

Sept. 23, 1958

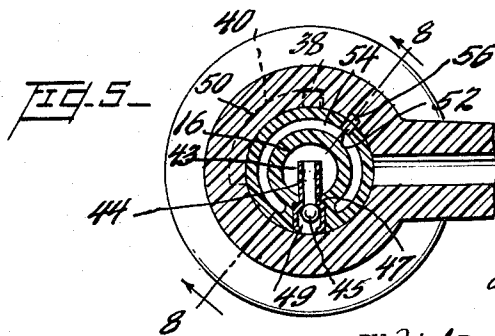
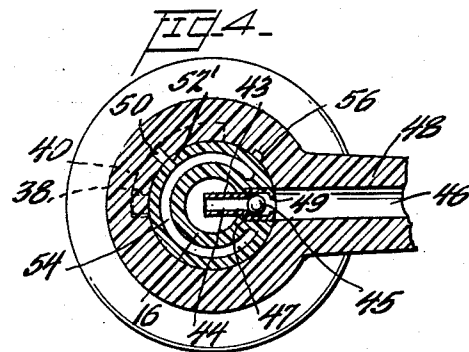
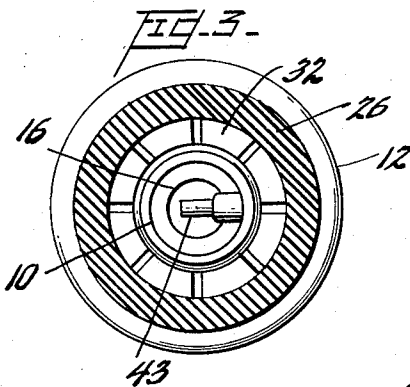
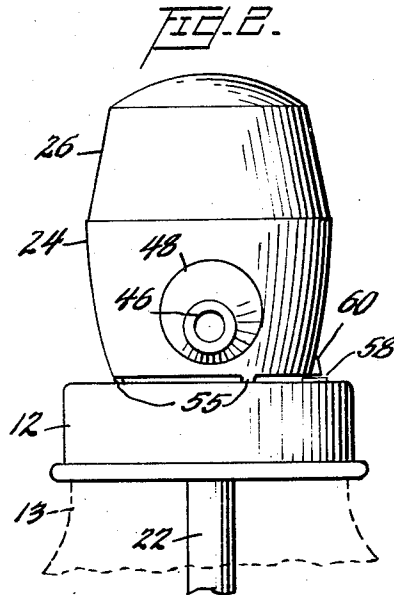
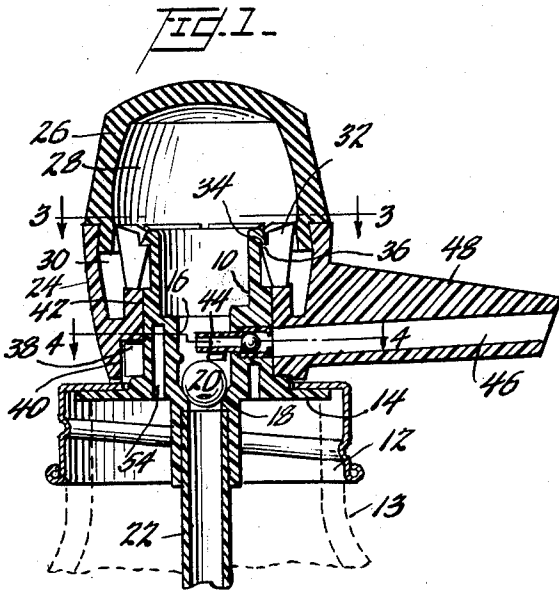
J. U. STEWART ET AL

