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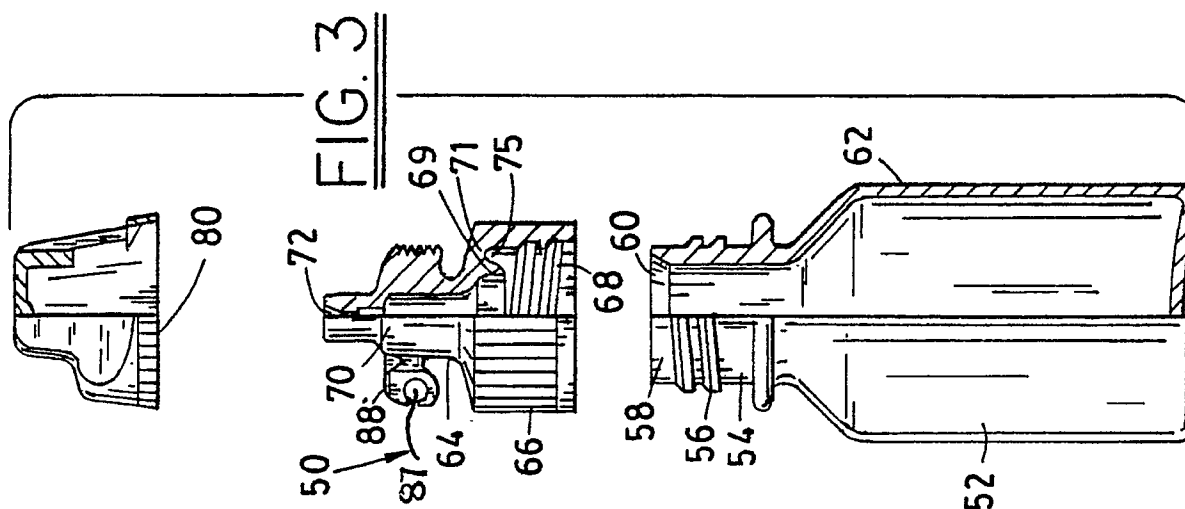
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(54) **Dropper bottle assembly.**

(57) The present invention is directed to a dropper bottle assembly having a cap 80 that is rotatably mounted to the neck portion 54 of the bottle 52. In one embodiment a flexible indexing finger 94 (see

Figure 9) is provided to lock the cap in the closed position. In another embodiment the cap is provided with a projection 96 (see Figure 9) for sealing the dispensing outlet of the nozzle.



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The present invention is directed to a dropper bottle assembly used to dispense liquids.

BACKGROUND OF THE INVENTION

Dropper bottle assemblies are used to dispense a variety of liquids, typically one drop at a time. For example, the dispensing of a liquid reagent used in laboratories, dispensing eye medication, dispensing ear medication, or in any other environment where dispensing of a liquid in controlled drop increments is desired.

A typical prior art bottle assembly comprises a plastic bottle, a nozzle or spout section which is snap fit into the bottle and a cap which is threaded onto the bottle. Liquid is dispensed one drop at a time by squeezing the bottle so as to force liquid out the end of the tip of the nozzle. Due to the construction of the bottle assembly, leakage is a problem during dispensing. An additional problem with this type bottle construction is that filling of the bottle by the liquid manufacturer requires a two-step assembly process. After, the bottle is filled with the appropriate liquid to be dispensed, the nozzle must first be snap fit onto the bottle and secondly, the cap must be threaded onto the bottle. This two step assembly process typically requires expensive capping equipment.

There also exists in the prior art dispensing bottles which comprises a plastic bottle upon which a dispensing plastic nozzle is threaded onto the bottle. A cap is also threaded onto the nozzle section.

A serious problem with both types of prior art bottle assemblies is contamination of the liquid to be dispensed. In many instances, such as in laboratories and research centers, a variety of different liquid reagents are used simultaneously. Typically, these reagents are quite expensive and extremely sensitive to contamination. The caps of the bottles are typically taken completely off and placed on a bench and to be later returned to their respective bottles. The possibility exists that the a cap will be placed on a different bottle from where it was originally placed, thus resulting in cross contamination between different reagents. If recognized, these reagents should be discarded. However, if the user fails to recognize this cross contamination, the continue used of such reagents could result in faulty test results. In addition to cross contamination, great care is taken to avoid contamination of the cap or the nozzle that may be caused by the fingers of the user or by the surface upon which the cap is placed. In some instances, the user will attempt to hold the cap in his hand while also holding the bottle. This makes dispensing of a liquid cumbersome and presents the possibility of dropping the cap which can also result in

contamination.

Applicants have invented an improved dropper bottle assembly which minimizes or eliminates many of the problems of the prior art. A bottle assembly made in accordance with the present invention can be supplied to the liquid manufacturer such that the cap and nozzle are pre-assembled allowing for one step capping with conventional equipment. The bottle is designed to minimize leakage. Additionally the cap is designed to be permanently mounted to the nozzle to minimize potential contamination and permits simple one hand dispensing. A bottle according to the present invention provides further benefits as herein described.

SUMMARY OF THE INVENTION

In one aspect of the present invention, there is provided a plastic dropper bottle assembly for holding a liquid to be dispensed. The assembly includes a bottle having a neck portion that includes an externally threaded portion and an outer rim which defines an outlet of the bottle. The assembly further includes a plastic dispensing nozzle for engagement with the neck portion of the bottle. The nozzle is in fluid communication with the outlet of the bottle. The nozzle has an annular skirt having internal threads for engagement with the externally threaded portion of the neck portion and an outlet dispensing passage way for allowing liquid within the bottle to pass out of the nozzle. A plastic closure cap is rotatably mounted to the nozzle for rotation between a closed position and a dispensing position. Locking means is provided for securing the closure cap on the plastic dispensing nozzle in the closed position which comprises a plurality of teeth disposed on the outer surface of the nozzle and a flexible indexing finger formed on the closure cap designed to engage said teeth.

In another aspect of the present invention, there is provided a plastic dropper bottle assembly for holding a liquid to be dispensed. The assembly includes bottle having a neck portion that includes an externally threaded portion and an outer rim which defines an outlet of the bottle. A plastic dispensing nozzle is provided for engagement with the neck portion of the bottle. The assembly further includes a nozzle which is in fluid communication with the outlet of the bottle. The nozzle has an annular skirt having internal threads for engagement with the externally threaded portion of the neck portion and an outlet dispensing passageway for allowing liquid within the bottle to pass out of the nozzle. A plastic closure cap rotatably mounted to said nozzle is rotatable between a first closed position and a second dispensing position. Sealing means is provided for effectively preventing the

liquid passing through the passageway when the cap is in the closed position. The sealing means comprises a projection extending from the cap to engage the outlet port of the nozzle when the cap is in the closed position.

