Oct. 28, 1941. M. C. SCHWAB 2,261,037

LIQUID DISPENSING APPARATUS

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Fig. 1.

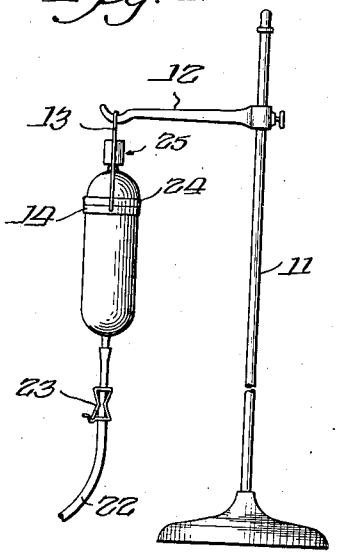


Fig. 3.

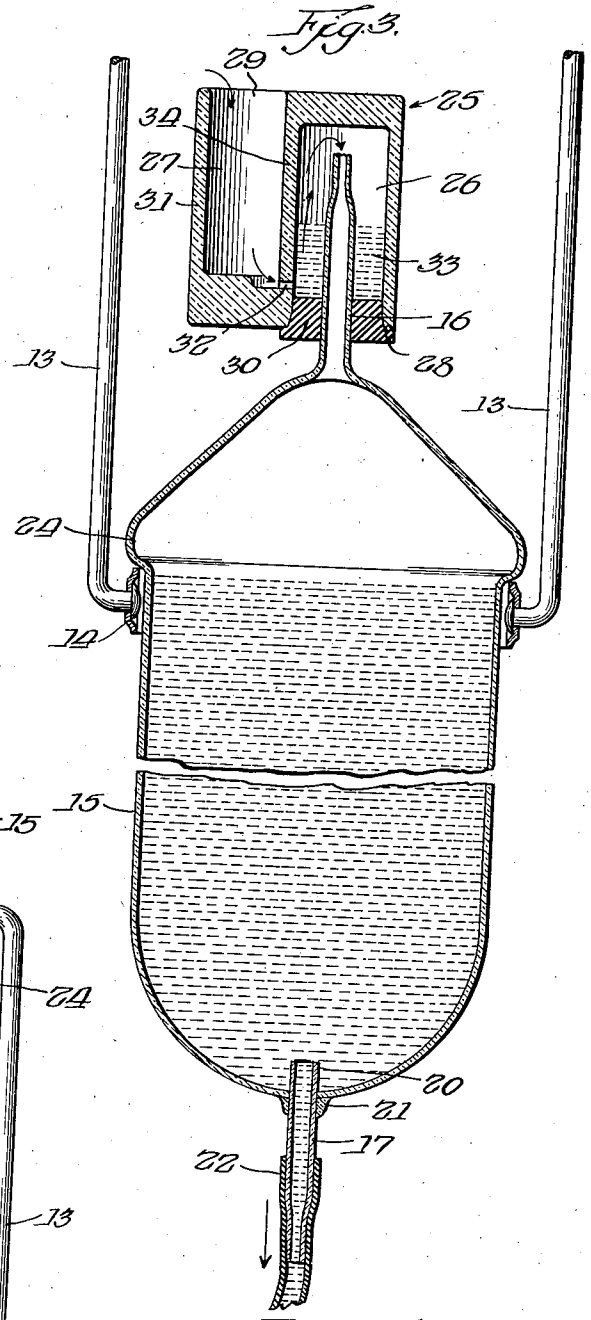
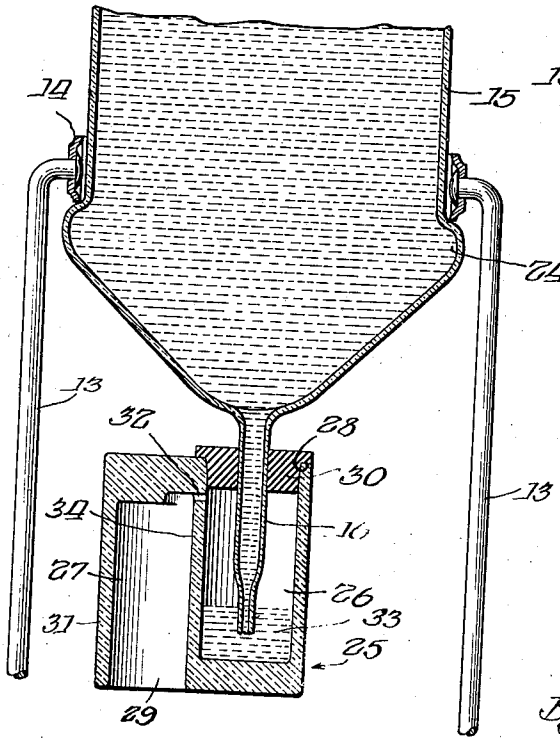