2,853,210

SELF-SEALING INTERNALLY VENTED DISPENSER PUMP

Filed Nov. 13, 1956

2 Sheets-Sheet 1



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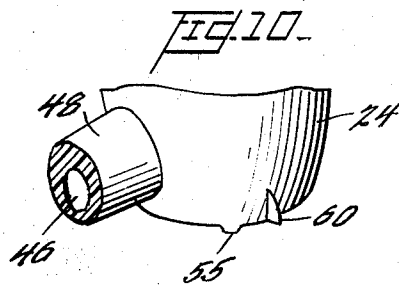
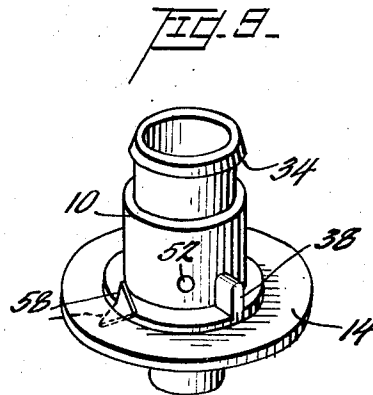
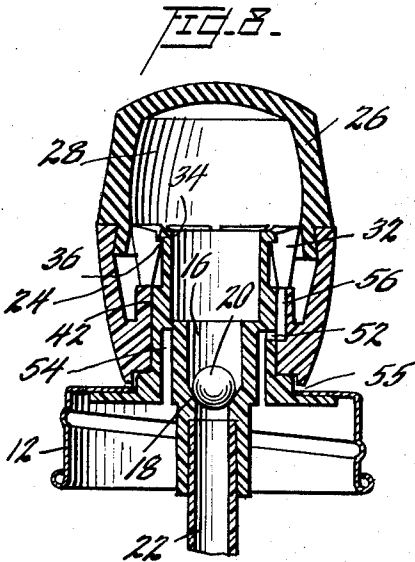
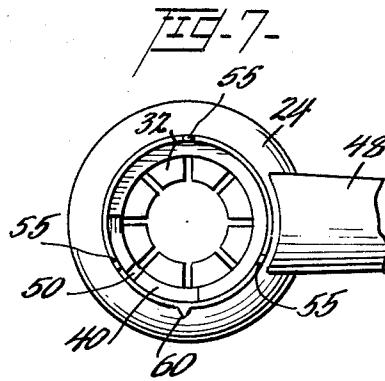
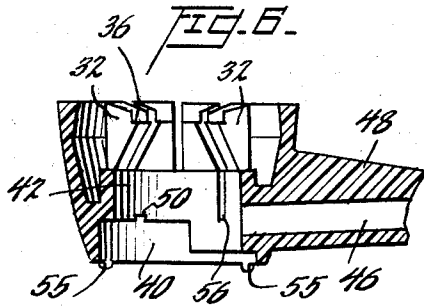
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2 Sheets-Sheet 2



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2,853,210

**SELF-SEALING INTERNALLY VENTED DISPENSER PUMP**

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Application November 13, 1956, Serial No. 621,961

11 Claims. (Cl. 222—207)

This invention relates to improvements in a self-sealing dispensing pump for liquid containers, such as is exemplified in our copending application Serial No. 569,459, filed March 5, 1956, entitled Dispenser for Liquids, now Patent No. 2,815,890, issued Dec. 10, 1957.

In such a pump, a generally cylindrical inner body is mounted in fluid tight relation in a container opening and is provided with a delivery passage therethrough adapted to communicate through a suction tube with the liquid contents of the container. An outer body which rotatably embraces the inner body includes a bulbous diaphragm cooperating with the bodies to define a variable volume pump chamber communicating with the said delivery passage, and with a discharge passage, both said passages being controlled by check valves to prevent back-flow of liquid.

The outer body is rotatable on the inner body between a dispensing position in which segments of said discharge passage and segments of a vent passage in the respective bodies are in registry, and a sealing position in which said segments of both passages are out of registry to close the discharge and vent passages.

It has been found that after such a pump has been used, if its said bodies are thereafter returned to sealing position, as for travelling, etc., this will entrap a certain amount of liquid in the pump chamber. While this is desirable from the standpoint of leaving the pump primed for future use, it involves the difficulty that flexing of the bulbous diaphragm while the pump is sealed (whether through inadvertence or through rough handling, etc.) will cause the relatively incompressible liquid in the pump chamber to tend to disconnect the diaphragm from its associated outer body. In addition, this may cause leakage of the liquid by forcing it at relatively high pressures between the several cooperating parts defining the pump chamber.

The present invention has been conceived with the foregoing in mind, and accordingly has for its primary object to provide the inner and outer bodies with segments of a return flow passage, independent of the delivery passage, positioned to register with each other in the sealed condition of the pump in order to return liquid from the pump chamber into the container. Thus inadvertent actuation of the diaphragm in the present invention will merely recycle the liquid from the container through the pump chamber and thence back to the container, without creating abnormal pressure within the pump chamber.

In accordance with the invention, the vent passage segment in the inner body may also be utilized, in the sealed condition of the pump, as one of the segments of the return passage above mentioned, whereby said segment may serve dual functions.

