body 4 after use. Whether deliberately or accidentally forgetting to replace the cap 6 onto container body 4, leaving the dispensing nozzle exposed to the atmosphere could cause the control solution to evaporate, thereby changing the relative concentration of active ingredients which may result in erroneous values.

[0017] Also, it is difficult to precisely and accurately dispense the requisite volume of the control solution from within such prior art containers 2. The volume dispensed is highly user dependent in that the user may apply too much control solution by over-squeezing the container or may apply too little solution by not squeezing enough. The control solution fluid may also contain a small amount of surfactant to promote filling of the strip, addition of which may lower the surface tension causing the control solution to exhibit a tendency to creep up the side of the dispensing tip 8. This can make it more difficult for the user to accurately aim the control solution onto the receiving zone 26 of the test strip 24.

[0018] Figure 5 is a side-plan view of an example fluid dispensing container 100 according to one embodiment of the present invention. The fluid dispensing container of Figure 5 includes a container body 102, a neck portion 104 with optional screw threads 106, a nozzle-shaped dispensing tip 108, a sleeve 110. Line B-B' in Figure 5 indicates the line of sight for the cross-section shown in Figure 6. Although not shown, container 100 is anticipated to include a cap, similar to cap 6 shown in Figure 1, which may optionally screw-fit onto neck portion 104 of container body 102 by means of threads 106, however alternative means of attaching a cap, such as a push-fit for example would be apparent to one skilled in the art.

[0019] Figure 6 is a cross-section view through line B-B' of Figure 5 now showing an example embodiment of an internal structure of container 100, including a container body 102, a neck portion 104 with optional screw threads 106, a nozzle-shaped or tapered dispensing tip 108, a sleeve 110, a cavity area 112, a narrowly tapering frusto-conical internal channel 114, a small outlet 116 and a reservoir region 118 surrounding outlet 116. Reservoir 118 is formed by the boundaries of sleeve 110.

[0020] Figure 7 is a similar cross-sectional view to that of Figure 6, shown now in an inverted position as would be typical during normal use of container 100 in order to dispense a drop of control solution. Figure 7 includes many of the same elements described previously in relation to Figures 5 and 6, as well as now showing the presence of a liquid 120 within cavity 112 of container body 102.

[0021] Referring now to Figures 5, 6 and 7, the aim is to provide adequate fluid volume required to fill a test strip without creating spills. An improvement to the user-control of dispensing control solution from a conventional container may be achieved by attaching a sleeve 110, such as a small piece of cylindrical tubing for example, to the dispensing tip 108. Provision of a sleeve 110 provides a reservoir 118 of fixed, predetermined volume making it easier to dispense the required amount of control solution. In addition, sleeve 110 may make control solution application easier for the user as it eliminates the need for a hanging drop, as discussed in reference to Figure 4.

[0022] In practice, the user needs only to gently squeeze the container in order to fill the reservoir region 118 around outlet 116 encompassed by the sleeve 110. The user may achieve this while holding the container 100 in the upright position as only a gentle squeeze to the container body 102 may be required to force the control solution through channel 114 and out via outlet 116. Use in a substantially upright position would allow the user to clearly see the control solution moving into and filling reservoir region 118. Alternatively, the user may tip container 100 into an almost inverted position as shown by Figure 7, in order to dispense fluid 120 through the narrow tapering channel 114 and out via outlet 116, allowing the fluid to culminate in the reservoir region 118. The required volume of control solution fluid 120 would then be retained within the boundaries of sleeve 110 by capillary action. By matching the volume of reservoir 118 with the volume required by the test strip, the present invention eliminates wasted control solution.

[0023] Sleeve 110 provides an expanded zone or reservoir region into which control solution 120 can fill and be held by capillary action, until such time that the user touches the end of the sleeve 110 onto the receiving portion 26 of a test strip 24. When contact is made between the sample-receiving portion 26 of the test strip 24 and the edge of the reservoir region 118, then the control solution is taken up into the test strip 24 by capillary action. The reservoir region 118 is sized to hold only the volume of control solution required to fill the test strip. Once the test strip is in fluid communication with the control solution, sample fill is accomplished by capillary action thus reducing the likelihood of control solution being spilled.

[0024] Providing an expanded zone or 'reservoir' region 118 within a simple sleeve 110 attached to the dispensing tip 108 allows for momentary storage of the required volume of control solution. This simplifies the application procedure for the user, as well as minimizing the dexterity required.

