

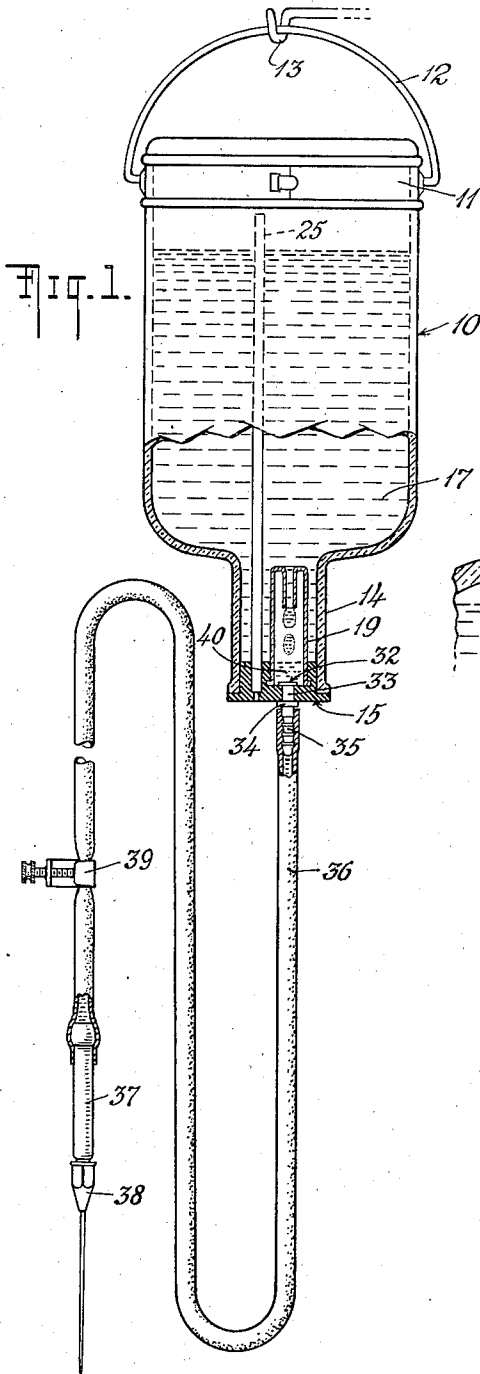
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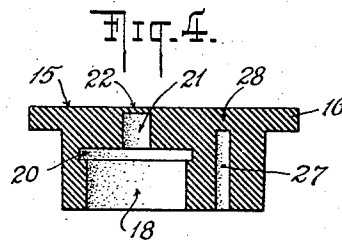
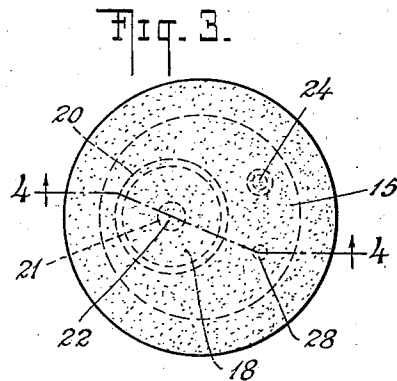
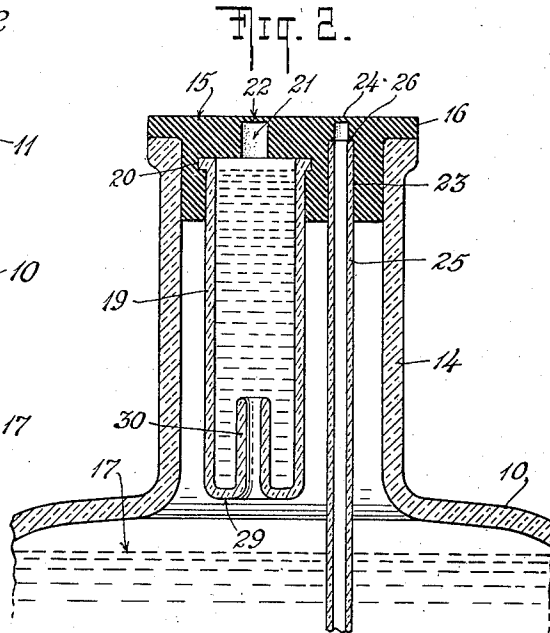
SURGICAL APPARATUS

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WITNESS

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SURGICAL APPARATUS

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This invention relates to surgical apparatus for administering dextrose, saline and other solutions to a patient.