DESCRIPTION OF THE DRAWINGS

Embodiments of the invention will now be described by way of example with reference to Figures 3 to 21 of the drawings, of which Figures 1 and 2 illustrate the prior art. In the drawings:

Figure 1 is a front elevational exploded view, partially in cross section of a prior art dropper bottle assembly;

Figure 2 is a front elevational exploded view, partially in cross section of another prior art dropper bottle assembly made in accordance with the prior art;

Figure 3 is an exploded front elevational view, partially in cross section of a dropper bottle made in accordance with the present invention;

Figure 4 is a perspective view of the dropper bottle assembly illustrated in Figure 3 assembled and with the cap in the closed position;

Figure 5 is a perspective view of the cap and nozzle portion of the dropper bottle assembly illustrated in Figure 4 illustrating the cap in the opened position;

Figure 6 is a front elevational view of the nozzle of the dropper bottle assembly of Figure 3;

Figure 7 is a right side elevational view of Figure 6;

Figure 8 is a left side elevational view of Figure 6;

Figure 9 is a cross sectional view of the nozzle and cap of Figure 5 in the closed position;

Figure 10 is a cross sectional view similar to Figure 9 with the cap in the opened position;

Figure 11 is a top plan view of the cap of the bottle dropper assembly of Figure 9;

Figure 12 is a cross sectional view of the assembly of Figure 9 taken along line 12-12;

Figure 13 is a view similar to Figure 12 illustrating the cap in a deformed state illustrating the disengagement of the cap from the nozzle section;

Figure 13a is a greatly enlarged view of the cap and nozzle section of Figure 13 as outlined by line 13A-13A;

Figure 14 is a partial cross sectional view of a modified cap made in accordance with the present invention;

Figure 15 is a top plan view of yet another modified cap made in accordance with the present invention;

Figure 16 is a cross sectional view of the cap of Figure 15 taken along line 16-16;

Figure 17 is a partial perspective view of a modified nozzle section made in accordance with the present invention;

Figure 18 is an enlarged top view (similar to Figure 12) of the nozzle section of Figure 17 as it engages the cap;

Figure 19 is a side elevational view of Figure 18 as taken along line 19-19;

Figure 20 is a cross-sectional view of nozzle section taken along line 20-20 of Figure 18; and

Figure 21 is an enlarged cross sectional view of another modified nozzle section made in accordance with the present invention.

DETAILED DESCRIPTION OF THE INVENTION

Referring to Figure 1, there is illustrated a dropper bottle assembly 10 made in accordance with the prior art which comprises a bottle 12 having a nozzle 14 designed to snap fit within the neck portion 16 of bottle 12, and a cap 18 designed to fit over nozzle 14 and engage threaded portion 20 of neck portion 16. The nozzle 14 has a passageway 22 for allowing fluid within the bottle 12 to be dispensed through outlet 24. As is typical with such prior art bottle assemblies, the bottle 12, nozzle 14 and cap 18 are made of an appropriate plastic material. Liquid is dispensed by first removing cap 18 and then squeezing the cylindrical sidewall 26 of bottle 12 with one's fingers which causes liquid therein to pass through passageway 22. A problem encountered with such prior art devices is that fluid may leak between the nozzle portion 14 and bottle during dispensing. Further, the seal between the cap 18 and outlet 24 is generally inadequate when the cap is firmly secured on the bottle. Another disadvantage of this type of structure is that it requires a two step assembly for the product manufacturer after the bottle has been filled with the liquid to be dispensed, i.e., first the nozzle must be snap fitted onto the bottle and then the cap has to be threaded onto the bottle to complete the assembly. This type of construction also has serious contamination problems discussed later herein.

Referring to Figure 2, there is illustrated another bottle assembly 30 made in accordance with the prior art. The bottle assembly 30 comprises a bottle 32 having a dispensing nozzle 34 which is secured to the neck portion 36 by appropriate internal threads 38 in nozzle 34 which engage external threads 40 on neck portion 36. A cap 42 is secured to nozzle 34 by internal threads 44 which engage external threads 46 on nozzle 34. This type of construction, as with the other prior art assembly, is subject to serious contamination problems. Cross contamination may occur between several bottle assemblies being used at the same time as

the cap of one assembly may be inadvertently placed on the wrong bottle. Further, since the cap is typically completely removed and placed to rest on a supporting surface, the cap may be contaminated by the surface on which it is placed. If the user holds the cap in his hands, dispensing of the liquid becomes quite cumbersome as the user is typically also holding something in the same hand.

Referring to Figures 3-13 there is illustrated a dropper bottle assembly 50 made in accordance with the present invention. Dropper bottle assembly 50 comprises a molded plastic bottle 52 designed to hold a liquid to be dispensed, for example, reagents used in laboratories and research facilities. Bottle 52 may take any desired configuration as is typical for such bottles. It is to be understood that any desired liquid to be dispensed may be placed within the bottle 52. Bottle 52 includes a neck portion 54 having external threads 56 and an outer rim 58 which defines an outlet 60 of the bottle 52. In the particular embodiment illustrated, the bottle 52 is made of a low density polyethylene, however, the bottle 52 may be made out of any suitable plastic material. It is only necessary that the material of which the bottle is made be such that the sidewall 62 of bottle 52 is capable of being deflected so as to cause liquid to be dispensed therefrom.

The assembly 50 includes a molded plastic dispensing nozzle 64 (see Figures 3, 6, 7, 8 and 10) designed to engage neck portion 54 of bottle 52. In the particular embodiment illustrated, nozzle 64 is made of a high density polyethylene plastic, however, nozzle 64 may be made of any other suitable plastic material desired. Nozzle 64 includes an annular skirt 66 having internal threads 68 which are designed to engage the external threads 56 of neck portion 54. An annular sealing ring 69 is disposed within annular skirt 66 which extends from top wall 71 of skirt 66 and is spaced from the internal surface 73 so to provide an annular recess 75 to receive the rim 58 of bottle 52. The sealing ring 69 is sized, shaped and spaced from internal surface 73 so as to provide a seal between nozzle 64 and bottle 52. The plastic dispensing nozzle 64 further includes a dispensing section 70 which is in fluid communication with the outlet 60 of bottle 52. Nozzle section 70 includes a dispensing passageway 72 for allowing a liquid within bottle 52 to pass out of nozzle 64. In the particular embodiment illustrated, passageway 72 includes an axially inner section 74 having a substantially straight cylindrical opening having a diameter D of about .010 inches (.0254 cm) and an axially outer section 76. The outer section 76 starts with a diameter D adjacent the inner section 74 and increases as it approaches the outer dispensing end 78 of passageway 72. In the preferred embodi-

ment illustrated, the outer section 76 has a substantially conical configuration. However, the present invention is not so limited.

The dropper bottle assembly 50 includes a molded plastic closure cap 80 (which is best seen in Figures 3, 4, 5, 9 and 11) which is mounted on plastic nozzle 64 to be rotatable about a fixed point. In the particular embodiment illustrated the cap 80 is rotatably mounted to plastic nozzle 64 by a pair of axially aligned substantially cylindrically shaped projection 86 molded in cap 80 which rotate in circular opening 87 formed in a substantially C-shaped retaining member 88 which is integrally molded as a part of nozzle 64. The member 88 is designed to be substantially rigid so as to resist any substantial deformation that may result from the cap 80 being placed in the closed position. Member 88 has a width W, thickness t, and a configuration designed so that it can be integrally molded as part of nozzle 64. The opening 87 in member 88 is preferably slightly smaller than projection 86 so as to provide a Friction Fit which will permit the cap 80 to be positioned at any point along its path of rotation. However, it is to be understood that alternative locking means may be provided to maintain the cap in the open dispensing position as illustrated in Figure 10, for example, through the use of indexing projections (not shown) between cap 80 and nozzle 64. This would allow positive positioning of cap in any position along its path of rotation. Figure 9 illustrates the cap 80 in the closed (locked) position whereas Figure 10 illustrates the cap 80 in the open (dispensing) position.