[0025] Figure 8 is a close-up cross sectional view through a container 200 according to a further embodiment of the present invention, including a container body 202, a neck portion 204 with optional screw threads 206, a one-piece dispensing tip 208, a narrow tapering channel 214 leading to an outlet 216 and an expanded reservoir region 218. Figure 8 provides a container 200 according to a further example embodiment of the present invention, suitable for use in the dispensing of a liquid such as control solution. According to this embodiment, dispenser tip 208 may be fabricated in one piece, thereby eliminating the additional or separate sleeve element 110 described in relation to Figures 5 to 7. There may be many advantages to one-piece fabrication, such as, for example, reduced complexity, time and cost. Dispenser tip 208 may be manufactured using appropriate technology e.g. injection molding. Such techniques also provide the advantage of mass production capability.

[0026] The dispensing tip 208 of Figure 8 incorporates a narrow tapering internal channel 214 (similar to channel 114 of Figures 6 and 7) in fluid communication with the exterior environment by means of outlet 216. In this embodiment, channel 214 may be annular, concentrically aligned with respect to the axis of fluid outlet 216. Application of pressure onto the external surfaces of container body 202 by a user causes fluid to emerge through outlet 216 and fill expanded reservoir region 218. The approximate dimensions of the expanded opening 218 may be in the region of 5 to 20 times greater than the dimensions of the narrow internal channel 214. According to the present invention, expanded reservoir region 218 is designed to accommodate the volume of control solution required to fill the receiving region of a test strip in order for the user to perform a control solution test.

[0027] Figure 8 shows square-shaped expanded reservoir region 218 with further detailed information provided in relation to Figures 9 and 10. Figure 11 shows a similar, but rounded or semi-circular shaped expanded reservoir region 318. The example embodiments provided in Figures 8 and 11 are intended to be purely for illustration of embodiments of the present invention, and it will be apparent to one skilled in the art that any size and shape of expanded reservoir region is conceivable e.g. cylindrical, conical or hemispherical reservoirs for example, and are therefore intended to be included in the present invention.

[0028] Figure 9 is a close up cross-sectional view of the dispensing tip 208 of Figure 8, including a fluid outlet 216, an expanded reservoir region 218 having a diameter d_1 and a height h_1. Figure 10 is a close up cross-sectional view of the dispensing tip 208 of Figure 8, including an outlet 216, an expanded reservoir region 218 having a diameter d_2 and a height h_2.

[0029] Figures 9 and 10 provide two example embodiments for a dispensing tip 208 of Figure 8 according to the present invention, the difference being in the relative diameter (d) and height (h) dimensions of the expanded reservoir region 218. Figure 9 shows an expanded reservoir region 218 which may have a diameter d_1 in the range of approximately 1 to 4mm, and more typically close to 2 mm, and a height h_1 in the range of approximately 1 to 2 mm, and more typically close to 1.6 mm. Such dimensions provide a volume capacity in the region of approximately 5 μL, and may be appropriately sized to contain smaller or larger volumes.

[0030] The second embodiment of a reservoir region 218 provided in Figure 10 has a diameter d_2 in the range of approximately 1 to 5mm, and more typically close to 3mm, and a height h_2 in the range of approximately 0.5 to 1.5mm, or more typically close to 0.7mm. The dimensions of this second embodiment are also designed specifically to hold approximately 5μL of control solution.

[0031] The embodiments of dispensing tip provided in both Figures 9 and 10 would each hold a sufficient amount of control solution momentarily until the user is ready to proceed with the test and therefore touches the edge of the reservoir region 218 against the sample-receiving portion of a new test strip, causing the fluid to be taken into the reaction chamber of the test strip by capillary action. Reservoir region 218 holds the fluid momentarily, allowing the user to either bring the test strip into contact with the container in the upright position, or alternatively the user may prefer to invert the container to a suitable angle that is most comfortable for them to dispense the control solution onto the test strip. It will be apparent that a further advantage of the present invention is the ability to dispense control solution using an upright container.