It is a further feature of the invention to form one of the segments of the return passage as a capillary tube or channel, whereby escape of the priming charge from the pump chamber due to the action of gravity is prevented, and the upward flow of fluid through said channel

is so restricted as to result in a substantial upward flow of fluid into the pump chamber through the comparatively unrestricted suction tube and delivery passage. Thus the cost of a check valve in said passage may be eliminated, while attaining the advantage thereof, although the presence of a check valve in the return passage is by no means precluded by the instant invention.

A further problem inherent in the structure of our earlier application consisted in that the sealing of the pump necessarily involved a closing off of the vent passages from the pump chamber. Therefore, upon application of the pump in sealed condition to a filled container, there was formed an air lock preventing entry of liquid into the suction tube.

By virtue of the novel structures aforementioned, the present invention eliminates such an air lock and vents the pump chamber so that air may be freely displaced therefrom to permit the liquid to rise to its natural level in said tube, whether the pump is applied in its sealed or unsealed condition. This materially shortens the subsequent travel of the liquid to the pump chamber.

A further important object of the present invention is to render the dispensing pump capable of "self-priming" incident to its partial or complete inversion during shipping, and also due to actuation of the pump by rough handling. It will be apparent that such object is readily attainable by the structure above mentioned, since the inversion of the filled container, at least in certain positions in which the return passage is higher than the delivery passage, will permit air to escape from the pump chamber to be replaced by liquid entering the chamber through the delivery passage, and actuation of the pump in sealed condition will circulate the liquid into and through the pump chamber as above mentioned.

It is a still further object to provide an indicator arm on the inner body in which said body and arm are integrally cast of a somewhat resiliently flexible material such as a polyethylene resin, with the free end of the arm directed upwardly whereby the body and arm may be readily inserted through the apertured bottle cap, and the arm thereafter swung downwardly about its connection to the inner body by application of the outer body thereto. Thus the arm when assembled will overlie the cap in radially outwardly projecting position for cooperation with a pointer or indicator on the outer body.

In this application there is shown and described only the preferred embodiment of the invention, simply by way of illustration of the preferred mode of carrying out the invention. However, it is realized that the invention is capable of other embodiments and that its several details may be modified in various ways without departing from the invention. Accordingly, the drawings and description herein are not to be construed as restrictive but merely as exemplary in nature.

In the accompanying drawings:

Figure 1 represents an enlarged central vertical section through a preferred exemplification of the invention as applied to the upper portion of a bottle, showing the parts of the pump structure in dispensing position;

Figure 2, a side elevation of the structure shown in Figure 1;

Figure 3, a section on the line 3—3 of Figure 1;

Figure 4, a section on the line 4—4 of Figure 1;

Figure 5, a view similar to Figure 4, but with the outer body rotated from the dispensing position of Figure 4 to its sealing position;

Figure 6, a vertical axial section through the outer body member;

Figure 7, a bottom plan view of the structure of Figure 6;

Figure 8, a section on the line 8—8 of Figure 5;

Figure 9, a perspective view of the inner body showing

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the normal position of its indicator hand in full lines, and the assembled position thereof in broken lines;

Figure 10, a fragmentary perspective view of the outer body.

Referring now in detail to the accompanying drawings, it will be seen that the invention is applied to a dispensing pump such as disclosed in our copending application Serial No. 569,459, filed March 5, 1956. Such a pump comprises a substantially cylindrical inner body 10 adapted for mounting in sealed relation within the outlet opening of a container. As illustrated, the inner body 10 projects upwardly through a centrally apertured bottle cap 12 of the type which is adapted to be screwed onto the externally threaded neck of a usual bottle 13. A radial flange 14 of the inner body projects radially beyond the edges of the aperture and engages the lower face of the cap. This flange 14 is proportioned to rest upon the neck of the bottle and to be clamped thereagainst by the cap, as the latter is threaded onto the bottle neck. Thus the flange 14 and its associated cap 12 exemplifying one means for positioning the inner body 10 in fluid tight relation in the container opening.

Extending axially through the inner body 10 is a delivery passage 16 formed with an enlarged diameter upper portion to define an upwardly directed shoulder or seat 18 for a usual ball check valve 20 which prevents backflow of fluid toward the container. At its lower end, the passage 16 communicates with a usual suction tube 22 which depends into the liquid contents of the container.

Snugly journaled on the inner member 10 above cap 12 for angular movement between a dispensing position and a sealing position, is an outer body 24 having a flexible wall portion such as exemplified by the bulbous diaphragm 26. The outer body 24 with its said flexible wall portion cooperates with the inner body 10 to define a pump chamber 28 of variable volume communicating with the upper end of delivery passage 16.