The cap 80 is a separate integrally molded part. The configuration of projections 86 and retaining member 88 allows easy installation of cap 80 to nozzle 64. The flexibility of projections 86 and member 88 allows cap 80 to be mounted to nozzle 64 by simply pushing cap 80 on nozzle 64 so as to snap projections 86 into opening 87. Therefore the cap 80 is easily captured on to nozzle 64, avoiding the necessity of completely removing cap 80 and preventing contamination thereof. This also allows easy use of the bottle during dispensing.

The dispenser bottle assembly 50 includes locking means for securing said closure cap 80 on plastic nozzle 64 in the closed position. In the particular embodiment illustrated the locking means comprises a plurality of vertically aligned locking teeth 90 disposed on the outer surface of projection 92 which is integrally formed in nozzle 64. The projection 92 has a height h and width W1 which allows it to be integrally molded as a part of nozzle 64. The teeth 90, in the particular embodiment illustrated, have a pitch P of about .025 inches (.0635 cm), however, pitch P may be selected to any desired increment. The teeth 90 are oriented in

a substantially horizontal direction as illustrated in Figure 7. Cap locking means further includes a flexible indexing finger 94 which is designed to engage teeth 90. Indexing finger 94 is preferably integrally formed with cap 80 as illustrated, and comprises a first substantially vertical section 95 which extends from the lower rim 97 of cap 80 and a substantially radially extending section 99 directed toward the center of cap 80. In the preferred embodiment illustrated, cap 80 has an opening 101 (see Figure 4) formed therein which substantially surrounds finger 94. It is important that cap 80 be made of an appropriate plastic material to allow flexibility and durability of cap 80 and finger 94 so as to allow repeated flexure without damage to finger 94 or taking a permanent set. Applicants have found that polycarbonate or acetal will provide the desired performance.

In order to secure the cap 80 on plastic nozzle section 64, the cap 80 is rotated to the position illustrated in Figure 9 which causes the inner end 102 of radially extended section 99 of index finger 94 to slide down over teeth 90 and seat into one of the appropriate spaces provided between teeth 90. Thereafter the cap 80 is released and held in position by the indexing finger 94 engaging the adjacent tooth.

In order to release or disengage the cap 80 from its locked position from plastic nozzle section 64, a substantially axial force is applied to cap 80 as indicated by arrow 98 in Figures 13 and 13A to cause the cap 80 to flex a sufficient amount so as to cause indexing finger 94 to axially slide past the side 100 of teeth 90. This will disengage the indexing finger 94 from the locking teeth 90. Since a sliding action is used to disengage the index finger 94, the force required is substantially dependant upon the resistance to the axial movement and is relatively independent of the amount of locking force being applied to the finger 94 in the vertical direction. Indexing finger 94 is designed such that when in the normal unengaged position, its inner end 102 extends radially inward of the bottom of teeth 90 (see Figure 13a). Once the indexing finger becomes disengaged it will be positioned inward of teeth 90 a distance d, as illustrated in Figure 13a. Thus, once finger 94 is disengaged, the cap 80 will not automatically re-lock. The cap 80 must be rotated back upwards and then brought back down to re-engage finger 94 as previously discussed. During dispensing of a liquid, the cap 80 is rotated to the position illustrated in Figure 10. This avoids the necessity of placing the cap 80 on a bench or holding it during dispensing, which mining potential contamination problems of prior art bottles while still maintaining a high ease of use.

The bottle assembly 50 is further provided with means for sealing the outer dispensing end 78 of

passageway 72. In the particular embodiment illustrated, this is accomplished by providing a projection 96 within the interior of the cap 80 and positioned such that it will engage the outer dispensing end 78 of passageway 72. In the preferred embodiment illustrated, the projection 96 is substantially hemispherical or dome shaped such that it will engage the substantially conical surface provided in the outer section 76 of passageway 72 so as to provide an annular seal therebetween. It can be seen as the cap 80 is rotated in the locked position the projection 96 engages the outer dispensing end to form a sealing engagement therewith. The cap 80 is made of a flexible plastic material so as to provide substantially constant force against the outer surface of the outer section 76 when the cap is in the locked position. Typically a sealing force of about 10 pounds is applied when the cap 80 is in the locked position.

Referring to Figure 14 there is illustrated a partial cross sectional view of a modified cap 120 made in accordance with the present invention. The cap 120 is provided with an alternative sealing means for engaging axially outer section 76 of nozzle 64. In this particular embodiment a flexible projection 122 is provided which is made of an appropriate elastomeric or rubber material which is capable of greater deformation (as opposed to the relatively harder rigid plastic material of the cap or nozzle) so as to better conform to and seal with outer section 76. The projection includes an elongated retainer section 128 which is press fit into an opening 124 in cap 120. The outer end 126 is substantially bulbous shaped so as to assist in retaining projection 122 onto cap 120. However, the projection may be secured to cap in any desired manner, for example by the use of an adhesive or other mechanical locking arrangement.

Referring to Figures 15 and 16 there is illustrated yet another modified cap 130 made in accordance with the present invention. In this embodiment a flexible projection 136 is molded in cap 130. An opening 134 extends around projection a distance so as to form a flexible connecting portion 132. In the particular embodiment illustrated opening 134 extends about 300° around projection 136. When the cap 80 is placed in the locked position, the flexible nature of projection 136 allows it to set within outlet 78 to form a sealing engagement with outer section 76.

Referring to Figures 17-20, there is illustrated a modified nozzle and cap assembly made in accordance with the present invention, like numerals referring to identical parts, previously discussed. In this embodiment, there is provided a nozzle 164 which is designed to engage the neck portion 54 of bottle 52 in the same manner as nozzle 64. The locking means for securing cap 180 to nozzle 164

operates in the same general manner as that illustrated in Figures 9-13 except that a greater number of locking positions are provided. In this embodiment, a pair of spaced projections 150, 151 are molded on the exterior of nozzle 164. Each projection 151, 151 has a plurality of teeth 154 having a pitch P. The teeth 154 of projection 150 are disposed approximately midway between the teeth 154 of projection 151 as illustrated in Figures 19 and 20. In the particular embodiment illustrated, teeth 154 of projection 150 are staggered with respect to teeth 151 of projection 156 by a distance h which is about one half of pitch P. Cap 80 includes a pair of independent indexing fingers 160, 161 which are designed to engage teeth 154 of projections 150, 151, respectively, in the same manner as indexing finger 94 engages teeth 90.

Cap 180 is secured to nozzle 164 in the same manner as cap 80 is secured to nozzle 64. The cap 180 in the closed position is rotated to the position illustrated in Figure 20. Indexing fingers 160, 161 slide over teeth 154 of projection 150, 151, respectively. How far the cap can be pushed down will determine which indexing finger 160 or 161 will engage teeth 154 so as to secure the cap 180 in the locked position. By providing two spaced rows of teeth 154, the size and pitch of the teeth can remain sufficiently large so as to provide a secure engagement between the indexing finger and adjacent tooth. As the cap is pressed down, either indexing finger 160 or 161 will provide the locking means while the other indexing finger will slide down on the adjacent tooth as illustrated by dash lines in Figure 20.

The cap 180 is disengaged from nozzle 164 in the same general manner as cap 80 is disengaged with nozzle 64. The cap 180 is deformed so that indexing finger 160 and 161 slide past the side 170 of the projection 150, 151. The indexing fingers 160, 161 will go forward toward nozzle 164 in the same manner as indexing finger 94 so as to prevent re-engagement with the adjacent teeth. The space D between projections 150, 151 is greater than the width W of indexing fingers 160, 161 so that they can easily disengage the adjacent tooth 154. In the particular embodiment illustrated, cap 180 is separated between indexing finger 160, 161 so as to allow free independent movement.