[0032] Depending on the application for which the control solution or other liquid agent is being used, the volume of the expanded reservoir region of the present invention can be designed specifically, and may range from about 100 nL to 200 μL. For control solutions used on test strip sensors for analyte detection and measurement e.g. blood glucose, the reservoir volume typically ranges from about 1 to 20 μL. The diameter of the expanded reservoir region may therefore be typically within the range from about 1 to 10mm, and more typically in the range from about 2 to 4mm. Similarly, the depth of the expanded reservoir region (or alternatively 'height' as depicted by h_1 and h_2 in Figures 9 and 10 respectively) may be typically in the range from about 0.5 to 5mm, and more typically in the range from about 1 to 2mm. In cases in which a range of values is provided, it is understood that every intervening value, between the upper and lower limit of that range and any other stated or intervening value in that stated range is encompassed within the invention.

[0033] Figure 11 is a cross sectional view through a container 300 according to a further embodiment of the present invention, including a container body 302, a neck portion 304 with (optional) screw threads 306, a dispensing tip portion 308, a narrow tapering internal channel 314 leading to a small fluid outlet 316 and an expanded reservoir region 318. Container 300 of Figure 11 is similar to container 200 of Figure 8 however there are some differences. The first difference being in the shape of the respective expanded reservoir regions surrounding the fluid-dispensing outlet. The embodiment of an expanded reservoir region 318 in Figure 11 is shown to be curved or hemi-spherical in shape, whereas the shape of expanded reservoir region 218 in the example embodiment of Figures 8, 9 and 10 is shown to be primarily square or rectangular. Both shapes of reservoir region, as well as other shapes that will be conceivable to those skilled in the art, are able to hold the required volume of control solution by capillary action, at least momentarily until the user is ready to apply the drop of control solution to the sample-receiving area of a test strip to check the accuracy and efficacy of their analyte testing system.

[0034] It is to be understood that the shapes of dispensing tip provided by Figures 9, 10 and 11 are exemplary of suitable shapes in terms of volume and cross-section, however it would be apparent to one skilled in the art that any appropriate three-dimensional shape may be employed for the volume e.g. spheres, ellipsoids, paraboloids, cylinders, cones and the like, and any appropriate two-dimensional shape may be employed for the cross-sectional area, for example rectangles, triangles, ellipses, quadrilaterals such as parallelograms, polygons such as pentagons, and the like.

[0035] The second main difference between container 300 of Figure 11 and container 200 of Figure 8 is optionally in the manufacture thereof. Dispensing tip 208 of container 200 is shown as a separate moldable component, optionally manufactured separately from container body 202 and neck region 204, whereas dispensing tip 308 region of container 300 may be molded as one single element i.e. combined with container body 302 and neck region 304 for example. Molding the container 300 in a single piece may reduce the complexity of the container as well as the manufacturing and assembling processes. It would be apparent to a person of ordinary skill in the art that differences in the fabrication procedure for containers incorporating the present invention are conceivable and are therefore intended to be included herein.

[0036] Figure 12 is a close up cross-sectional view 400 of an example embodiment of a cap 408 designed specifically to cooperate with an embodiment of a fluid dispensing tip 402 of the present invention, including a fluid outlet 404, an expanded reservoir region 406 having a diameter d_3 and a height h_3, a cap internal protrusion 410 having a corresponding depth p_3.

[0037] Figure 13 is a close up cross-sectional view 500 of a further example embodiment of a cap 508 designed specifically to cooperate with an embodiment of a dispensing tip 502 of the present invention, including a fluid outlet 504, an expanded reservoir region 506 being of a cone-shape with a base diameter d_4 and a height h_4, a cap internal protrusion 510 having a corresponding depth p_4.

[0038] Figures 12 and 13 show example embodiments of a dispensing tip design according to the present invention, now incorporating a complimentary feature in the container cap (items 410 and 510 respectively) designed specifically to seal the tip opening, as well as ensuring the container is fluid-tight during transportation and providing reliable storage. In one embodiment the cap protrusions 410, 510 may have a male-female structural cooperating relationship with the dispensing tip portions 402, 502 respectively in order to provide a reliable seal.