Although the particular arrangement of the flexible wall portion 26 and its mode of association with the outer body 24 constitutes no part of the instant invention, these parts may conveniently be formed and assembled as taught in our aforesaid copending application. Thus the domelike flexible wall or bulbous diaphragm 26 may have its lower peripheral edge disposed in an upwardly opening annular slot 30 in the body or member 24 and clamped between the opposed sides of the slot by radial expansion of the radially deflectable fingers 32 collectively defining the annular inner wall of the slot. Such expansion of the fingers 32 is caused by the insertion upwardly therethrough of the inner body 10, the latter being formed to define a retainer flange 34 at its upper end beneath which the shouldered free end portions 36 of the fingers may slightly contract to secure the inner and outer bodies 10 and 24 as well as the flexible wall 26 in assembled relation. It will be noted that the container cap 12, being sandwiched between the assembled inner and outer bodies 10 and 24 forms therewith a prefabricated closure and pump unit for easy application to a container.

For limiting the relative angular movement between their dispensing and sealing positions, and for accurately ascertaining these positions there may be provided an upwardly projecting lug 38 on the inner body 10, received in an arcuate slot or cut-out 40 in the outer body, whereby engagement of the opposite ends of the slot 40 with lug 38 will determine the respective dispensing and sealing positions of the bodies.

It will be noted that the outer body 24 is provided with a cylindrical inner wall or journal portion 42 below the fingers 32 which is snugly rotatably journaled on the inner body 10 whereby these may function as the cooperating elements of a rotary valve. To this end the inner and outer bodies are provided with various passage segments or ports which are positioned for registry

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in the different operative positions of the bodies 10 and 24.

Thus there are provided segments 44 and 46 of a discharge passage extending radially through the inner and outer bodies respectively, and registering with each other in the dispensing condition of the pump as in Figure 1 to establish communication between the delivery passage 16 and a suitable discharge nozzle 48, which may be of either the jet or spray type.

In the present embodiment, the passage segment 44 of the inner body is defined by a two diameter tubular valve insert 43, press fitted into a radial opening through the inner body 10, and having a ball check valve 45 in its larger diameter portion adapted for cooperation with valve seat 47 to prevent the ingress of air into the pump chamber on the expansion stroke of flexible wall 26. Ball valve 45 is retained in tubular insert 43 by inwardly bending or deforming portions of the larger diameter tube end to define radial inward projections 49.

Such arrangement permits the insert 43 with its ball valve 45 to be preassembled and inserted as a unit in the inner body 10, to simplify the fabrication thereof.

Also, as in the said earlier application, the bodies 10 and 24 may be provided with segments of a vent passage which register in the dispensing condition of the pump to provide a passage for air from the atmosphere to replace the liquid expelled from the container by the pump.

Such a vent passage segment in the outer body is provided by the notch 50 which is adapted to register with a radial port 52 in the inner body. In the embodiment shown, the part 52 communicates with the container interior through an annular downwardly opening passage 54 concentric to the delivery passage 16, and the passage 54 and port 52 jointly define the vent passage segment of the inner body. In order to permit free communication between the notch 50 and the atmosphere, the bottom edge of the outer body is spaced slightly above the cap, such spacing being maintained by depending lugs 55.

The arrangement is such that in the sealing position of the pump bodies (as in Figures 5 and 8) both the discharge passage segments 44, 46 and the vent passage segments 50, 52 and 54 of the respective bodies 10 and 24 will be disposed out of registry to prevent escape of liquid through the nozzle 48 or the passage of either liquid or air through the vent passage segment or opening 50.

In accordance with the invention, however, the inner and outer bodies 10 and 24 are respectively provided with segments of a return passage which register with each other in the sealing position of the pump (as shown in Figures 5 and 8) to return liquid from the pump chamber 28 back into the container C.

The annular passage 54 and its port 52 aforementioned may be employed also as one segment of such a return passage, the other segment thereof comprising an axial groove or channel 56 in the inner wall 42 of the outer body 24.