Fig. 2.



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Fig. 4

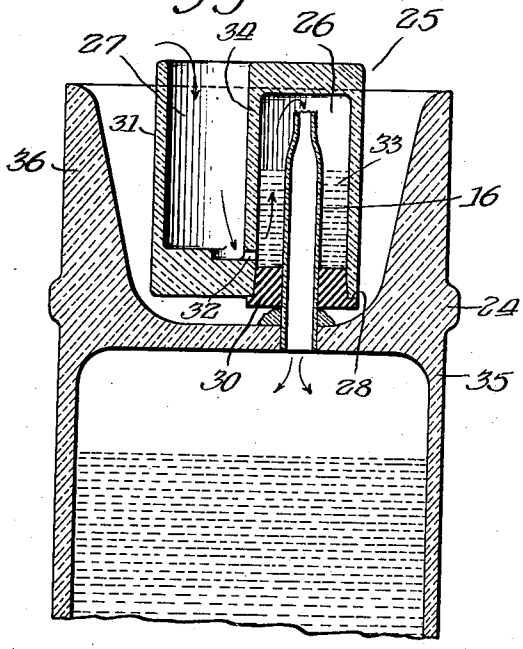


Fig. 6.

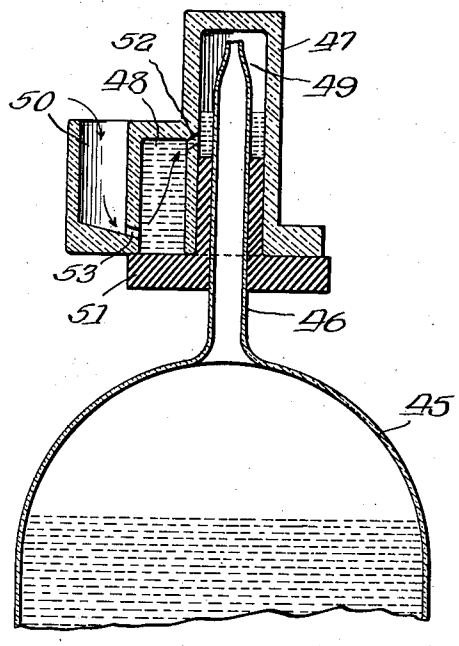


Fig. 5.

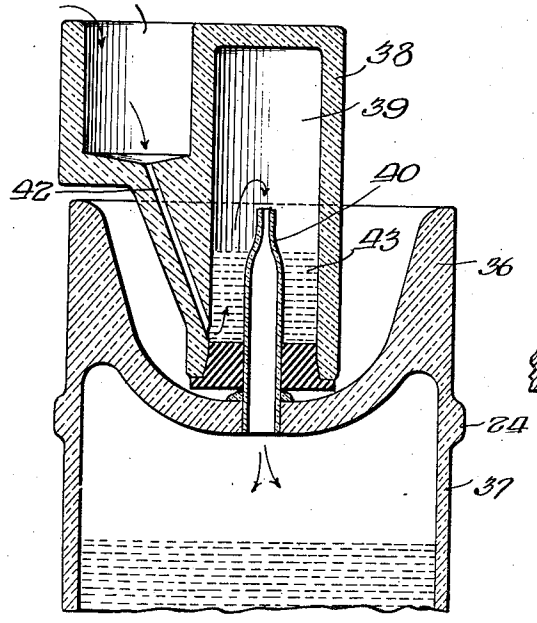


Fig. 7.