[0039] It can be seen in Figures 12 and 13 that internal protrusions 410 and 510 are specifically designed to interlock with the receiving portions, expanded reservoir regions 406 and 506 respectively, of the cooperating dispensing tip. The expanded reservoir regions 406 and 506 are sized and shaped accordingly to accept protrusions 410, 510. Figure 12 shows that the size and shape of expanded region 406 is not only designed specifically to hold an appropriate volume of control solution until the user is ready to apply it to a test sensor, but additionally the size and shape of expanded region 406 cooperates with internal protrusion 410 to provide a means for ensuring a reliable and trustworthy seal, thereby virtually eliminating the possibility of any control solution leaking out of the container while not in use. Depth p_3 of internal protrusion cooperates with height h_3 of expanded reservoir region 406, and the diameter d_3 of reservoir region 406 also cooperates with the corresponding diameter of the internal protrusion 410. Therefore, when the container of control solution is not being used, cap 408 can be fixed upon the container body, making contact primarily with the dispensing tip portion 402 thereof. Internal protrusion 410 fits snuggly within reservoir region 406 thereby forming a reliable seal over fluid outlet 404.

[0040] Similarly, Figure 13 shows a depth p_4 of a cone-shaped internal protrusion 510 that corresponds with the height h_4 of reservoir region 506. Therefore, when a user attaches cap 508 onto their container of control solution at dispensing tip 502, protrusion 510 is received by reservoir region 506 and forms a reliable seal across fluid outlet 504. Figures 12 and 13 show exemplary embodiments of container caps incorporating specific designs of sealing feature.

[0041] The present invention includes devices for containing and dispensing liquid solutions. The liquid solutions may be any type of agent, reagent or control solution. Because there are wide variety of types of liquids used in various types of applications and settings, it is beyond the scope of this disclosure to list all possible liquids that may be used with the systems of the present invention. However, the subject systems may be used in any applications requiring single-doses of a liquid for frequent or infrequent use. For purposes of describing the subject methods below, the liquid is a control solution for the performance evaluation of a system for measuring analyte concentration in a sample of physiological fluid. Examples of such control solutions are disclosed in U.S. Patent Nos. 5,187,100 and 5,605,837 incorporated herein in their entireties.

[0042] There are many advantages provided by the present invention, including the increased ease of sample volume control and hence application thereof giving the user added confidence in the control solution testing procedure. It is also an aim of the dispensing tip of the present invention to minimize any sample spillage or fluid migration up the side of the dispensing tip by only providing a volume of control solution that is close to the required volume. Furthermore the volume of fluid is retained at least momentarily localized in the expanded region of the dispensing tip to help ensure adequate sample volume each time a control solution test is performed.

[0043] The example embodiments of a fluid-dispensing tip provided herein facilitate the user in aiming the sample onto the sample-receiving region of the test sensor. Improved sample application also virtually eliminates the need to clean up any accidental spills. The fluid-dispensing tip of the present invention also minimizes the dexterity requirement of a user, easing the control solution testing procedure. In addition, the cooperating cap design ensures that the container remains fluid tight when not in use and during transportation and storage.

[0044] A control solution container incorporating a dispensing tip of the present invention may also reduce the risk of contamination of unused control solution, which in turn provides a more reliable measurement system and may additionally be more cost effective to the user by maximizing the shelf life. Contaminated control solution may generate inaccurate results, and should be discarded.

Claims

1. A liquid dispensing container, comprising:

a deformable container body having a dispensing tip and a hollow interior for containing a liquid to be dispensed there-from,
a tapering internal channel leading to an outlet to allow passage of liquid droplets there-through; and
a reservoir surrounding said outlet, said reservoir being sized to hold a predetermined volume of liquid.

2. The container of claim 1, wherein the reservoir region has a diameter in the range of approximately 1.0 mm to 10.0 mm, and a depth in the range of approximately 0.1 mm to 5.0 mm.

3. The container of claim 1, wherein the reservoir region has a diameter in the range of approximately 2.0 mm to 4.0 mm, and a depth in the range of approximately 1.0 mm to 2.0 mm.