Referring to figure 21, there is illustrate an enlarged partial cross sectional view of a nozzle 264 also made in accordance with the present invention. Nozzle 264 is similar to nozzle 64, like numerals indicating like parts, except that the dispensing section 70 has been slightly modified. In particular, the outer tip 270 adjacent outlet 272 has been configured so as to provide greater compliance to provide better sealing relationship with projection 96 in cap 80 when the cap 80 is placed

in the closed position. Dispensing passageway 76 comprises four (4) discrete sections which assist in accurately controlling of the dispensing of individual drops. Passageway 76 has an inner section 280 having a diameter D1, and length L1. In the particular embodiment illustrated, L1 is about .010 inches (.254 cm) and D1, is about .010 inches (.254 cm). Adjacent inner section 280 is a first conical transition section 282 which increases to a diameter D2 and has a length L2. In the embodiment illustrated diameter D2 is .047 inches (.119cm) and L2 is about .032 inches (.0813cm). Adjacent outer end of conical transition section 282 is disposed is a second conical section 284 which has a diameter D3 at its outer end and a length L3. A fourth outer section 286 is disposed adjacent second conical section 284 to form outlet 272 having a diameter D4. In the particular embodiment illustrated D3 is about .060 inches (.152cm), L3 is about .184 inches (.467cm), D4 is about .110 inches (.279 cm), and L4 is about .043 inches (.109cm). It is of course understood that the values for the tip dimensions may be varied as desired. Fourth outer section 286 has an conical surface 288 which forms an angle α with respect to the longitudinal axis X-X of passageway 76. In the particular embodiment illustrated, α is about 30 degrees. However α may be varied as desired. Preferably it is no more than about 45 degrees. Tip 270 adjacent outlet 272 has a thickness T1. The tip 270 has an outer surface 290 disposed at an angle β so that tip 270 increases to a thickness T2 at a length L5. In the particular embodiment illustrated, T1 is about .005 inches (.0127 cm), T2 is about .042 inches (.1067 cm) and L5 is about .030 inches (.0762 cm). The values for T1, T2, and L3 are selected such that tip 270 is sufficiently compliant so as to conform to projection 96 in cap 80 so as to assist in providing a liquid tight seal there between. The material selection will of course also affect the selection of T1, T2, and L3 to obtain the desired compliance. In the particular embodiment illustrated nozzle 264 is made of a high density polyethylene. The thickness of nozzle 264 goes to T3 at the lower end of tip 270 so as to provide the desired rigidity for the remaining portion of nozzle 264. In the particular embodiment illustrated T3 is about .049 inches (.229 cm), however, T3 may be varied as desired to provide the degree of rigidity desired.

It is, of course, to be understood that various changes and modifications may be made without departing from the scope of the present invention. For example, but not by way of limitation, the flexible indexing finger may be molded in the nozzle and the corresponding teeth may be formed on the internal surface of the cap.

Claims

1. A dropper bottle assembly comprising:
 - a plastics bottle for holding a liquid to be dispensed, said bottle having a neck portion that includes an externally threaded portion and an outer rim which defines an outlet of the bottle;
 - a plastics dispensing nozzle for engagement with said neck portion of said bottle, said nozzle being in fluid communication with said outlet of said bottle, the nozzle having an annular skirt having internal threads for engagement with said externally threaded portion of said neck portion and an outlet dispensing passageway for allowing liquid within said bottle to pass out of said nozzle;
 - a plastics cap rotatably mounted to said nozzle between a first closed position and a second dispensing position; and
 - locking means for securing said closure cap on said plastic dispensing nozzle in said first closed position.
2. A dropper bottle assembly according to claim 1, wherein said plastics cap is rotatable about a fixed point.
3. A dropper bottle assembly according to claim 1 or 2, wherein said locking means comprises a plurality of teeth disposed on said nozzle or said cap and an indexing finger formed on the other of said cap and said nozzle designed to engage said teeth.
4. A dropper bottle assembly according to claim 3, wherein said teeth are disposed on the outer surface of said nozzle.
5. A dropper bottle assembly according to claim 3 or 4, wherein two substantially vertical rows of teeth spaced axially apart are provided, said teeth in one row being staggered with respect to said teeth on the other row so as to provide a plurality of different locking positions.
6. A dropper bottle assembly according to any preceding claim, further comprising sealing means for effectively preventing liquid from passing through said dispensing passageway when said cap is in the closed position.
7. A dropper bottle assembly comprising:
 - a plastics bottle for holding a liquid to be dispensed, said bottle having a neck portion that includes an externally threaded portion and an outer rim which defines an outlet of the bottle;
 - a plastics dispensing nozzle for engagement with said neck portion of said bottle, said nozzle being in fluid communication with said outlet of said bottle, the nozzle having an annular skirt having internal threads for engagement with said externally threaded portion of said neck portion and an outlet dispensing passageway for allowing liquid within said bottle to pass out of said nozzle;
 - a plastics cap rotatably mounted to said nozzle between a first closed position and a second dispensing position; and
 - sealing means for effectively preventing liquid passing through said passageway when said cap is in the said closed position.
8. A dropper bottle assembly according to claim 7, wherein said plastics cap is rotatable about a fixed point.
9. A dropper bottle assembly according to claim 6, 7 or 8, wherein said sealing means comprises a projection formed in said cap designed to engage said outlet dispensing passageway of said nozzle.
10. A dropper bottle assembly according to claim 9, wherein said projection in said cap has a substantially hemispherical configuration.
11. A dropper bottle assembly according to any of claims 6 to 10, wherein said sealing means comprises an elastomeric projection secured to said cap.
12. A dropper bottle assembly according to any of claims 9 to 11, wherein an opening is placed in said cap which extends around a portion of said projection so as to increase its flexibility.
13. A dropper bottle assembly according to any of claims 9 to 12, wherein said plastics dispensing nozzle has a dispensing tip having a configuration so that said tip will be compliant so as to conform to said projection formed in said cap.
14. A dropper bottle assembly according to any preceding claim, wherein said outlet dispensing passageway includes an inner substantially straight section and an outer section which increases in cross sectional width.
15. A dropper bottle assembly according to claim 12, wherein said outer section has a substantially conical configuration.
16. A dropper bottle assembly according to any preceding claim, wherein said plastics cap is

rotatably mounted to said nozzle by a pair of substantially cylindrical axially aligned projections which mate in a substantially circular opening formed in a projection formed in said nozzle.

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17. A dropper bottle assembly according to claim 16, wherein said projection in said nozzle has a substantially C-shaped configuration.

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18. A dropper bottle assembly according to any preceding claim, wherein said bottle is made of a low density polyethylene.

19. A dropper bottle assembly according to any preceding claim, wherein said nozzle is made of a high density polyethylene.

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20. A dropper bottle assembly according to any preceding claim, wherein said cap is made of a polycarbonate plastics material.

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21. A dropper bottle assembly according to any preceding claim, wherein said outlet dispensing passageway includes an inner substantially straight section which increases in cross sectional width.

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22. A dropper bottle assembly according to claim 21, wherein said outer section has a substantially conical configuration.