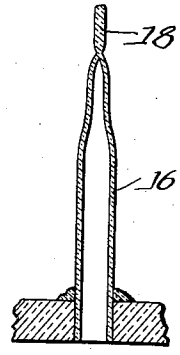
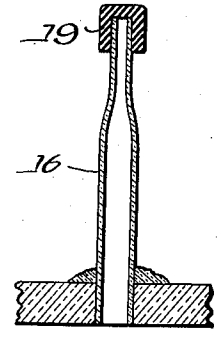


Fig. 8.



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UNITED STATES PATENT OFFICE

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LIQUID DISPENSING APPARATUS

Martin C. Schwab, Chicago, Ill.

Application March 16, 1940, Serial No. 324,238

10 Claims. (Cl. 128—214)

This invention relates to liquid dispensing apparatus and more particularly to devices for dispensing sterile liquids for subcutaneous or intravenous injections or equivalent uses. In withdrawing liquid from containers generally, it is necessary that air or other gas or fluid be permitted to enter the container to replace the liquid withdrawn, and in devices to be employed for the purpose specifically herein pointed out, it is particularly important that the air entering the container upon withdrawal of the liquid be filtered or washed in order to prevent contamination of the sterile liquids within the container.

The invention relates to liquid dispensing apparatus of the general character disclosed in my Patents No. 2,010,417 of August 6, 1935, and No. 2,065,829 of December 29, 1936.

The practice of injecting liquids intraveneously, subcutaneously and intramuscularly into tissue is well known to medical science, and it is also well known that the introduction of aseptic medicinal liquid for this purpose may be dangerous to the patient, owing to the possibility of foreign matter in the form of dust, spores and other impurities becoming entrained in the liquid to be injected from the air with which the liquid comes in contact, thus rendering the liquid septic and unfit for injection purposes.

A primary object of the invention is to provide improved apparatus for washing the incoming air prior to its entry into the liquid container, whereby the possibility of contaminating the sterile liquid by foreign bodies is eliminated, and an important feature of the invention is the provision of a construction in which the incoming air does not bubble through the liquid to be dispensed as in the devices known to the art. A further important object is the provision of apparatus of this nature in which the liquid container may be in the form of an ampule, and the air washing fluid comprises a predetermined portion of the liquid to be dispensed which may be segregated and trapped upon momentary inversion of the container. Liquid dispensing apparatus of the type described and known to the art are operable only upon inversion, and it is an important object of the invention to provide liquid dispensing apparatus which is operable in its customary upright position. A feature of the present invention is that the devices require considerably less sterilization than similar devices known to the art and may be readily assembled for instant use by unskilled persons. The improved dispensing device may be delivered in a sealed package to hospitals or other users and the device rendered ready for use by removing the seal, sterilizing the dispensing tube and air washing cap and mounting the cap and its stopper on the air inlet tube of the container and securing a dispensing tube to the liquid outlet of the container.

A further object of the invention is to provide liquid dispensing apparatus in which a portion of the liquid to be dispensed serves as the media for washing incoming air both in the primary and secondary air washing chambers, when it is desired to employ a secondary air washing chamber and which is operable in the normally upright position of this container. The assembly of the present device is readily sterilized and is capable of portable use as well as being sold as part of the liquid container. Further objects are to provide a construction of maximum simplicity, economy and ease of assembly.

It will be understood that the invention may be employed in connection with other liquid dispensing devices other than the field of utility particularly specified, and therefore, finds a wide industrial field of utility where an uncontaminated liquid is desired to be dispensed.