4. The container of claim 1, wherein the predetermined volume of liquid is in the range from about 100 nL to 200 μL.

5. The container of claim 1, wherein the predetermined volume of liquid is in the range from about 1 μL to 20 μL.

6. The container of claim 1, wherein said reservoir detachable from the container body.

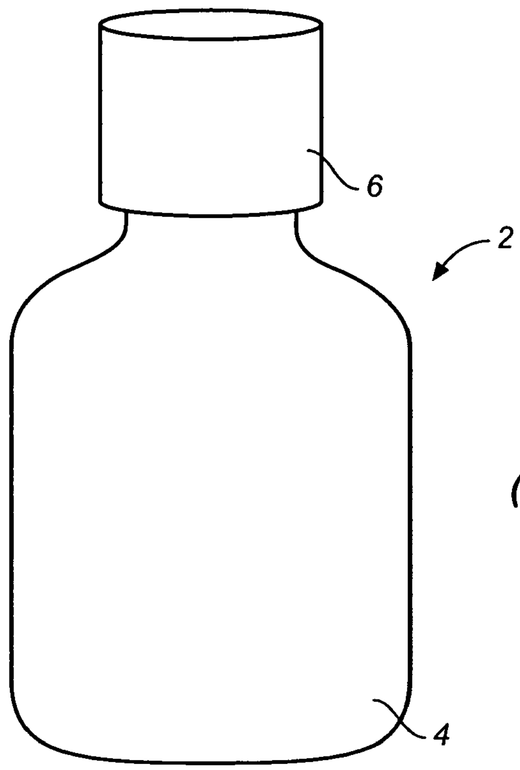

FIG. 1
(PRIOR ART)

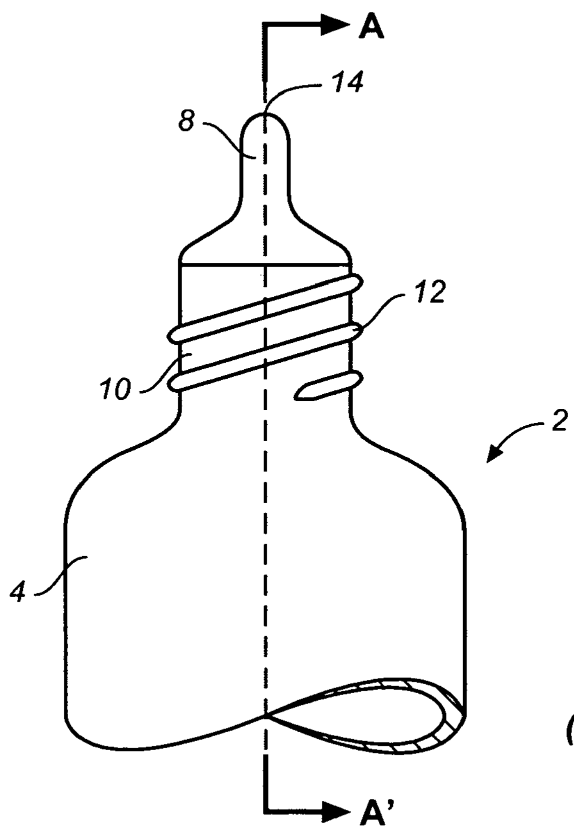

FIG. 2
(PRIOR ART)

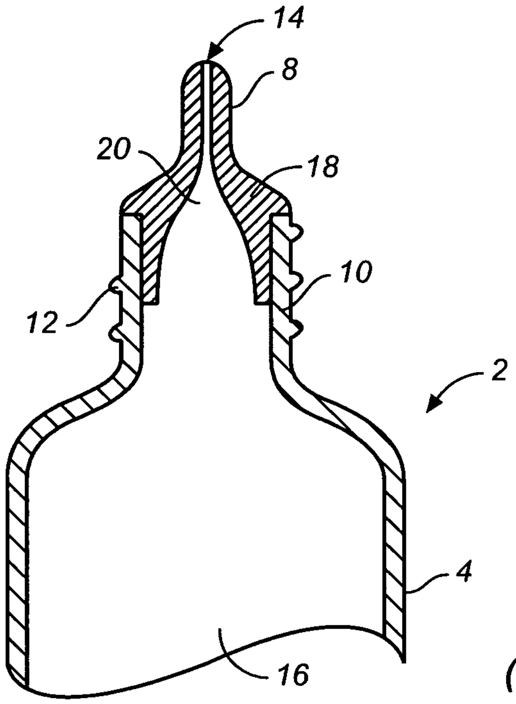

FIG. 3
(PRIOR ART)