In the arrangement shown, the channel 56 communicates at its upper end with one of the spaces between adjoining fingers 32, and the said space in effect constitutes a continuation of the channel 56. It will be apparent, in the position of the parts shown in Figure 8, that liquid pumped into the chamber 28 through flexing of the wall 26, is prevented by the ball valve 20 from returning to the container through the delivery passage 16. However, repeated flexing or depressing of the wall 26 in a manner to reduce the volume of the pump chamber 28, will cause the liquid therein to circulate between the gripping fingers 32 to channel 56, thence through the port 52 and passage 54 back into the container. This will relieve the tendency that would otherwise exist for liquid trapped in the pump chamber 28 to disconnect the flexible wall or diaphragm 26 from the outer body 24 incident to actuation of the pump and otherwise to exert an abnormally high pressure tending to cause leakage of

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liquid from the chamber 28 between the associated pump components.

Where the pump is moved to sealing position (Figures 5 and 8), prior to its application to a filled bottle, the interconnected return passage segments 52, 54 and 56 will readily permit the escape of air from the pump chamber so that liquid can move up into the suction tube 22 as the pump is applied. This has the advantage of reducing the distance required for subsequent movement of the liquid into the pump chamber for priming same.

Further, it will be seen that shipping of the filled containers either on their sides or in wholly or partially inverted position, may result in liquid entering and priming the pump chamber, and this action will be furthered by such flexing of the bulbous diaphragm as occurs incident to its shipping and handling.

Accordingly, it will be apparent that the invention provides a substantially self-priming dispensing pump, having a built-in recycling feature for preventing the creation of abnormal or harmful fluid pressures within the pump chamber.

In order to retain a priming charge of liquid within the pump chamber, one of the segments 56 of the return passage may advantageously be restricted, preferably to the point where it constitutes a capillary passage capable of preventing the return flow of liquid therethrough except as caused by pressure on the diaphragm 26. This passage 56 performs a function equivalent to that of a conventional check valve, while eliminating the expense thereof, though such a check valve is by no means precluded by the invention. In this connection, it will be seen that the passage 56 is so restricted relative to the suction tube 22 that on expansion of the pump chamber 28, only a negligible amount of air is drawn thereinto through passage 56, while an appreciably greater amount of liquid is drawn into the chamber through suction tube 22.

For permitting ready visual ascertainment of the relative rotational positions of the bodies 10 and 24, the inner body may be provided with a radial index arm 58 which projects outwardly over the cap 12 for cooperation in obvious manner with the pointer 60 fixed on the outer body.

In accordance with a further novel aspect of this invention, the assembly of the inner body 10 with its radial arm 58 within the apertured cap is greatly facilitated by ethylene resin. As initially formed the arm 58 projects 10, the latter as well as the outer body 24 being formed of a suitable somewhat flexible plastic, such as a polyethylene resin. As initially formed the arm 58 projects upwardly and slightly outwardly from its point of connection to the inner body 10, as in Figure 9 with its free end positioned for free passage through the apertured cap with the remainder of the body 10, and in position to be engaged and swung downwardly and outwardly over the cap 12 by the lower edge of the outer body 24 incident to its axial positioning on the inner body 10.

Having thus described the invention what is claimed as new and desired to be secured by Letters Patent is:

1. A dispensing pump for a liquid container having an outlet opening comprising a generally cylindrical inner body, means positioning said body in the container opening, said body having an axial fluid delivery passage therethrough in communication with the container interior, a hollow outer body snugly journaled on said inner body for angular movement between a dispensing position and a sealing position, a flexible diaphragm closing the upper end of said outer body and cooperating with said bodies to define a variable volume pump chamber communicating with said delivery passage, said inner and outer bodies being formed with segments of a discharge passage relatively positioned for registry in the dispensing position of said outer body to establish communication between said pump chamber and the atmosphere, valve means being associated with said delivery passage and said discharge passage to prevent back-

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flow of fluid therethrough, said inner body being formed with a return passage communicating with the interior of said container independently of said delivery passage, said outer body being formed with an air vent positioned to communicate with said return passage in the dispensing position of the outer body to permit an inflow of air into said container from the atmosphere to replace the fluid discharged therefrom, said outer body being further formed with a recycling passage communicating with said pump chamber and positioned to communicate with said return passage in the sealing position of the outer body, whereby actuation of the said pump in said sealing position will draw fluid into the pump chamber from the container and return it to the container through said recycling and return passages.

2. The combination of claim 1 including an apertured cap for closing the outlet opening of said container, said inner body being insertible upwardly through the aperture of said cap, said inner body being formed of a resiliently flexible material and including a normally axially upwardly directed indicator hand integral therewith, for insertion upwardly through said aperture with the inner body, stop means on said inner body for limiting the upward movement thereof in said cap, said outer body being assembled axially onto the upper end of said inner body and into outwardly deflecting engagement with said indicator for positioning and maintaining the latter with its free end in a radially outwardly directed position overlying said cap, in combination with a radial pointer carried by said outer body for cooperation with said indicator.