The invention will be readily understood from the following description in conjunction with the accompanying drawings wherein certain preferred embodiments of the invention are illustrated, in which:

Fig. 1 is an elevational view of the improved dispensing device mounted upon a suitable standard;

Fig. 2, a fragmentary vertical sectional view of one embodiment of the invention showing the improved air washing and dispensing assembly attached to a portion of a liquid container in inverted position;

Fig. 3, a broken vertical sectional view of the embodiment of Fig. 2 in upright operating position;

Fig. 4, a fragmentary vertical sectional view of a modification of the invention;

Fig. 5, a fragmentary vertical sectional view of still another modification or embodiment of the invention;

Fig. 6, a fragmentary vertical sectional view of a further modification;

Fig. 7, a detailed vertical sectional view of the ampule tip; and

Fig. 8, a further vertical sectional view of a modified closure for the ampule tip.

Referring to Fig. 1, the reference character 11 indicates a standard having an adjustable arm

12 from which is suspended a carrier member 13 preferably in the form of a loop whose ends are oppositely disposed and rotatably carried in a ring member 14. The ring member 14 is adapted to engage a portion of the outer surface of a container housing the liquid to be dispensed. As shown in Figs. 2 and 3, the container is preferably in the form of an ampule 15 having protruding tubes 16 and 17 at each end thereof. Other forms of liquid containers, such as those having a conventional body portion and neck, may be employed, but the ampule form of container shown in the drawings is preferred. As shown in Figs. 2 and 3, an upper portion 24 of the ampule is flared outwardly, thereby providing a shoulder against which the ring member 14 bears to support the ampule in an upright position. It will be seen that the ampule can be readily removed from the carrier 14 by lifting it upwardly therefrom or by inverting the container 15 to the position shown in Fig. 2 in which the container 15 can be readily pushed downwardly and away from the carrier ring 14.

The construction shown is particularly satisfactory in that when the container is to be used for dispensing fluids for intravenous or subcutaneous injections, the container may be employed as a package for these fluids, in that the container 15 may be filled with the fluid to be dispensed to the level shown in the drawings at a convenient distributing place and thus shipped to the place of use. The fluids are retained in a sterile condition during shipment and until ready for use, since after the ampule is filled to the desired level, the tube members 16 and 17 may be hermetically sealed by forming a glass bead 18 at the end thereof, as shown in Fig. 7, the glass bead being readily frangible when the liquid contents are to be dispensed, without depositing particles of glass within the container. On the other hand, a rubber closure seal 19 may be employed to seal the extremities of the tips, as shown in Fig. 8. The lowermost tube 17 is adapted to serve as the liquid dispensing conduit and has a portion 20 extending above the bottom of the ampule to provide a sedimentation zone between the bottom of the ampule and the upper end of the conduit 17, preventing the draw off of liquid within this zone in the unlikely event that the liquid contains particles of foreign matter. The junction between the conduit 17 and the bottom of the ampule 15 is suitably reinforced as indicated at 21. The lower end of the liquid dispensing conduit 17 is adapted to have secured removably thereon, as by a frictional engagement, the end portion of a rubber tubing 22 equipped with valve means 23 to control the flow of liquid from the container 15.

The improved cap 25 normally positioned above the container 15 in its upright position, is preferably removably secured to the tube member 16, the latter member serving as an air inlet tube for the liquid container. The cap generally comprises two chambers 26 and 27, formed by the web 34, having openings 28 and 29 at opposite ends of the cap from each other. The chamber 26 is adapted to serve as an air washing chamber and is provided with an apertured rubber stopper 30 adapted to be frictionally fitted into the opening 28. The tube 16 of the container may be readily inserted through the aperture of the stopper 30 until a considerable portion of the tube extends into the chamber 26, as shown in Fig. 3, and is frictionally retained therein. The tube 16 may be provided with a suitable bead to indicate the proper position of the tube within the stopper 30. The walls 31 of the cap 25 and the ampule 15 are preferably formed of glass but may be made of metal, plastics such as transparent resinous or cellulosic materials, or hard rubber, as may be deemed expedient. The chamber 27 of the cap forms an overflow chamber for the air washing chamber 26, the latter chamber extending below the lower surface of the overflow chamber 27. A duct 32 of constricted diameter connects the air washing chamber 26 and the overflow chamber 27 and enters each chamber near the bottom thereof. The opening 29 is preferably not provided with a closure although an apertured cover may be provided, if desired, and it will thus be understood that a ready path is provided for incoming air to the container 15, which is readily admissible through the opening 29, the overflow chamber 27, the duct 32, the air washing chamber 26 and into the tube 16 which serves as an air passage to the upper portion of the container 15. In this manner the incoming air does not pass through the liquid to be dispensed, as is customary in devices known to the art.