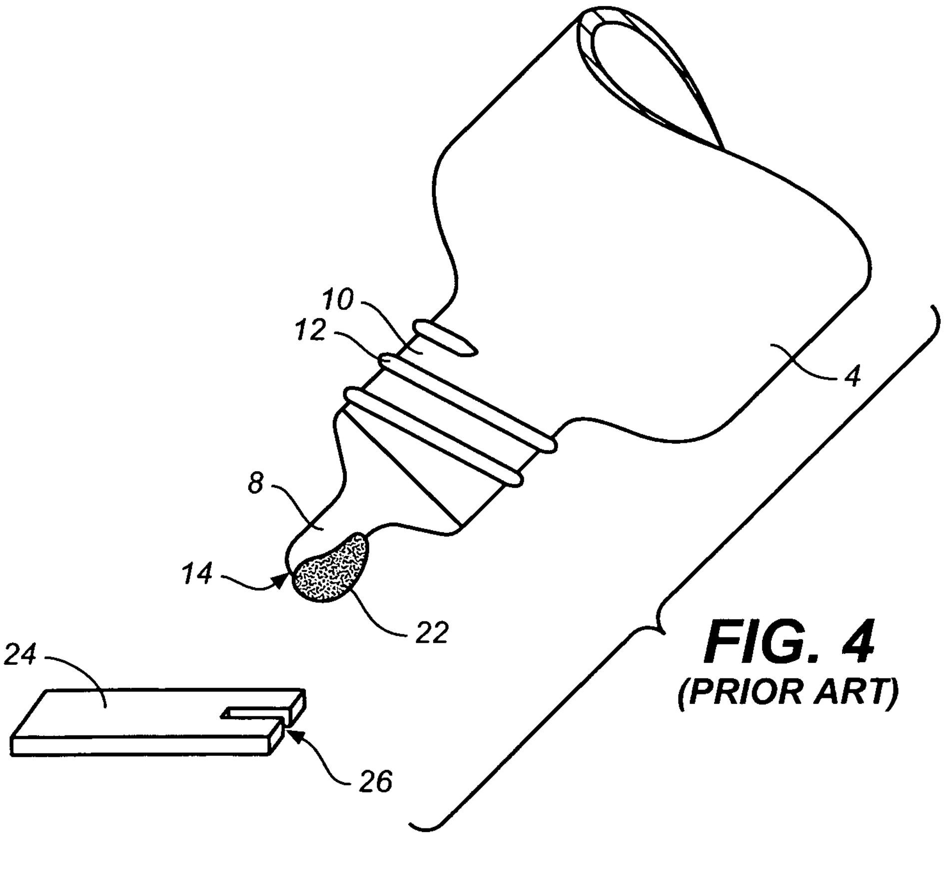

FIG. 4
(PRIOR ART)