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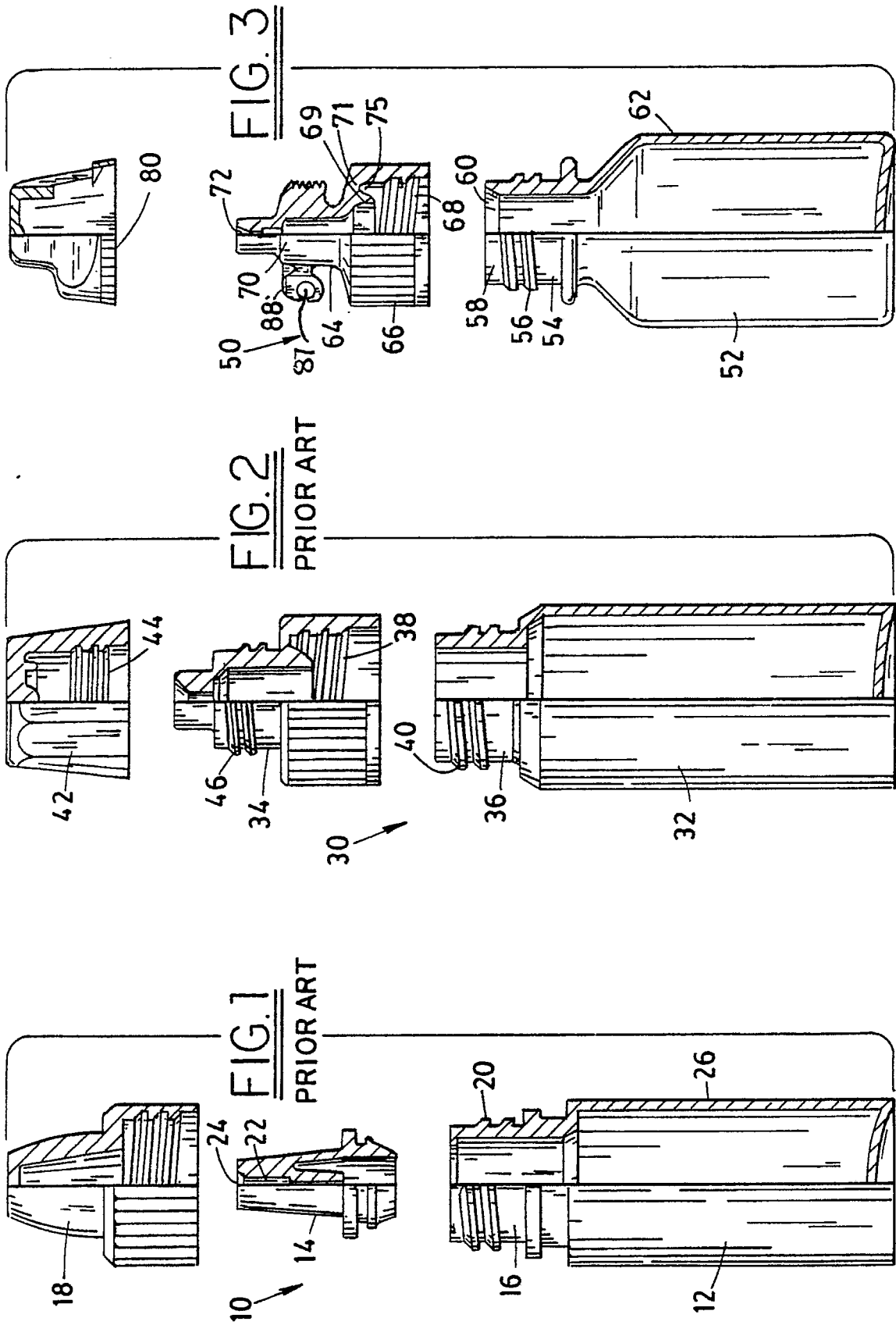
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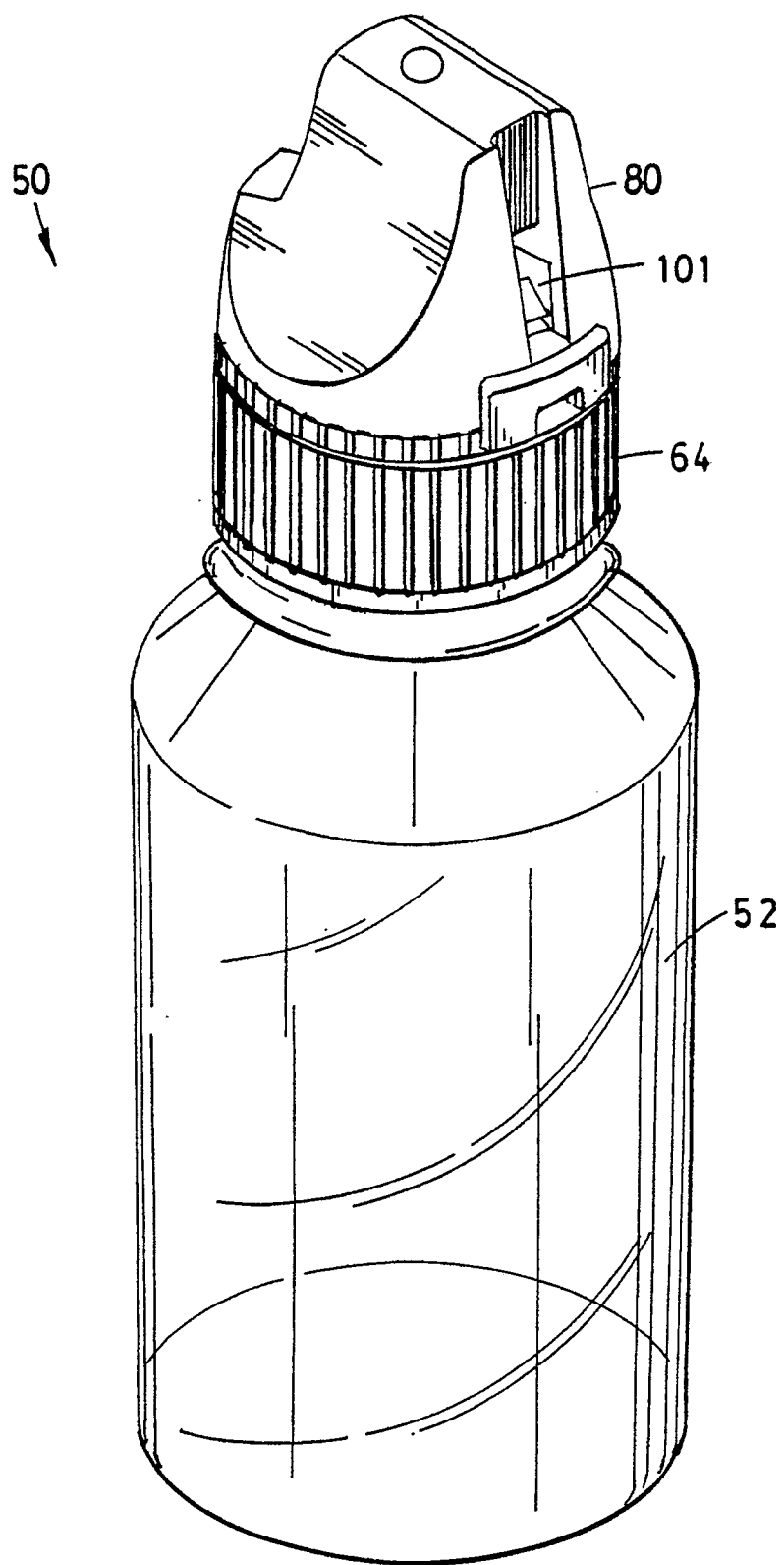