In practice, the device is preferably delivered to the user in package form containing the liquid to be dispensed, with the ends of the air tube 16 and the liquid dispensing tube 17 hermetically sealed, as shown in Fig. 7, or provided with a suitable closure, as shown in Fig. 8. After the sealing members have been broken or removed (Fig. 7 or 8), the liquid dispensing tube 22 is fitted over the tube 17 and the cap 25 is frictionally fitted on the incoming air tube 16 in the manner previously described, while the container remains in the upright position shown in Fig. 3. Upon momentary inversion of the ampule container 15, as shown in Fig. 2, a predetermined portion of the liquid to be dispensed flows through the air tube 16 into the air washing chamber 26. The size of the chamber 26 is commensurate with the amount of liquid to be dispensed to provide a thorough wash for the incoming air and, accordingly, is adapted to receive a predetermined portion of the liquid to be dispensed. Upon return of the container to its normal upright position, as shown in Fig. 3, a portion 33 of the liquid to be dispensed is retained in the air washing chamber at a point below the opening of the air tube 16. It will be apparent that some of the liquid 33 will enter the overflow chamber through the duct 32 until the atmospheric pressure on the liquid in the overflow chamber equalizes the pressure of the liquid head in the washing chamber 26.

Upon releasing the flow control means 23 on the tube 22, the liquid within the container 15 flows by gravity downwardly through the dispensing tubes 17 and 22 to a dispensing injection needle or to any other place of its employment, which may be surgical, industrial or otherwise. As the container empties, an area of reduced pressure is formed at the top of the container and in the upper portion of the air washing chamber 26, and the atmospheric pressure on the liquid in the overflow chamber 27 forces the liquid therein back through the duct 32 into the air washing chamber 26. Air then enters the air washing chamber 26 from the overflow chamber 27 and the duct 32 and bubbles upwardly through the liquid in the chamber 26 and receives a very thorough washing and deposits its foreign matter before emerging from the liquid bath 33, and then passes through the air tube

16, and then into the upper portion of the container 15. Thus when the air enters the container proper, it is free from dust, lint or other foreign material which may be entrained in the air or gas and which is retained in the wash liquid 33. The overflow chamber 27 serves to retain temporarily any of the wash liquid which may bubble back from the washing chamber 26, due to possible pumping action of the incoming air, and prevents the washing liquid from overflowing from the cap.

The embodiment shown in Fig. 4 is quite similar in construction to that shown in Figs. 2 and 3 in that a similar air washing cap 25 having an air washing chamber 26 and an overflow chamber 27 is adapted to be removably mounted upon an air tube 16 formed integrally with the top of a liquid container 35. The upper portion of the container 35 differs somewhat from that shown in Figs. 2 and 3 in that the extended sides 36 of the container form a concave open area in which the cap 25 may be nested and likewise provide a seat for the container if it is desired to rest it in its inverted position. The bottom portion of the container (not shown) may be formed in a like manner, if desired, to protect the liquid outlet tube. In use, the container 35 operates in a manner similar to that described in connection with the embodiment of Figs. 2 and 3.

In the embodiment of Fig. 5, the container 37 may be of the same form and construction as the container 35 of Fig. 4. In this embodiment, a slightly modified cap 38 is employed. A larger air washing chamber 39 is employed in which the air inlet tube 40 only extends approximately midway into the air washing chamber. Furthermore, the overflow chamber 41 is disposed considerably above the lower portion of the air washing chamber 39 and is connected to a lower portion of the air washing chamber by a downwardly extending duct 42. In operation, this embodiment functions very similarly to those previously described except that a portion of the air washing liquid 43 does not normally enter the overflow chamber 41 and only enters this chamber in the event of abnormal pumping action of incoming air within the air washing chamber 39.