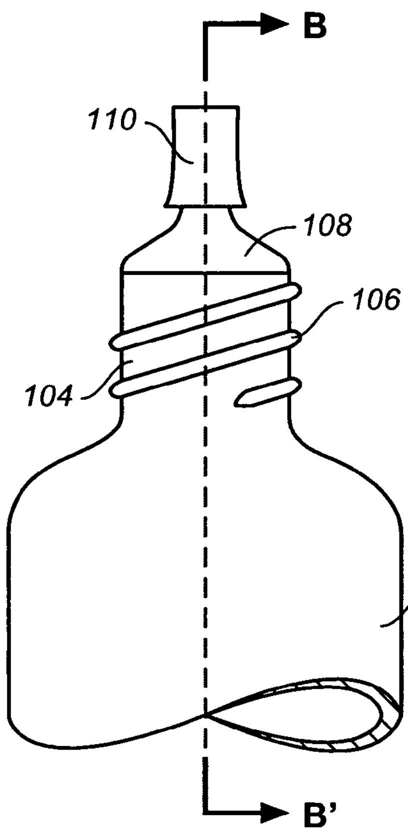

FIG. 5

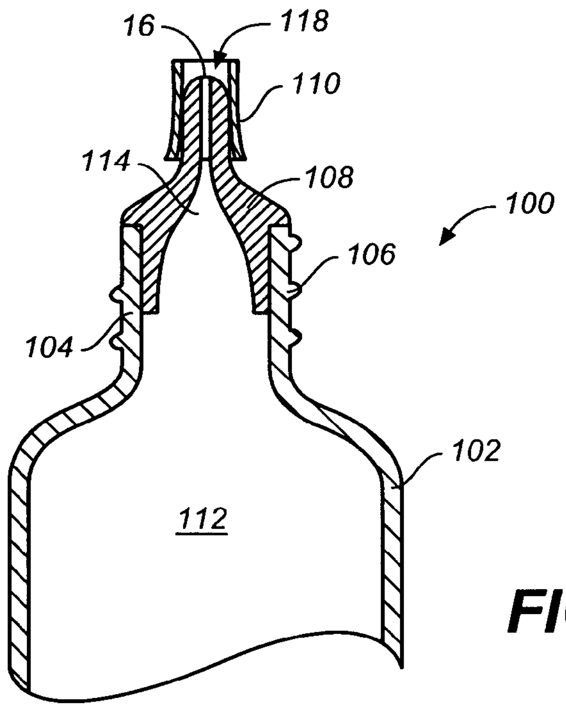

FIG. 6

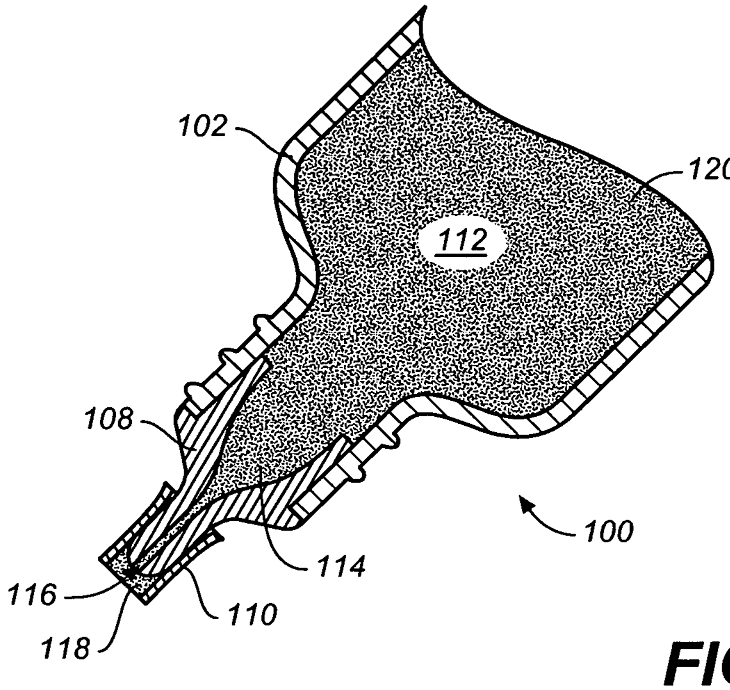
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FIG. 7

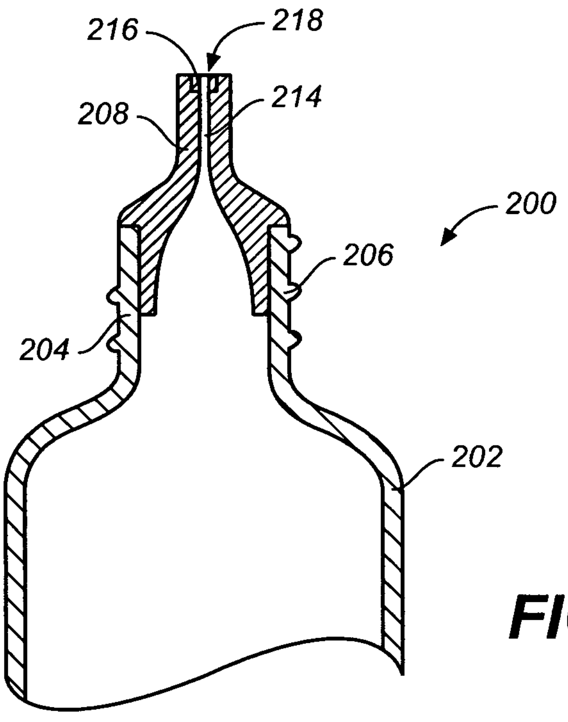
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FIG. 8