FIG. 4

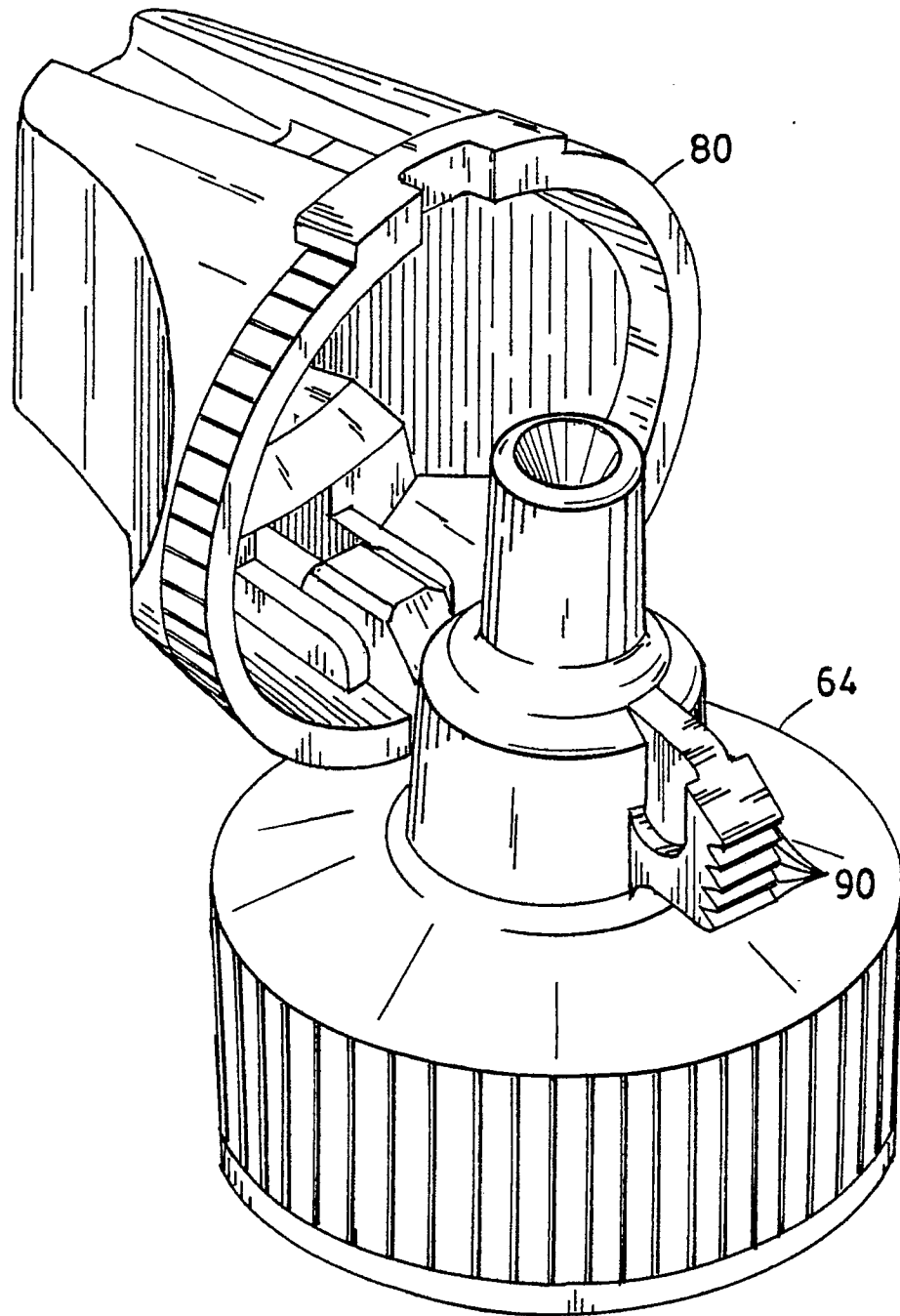
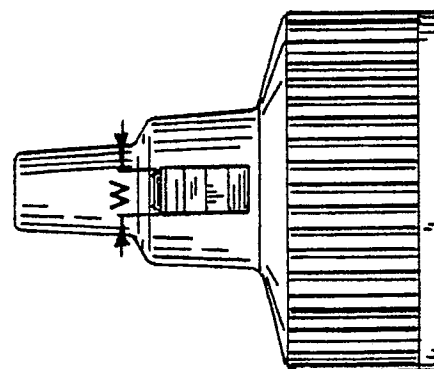
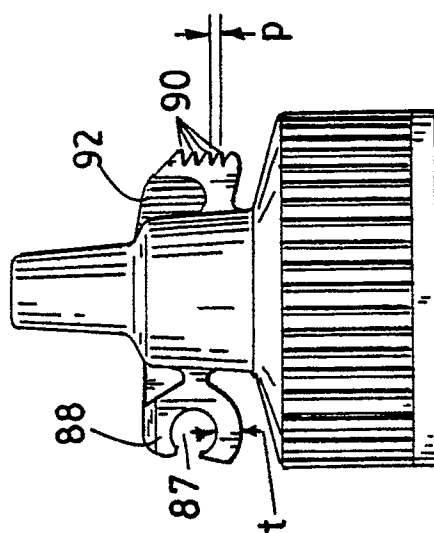
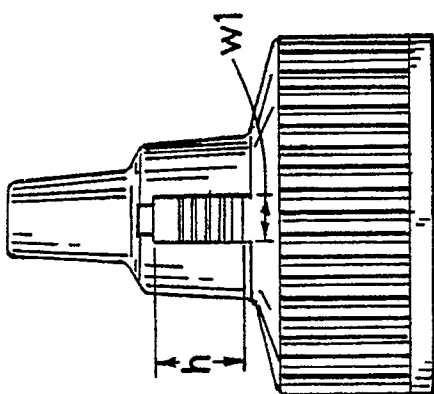