In the embodiment of Fig. 6, a liquid container 45, having a rounded top terminating in an air inlet tube 46 of somewhat larger diameter than the tube 16, is employed. Likewise the air washing cap 47 is of somewhat different construction, in that a plurality of air washing chambers 48 and 49 are employed; the chambers 48 and 49 open downwardly, while the overflow chamber 50 is open to the atmosphere at the upper end thereof. The air inlet tube 46 extends substantially into the air washing chamber 49 and is frictionally fitted therein by means of an apertured rubber stopper 51 plugging the lower openings of the air washing chambers 48 and 49. A duct 52 leads from an upper portion of the air washing chamber 48 to an intermadiate point of the secondary air washing chamber 49. Likewise the overflow chamber 50 and the air washing chamber 48 are connected by a duct 53 at lower points therein. It will thus be seen that upon momentary inversion of the container the chamber 49 will be substantially filled with a predetermined portion of the liquid to be disposed adapted to serve as air washing fluid. Upon return of the container to its normal upright position a portion of the liquid will flow into the chamber 48 and into the overflow chamber 50.

When dispensing of the liquid from the container 45 commences, the reduced pressure in the chamber 49 will cause the return of some of the air washing liquid to the chamber 49 and will drain the overflow chamber 50. Thus a plurality of washes for the inflowing air is provided since the air enters through the overflow chamber 50, flows upwardly through wash liquid in the chamber 48, through the duct 52, into the secondary air washing chamber 49 and downwardly through the air inlet tube 46 into the top of the container 45 without passing through any of the liquid to be dispensed.

While the novelty of the construction has been emphasized in the field of medicine in the dispensing of parenteral and other fluids and solutions, it will be understood that my improved device is not limited to such use but that the dispensing device has a wide field of utility, which will be readily apparent to those skilled in the art.

What I claim is:

1. Liquid dispensing apparatus comprising a container housing liquid to be dispensed, a liquid outlet depending from said container, an air inlet tube formed integrally with and extending above said container, and a cap member adapted to wash incoming air to said container, said cap comprising adjacent interconnected air washing and overflow chambers, and a stopper closing the opening to said air washing chamber and adapted to frictionally retain said cap on said air inlet tube, a portion of said tube extending into said air washing chamber, said air washing chamber being adapted to receive and retain a portion of the liquid to be dispensed to serve as air washing fluid upon momentary inversion of said container.

2. Liquid dispensing apparatus operable in its upright position, comprising a container housing liquid to be dispensed, said container being pivotally mounted and provided with a flange portion to form a shoulder for a supporting ring, a liquid outlet depending from said container, an air inlet tube to said container formed integrally with said container, and a cap adapted to wash incoming air and comprising adjacent air washing and overflow chambers connected by a duct, openings at opposite ends of said chambers, and an apertured stopper closing the opening to said air washing chamber and adapted to frictionally retain said cap on said air inlet tube, a portion of said tube extending into said air washing chamber, said air washing chamber being adapted to receive and retain a predetermined portion of the liquid to be dispensed, upon momentary inversion of said container, to serve as an air washing fluid.

3. Liquid dispensing apparatus comprising a container housing liquid to be dispensed and operable in its upright position, said container being provided with protruding tubes at either end thereof, the lower tube extending into said container above the bottom thereof and serving as a liquid dispensing tube and the upper tube serving as an air inlet, and means carried on said air inlet tube to wash incoming air to said container, said means comprising a plurality of interconnected chambers, one of said chambers having an opening to the atmosphere and the other chambers having passages to the next adjacent chamber, one or more of said chambers serving as air washing chambers and the others as overflow chambers for excess washing fluid from said air washing chambers, a stopper closing the openings to said air washing chambers, and serving as a mount for the air inlet tube which extends

into said air washing chamber, said air washing chamber being adapted to receive and retain as an air washing medium a predetermined portion of the liquid to be dispensed upon inversion of said container, and a duct connecting said air washing and overflow chambers near the bottom of said chambers.