3. A dispensing pump for a liquid container having an outlet opening comprising a generally cylindrical inner body positioned in fluid tight relation in said opening and projecting externally thereof, said body being formed with a fluid delivery passage therethrough in communication with said container, a hollow outer body including a flexible wall portion snugly journaled on said inner body for angular movement between a dispensing position and a sealing position, said outer body cooperating with the inner body to define a variable volume pump chamber communicating with said delivery passage, said inner and outer bodies being formed with segments of a discharge passage relatively positioned for registry in the dispensing position of said outer body, to establish communication between said pump chamber and the atmosphere, valve means associated with said delivery passage and said discharge passage to prevent the backflow of fluid through said passages, said inner body and said outer body respectively being formed with segments of a return passage positioned to register with each other in the sealing position of said outer body for permitting a return flow of fluid from the pump chamber to the said container.

4. The combination of claim 3 in which one of said return passage segments constitutes a capillary channel permitting the escape of fluid from the pump chamber to the container under conditions of unbalanced pressure as between the pump chamber and the container, but operative to maintain a priming charge of fluid in said chamber when said pressures are substantially balanced.

5. The combination of claim 3 wherein said outer body is formed with a vent passage positioned for communication with said return passage segment of the inner body in the dispensing position of the outer body.

6. A dispensing pump comprising a generally cylindrical inner body having inner and outer axially opposed ends, said body being adapted for liquid tight disposition in the outlet opening of a liquid container, and formed with an axial delivery passage therethrough, a hollow outer body including a flexible wall portion snugly journaled on the outer end of said inner body for angular movement between a dispensing position and a sealing position, said outer body cooperating with the inner body to define a variable volume pump chamber communicat-

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ing with said delivery passage, said outer body being formed with a discharge passage communicating with said pump chamber in the dispensing position of said outer body, means associated with the respective passages aforesaid for preventing backflow of fluid therethrough, means on said inner body for closing said discharge passage in the sealing position of the outer body, and said inner and outer bodies being formed respectively with segments of a return flow passage, said segments communicating with each other in the sealing position of the outer body and extending from said pump chamber through the said lower end of the inner body.

7. The combination of claim 6 including a suction tube depending from said inner body in communication with said delivery passage.

8. The combination of claim 7 in which said return passage segment in the inner body extends concentrically to said delivery passage and said suction tube.

9. A dispensing pump comprising a generally cylindrical inner body having inner and outer axially opposed ends, said inner end being adapted for reception in the outlet opening of a liquid container, said body having a delivery passage opening through said inner end, a hollow outer body including a flexible wall portion rotatable on said inner body and therewith defining a pump chamber in permanent communication with said delivery passage, said bodies being formed respectively with segments of a discharge passage, one of said segments communicating with said pump chamber, said segments being positioned for communication with each other in one rotational position of the outer body and out of communication with each other in another rotational position of the outer body means associated with said passages for preventing the backflow of fluid therethrough, said inner and outer bodies being formed with segments of a return flow passage positioned for communication with each other and with the pump chamber in said other rotational position of the outer body and extending from said pump chamber through said inner end of the inner body, said seg-

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ments of the return flow passage being out of communication with each other in the said one position.

10. A pump comprising an inner body defining a delivery passage open at both ends thereof, an outer body rotatable on and enclosing one end of said inner body to define a pump chamber permanently communicating with said passage, said outer body including means for varying the volume of said chamber, said bodies being formed respectively with segments of a discharge passage positioned for communication with each other and with the pump chamber in one rotational position of the outer body and out of communication with each other in another rotational position of the outer body, said bodies being further formed respectively with segments of a return passage positioned for communication with each other and with the pump chamber in said other rotational position of the outer body and out of communication with each other in said one rotational position, one of said segments opening through the other end of said inner body remote from the pump chamber, and means for preventing backflow of fluid through said delivery passage and said discharge passage.

11. In combination, a circularly apertured container cap, an inner pump body of flexible material including a cylindrical portion projecting upwardly through said aperture, a normally upwardly projecting pointer integral with said body and insertable with the cylindrical portion thereof through said aperture, and an outer body rotatable on said cylindrical portion and thrusting axially against said pointer to deflect same radially outwardly over said cap, indicia means being carried by said outer body for cooperation with the pointer.

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