FIG. 5



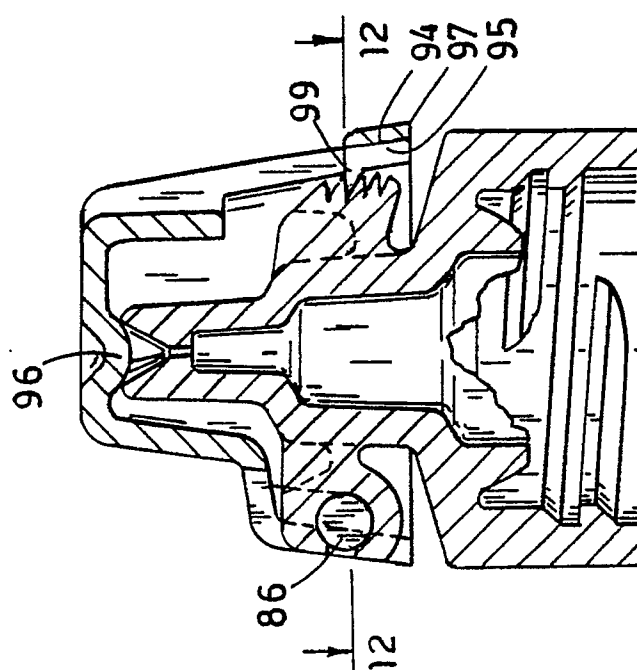


FIG. 9

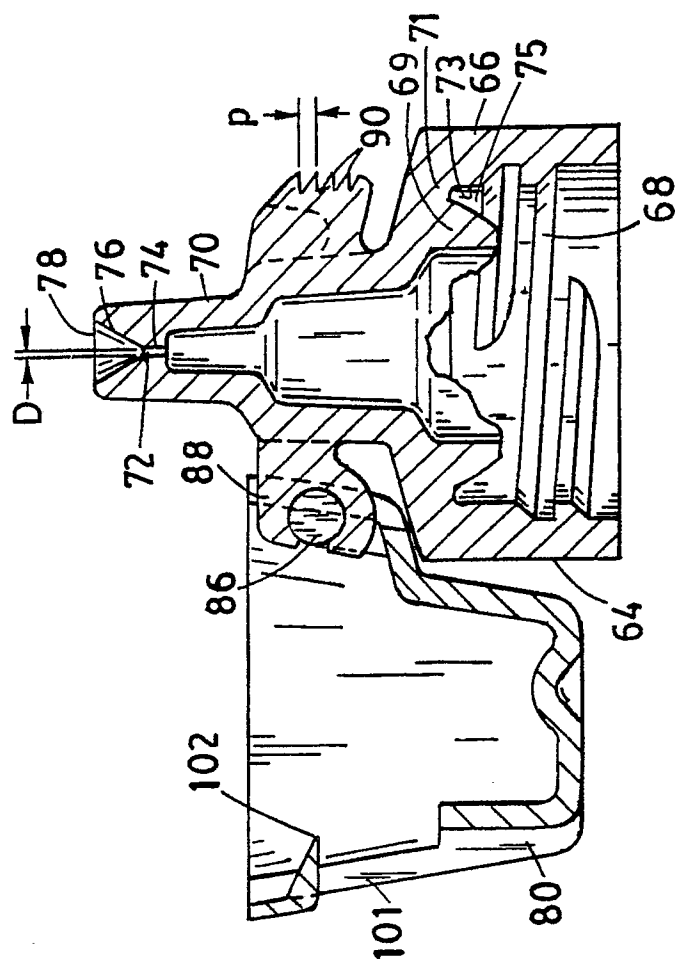


FIG. 10

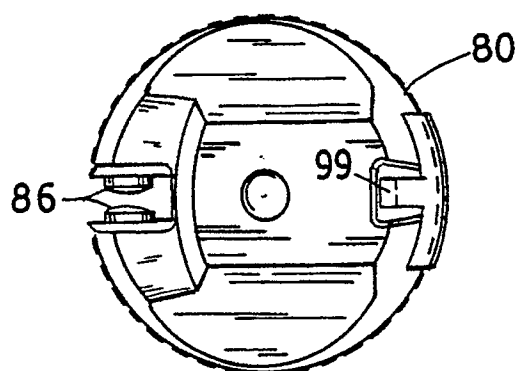


FIG. 11

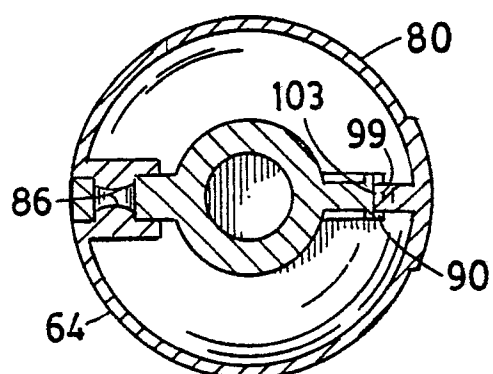


FIG. 12

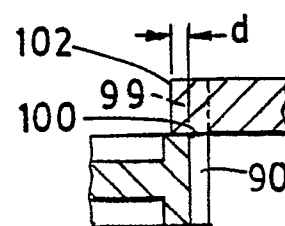


FIG. 13A

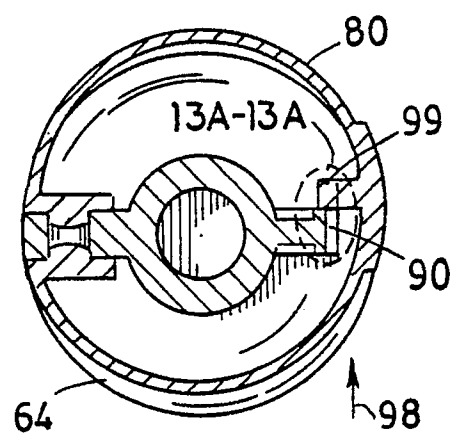


FIG. 13

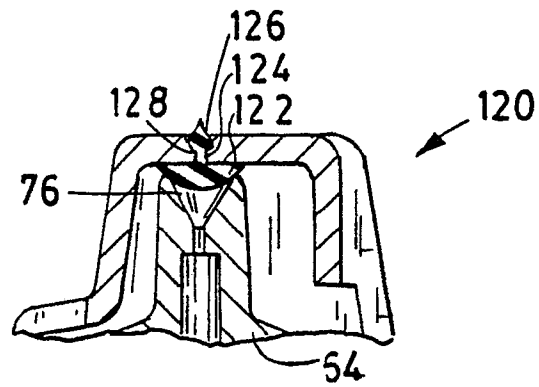