4. Liquid dispensing apparatus comprising a container housing liquid to be dispensed, said container having a concave upper portion, an air inlet tube mounted in said concave portion and a liquid outlet depending from said container, and means for washing incoming air, said means being nested within the concave portion and removably mounted on the air inlet tube, said means comprising adjacent chambers, one of said chambers serving as an air washing chamber and the other as an overflow chamber for excess air washing fluid, said air washing chamber being adapted to receive and retain a predetermined portion of the liquid to be dispensed upon momentary inversion of said container, said liquid portion serving as air washing fluid in normal upright position of said container.

5. Liquid dispensing apparatus comprising a container operable in its upright position and housing liquid to be dispensed, the upper portion of said container being of concave contour, an air inlet tube mounted in said concave area and a liquid outlet depending from said container, and air washing means mounted on said air inlet tube, said means comprising an elongated air washing chamber and an overflow chamber, the bottom of said overflow chamber being disposed above the bottom of said air washing chamber, and a duct connecting the bottom portions of said chambers, said air washing chamber being adapted to receive and retain a portion of the liquid to be dispensed upon momentary inversion of said container.

6. Liquid dispensing apparatus comprising a container housing liquid to be dispensed and operable in its normal upright position, a liquid outlet tube depending from said container, an air inlet tube entering and extending above said container, an air washing means mounted on said air inlet tube, said means comprising an elongated air washing chamber and an overflow chamber, the bottom of said overflow chamber being disposed above the bottom of said air washing chamber, and a duct connecting the bottom portions of said chambers, said air washing chamber being adapted to receive a portion of the liquid to be dispensed upon momentary inversion of said container and to segregate said liquid portion as an air washing fluid upon return of the container to its normal upright position.

7. Liquid dispensing apparatus comprising a container housing liquid to be dispensed and operable in its normally upright position, said container being equipped with a depending liquid outlet and an air inlet tube extending above said container and air washing means in the form of a cap removably carried on said air inlet tube, a plurality of open-ended chambers within said cap, two of said chambers serving as air washing chambers and the third chamber as an overflow chamber for air washing fluid, a duct connecting central portions of said air washing chambers and a second duct connecting the overflow chamber and one of said air washing chambers near the bottom thereof, and a stopper adapted to close the openings of said air washing chambers and to frictionally mount said cap upon said air inlet tube, a portion of said tube extending into one of said air washing chambers, said air washing chambers being adapted to receive and segregate a portion of the liquid to be dispensed upon momentary inversion of said container, said liquid portion serving as an air washing media upon return of the container to its normal upright position.

8. Liquid dispensing apparatus comprising a container housing liquid to be dispensed and operable in its normally upright position, said container being equipped with a depending liquid outlet tube and an air inlet tube, and means, in the form of a cap mounted on said air inlet tube, adapted to wash air entering said container through said air inlet tube, a chamber within said cap adapted to receive a portion of the liquid to be dispensed upon momentary inversion of said container and to trap said liquid portion upon return of the container to its normally upright position, said liquid portion serving as an air washing medium, and a second chamber connected to said first mentioned chamber, and open to the atmosphere, adapted to receive overflow liquid from said first mentioned chamber prior to and during the liquid dispensing operation.

9. Liquid dispensing apparatus comprising a container housing liquid to be dispensed and operable in a substantially upright position, said container being equipped with a liquid outlet and an air inlet, and means adapted to wash air entering said container through said air inlet including a chamber adapted to receive a portion of the liquid to be dispensed upon momentary inversion of said container and to trap said liquid portion upon return of the container to a substantially upright position, said liquid portion serving as a medium for washing incoming air.

10. Liquid dispensing apparatus housing liquid to be dispensed and operable in a substantially upright position, said container being provided with a liquid outlet and an air inlet, and means mounted above said container adapted to wash air entering said container through said air inlet and including a chamber adapted to receive a portion of the liquid to be dispensed upon momentary inversion of said container and to trap said liquid portion upon return of the container to a substantially upright position, said liquid portion serving as a medium for washing incoming air, the upper end of said air inlet extending into said chamber.

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