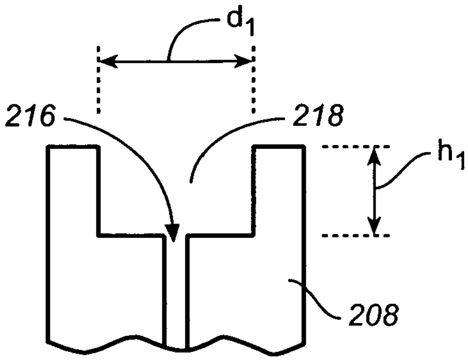

FIG. 9

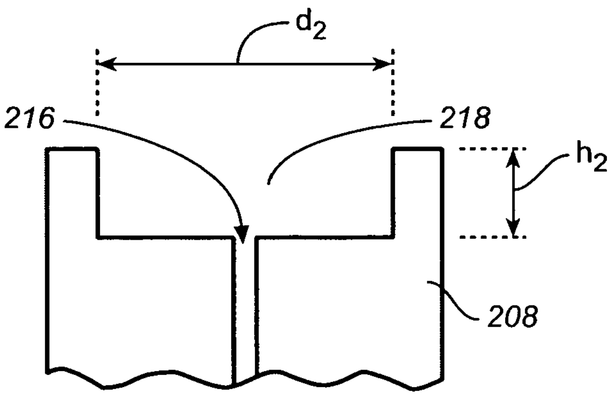

FIG. 10

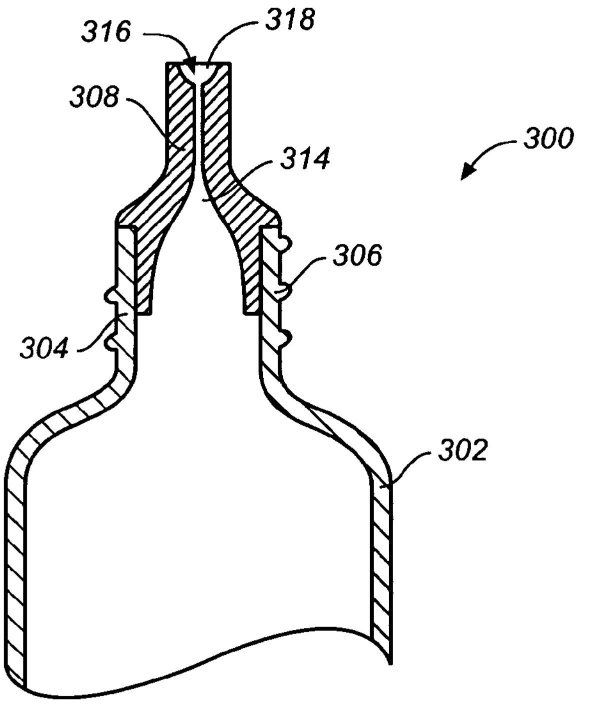

FIG. 11

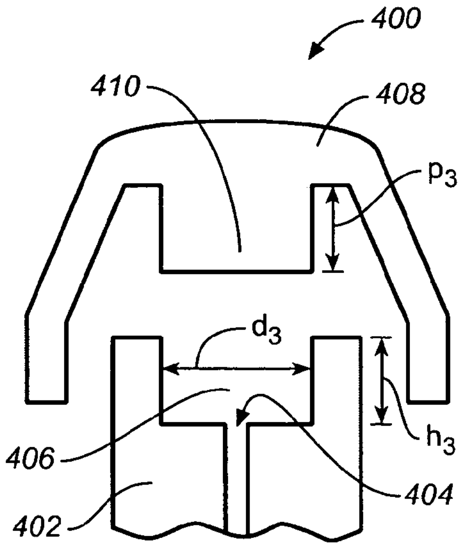

FIG. 12

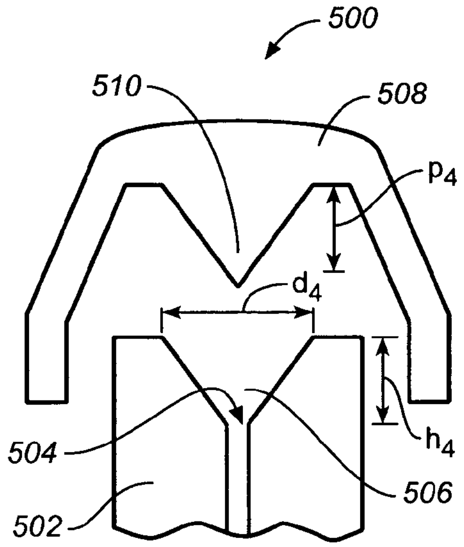

FIG. 13

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EUROPEAN SEARCH REPORT

Application Number
EP 08 25 3380

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	29 January 2009	Smith-Hewitt, Laura

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