FIG. 14

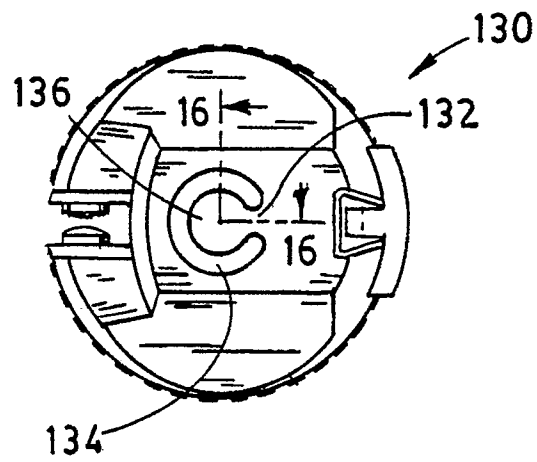


FIG. 15

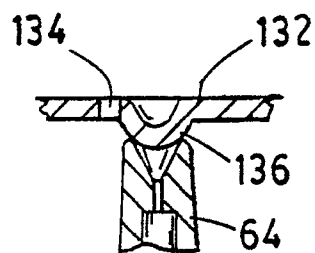


FIG. 16

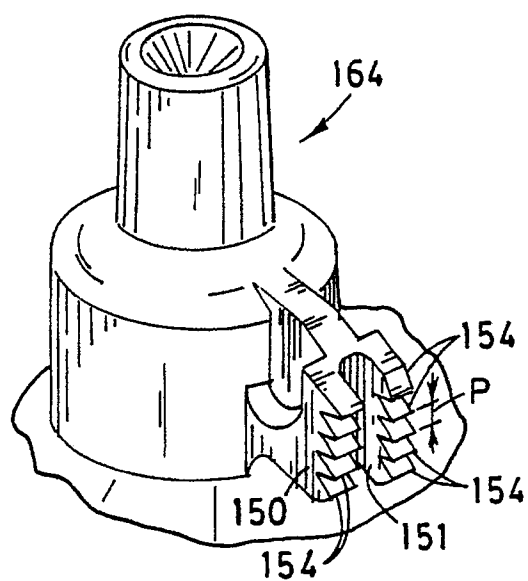


FIG. 17

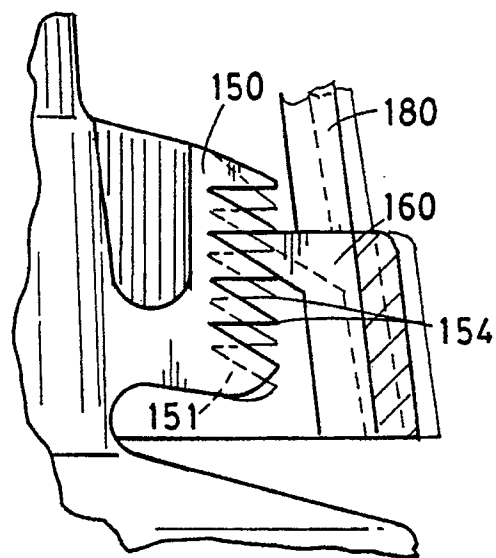


FIG. 20

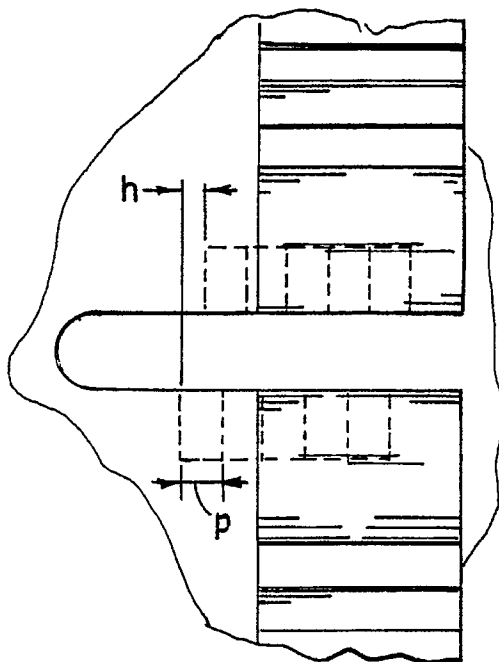


FIG. 19

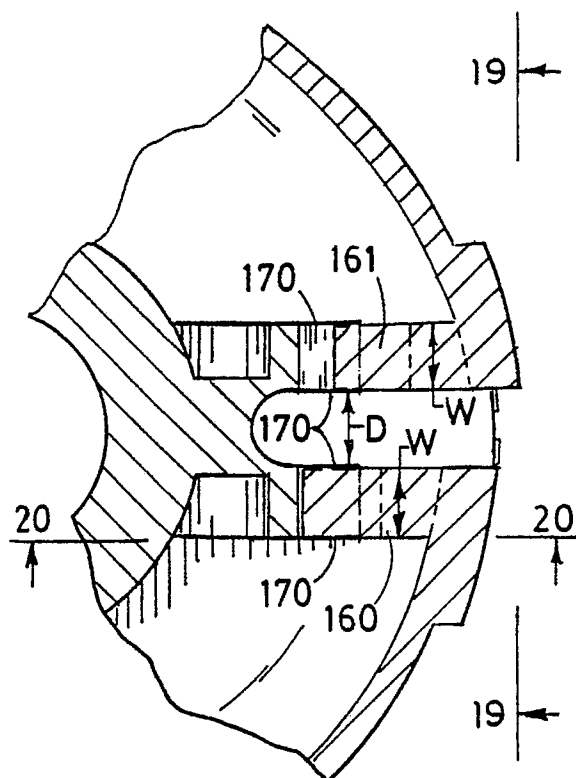


FIG. 18

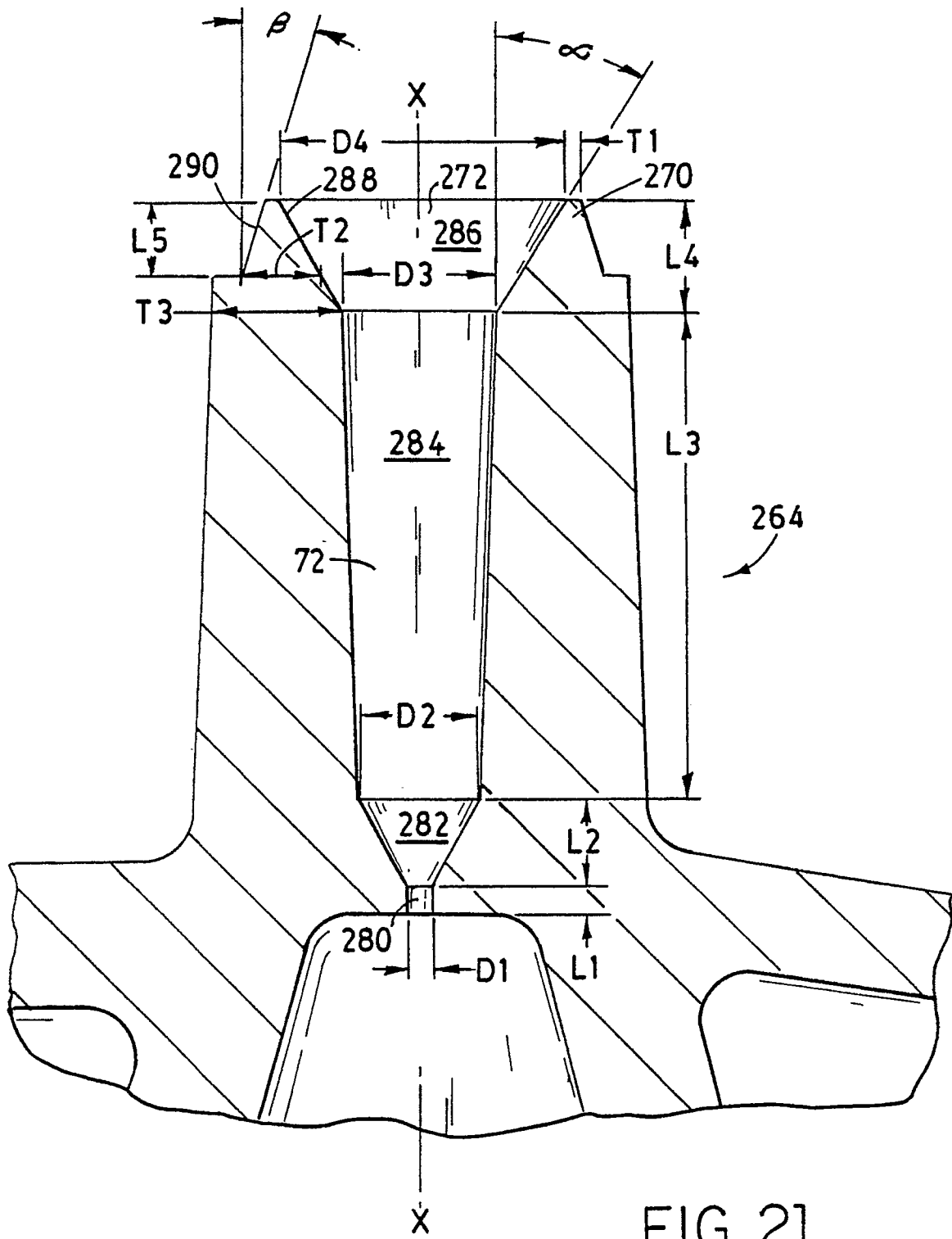


FIG. 21