Apparatus for the injection of intravenous solutions include a device known as a drip meter or tube for visually indicating to the physician the rate of flow of the solution being injected into the patient in order that he may control it. Such devices usually comprise a glass tube having an internal and downwardly extending nozzle which causes the solution passing therethrough to leave such nozzle in the form of drops. Heretofore these devices have been made as separate instrumentalities, being provided at their ends with integral nipples whereby they may be inserted into the flow of the fluid from the container supplying such liquid to the needle. Ordinarily such devices are inserted into the flow of the liquid at a point spaced from the container and needle by sections of rubber tubing. As this arrangement necessitates the use of many parts which are difficult to keep free from contamination and to assemble, the art devised a special form of plug or stopper for the container which enabled the drip device to be directly connected thereto. This arrangement eliminated some of the disadvantages previously encountered but was not entirely satisfactory because it still necessitated care in the handling of the drip device to keep it free from contamination. Furthermore, it was found that unless the drip device is inserted into the stopper at the proper angle and with great care, it frequently breaks under the pressure required for such insertion, thereby causing injury to the fingers, the loss of medication, etc.

The principal object of the present invention is to provide apparatus of the indicated type which will be free of the disadvantages above mentioned and in which a flow indicating device is mounted within and forms part of the container for the solution to be administered.

Another object of the invention is to provide a container-flow indicator unit so constructed and arranged that the indicator device will visually indicate to a user whether the contents of the container have been tampered with.

A further object of the invention is to provide an apparatus in which the drops discharged by the flow indicator device in the use of the apparatus are magnified, thereby enabling an operator to observe the rate of flow of the fluid more readily.

A still further object of the invention is to provide simple apparatus, of very few parts which

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can be readily assembled and disassembled, which may be readily cleaned and maintained in a sanitary condition, which will eliminate any possibility of injury to the operator and which will reduce the possibility of contamination to a minimum.

Other objects as well as the advantages and novel features of construction of the apparatus will become apparent after a perusal of the following description read in connection with the accompanying drawing in which Fig. 1 is an elevational view of the entire apparatus with some of the parts shown in sectional view in order to illustrate their construction more clearly; Fig. 2 is an enlarged vertical sectional view of the upper part of the container before the seal is broken; Fig. 3 is a top plan view of the stopper for the container and Fig. 4 is a vertical section of the stopper taken along the line 4—4 of Fig. 3.

In the drawing, the reference numeral 10 indicates generally the receptacle for the medicated solution to be administered by injection to a patient. The lower end of the receptacle which in the drawing is shown as a glass bottle, is provided with a metal band 11 to which is pivotally connected a wire bail 12 by which the bottle 10 can be mounted for use in inverted position upon a support, as upon the hook 13 shown in Fig. 1 of the drawing. The bottle 10 is provided with a neck 14 whose open end is closed by a plug or stopper 15 which may be made of rubber or any other suitable material. The stopper 15 includes a body portion which snugly fits in the open end of the bottle neck 14 and an outwardly extending flange 16 which seats on the outer end of the neck 14 of the bottle, the construction of the stopper with relation to the bottle neck being such that it hermetically seals the medicinal preparation 17 within the bottle 10. As is shown more clearly in Fig. 4 of the drawing, the body of the stopper 15 before the seal is broken has an outer or top surface which is entirely closed and unbroken. The inner portion of the stopper body is provided with a recess 18 formed to snugly receive the open end of a flow indicating device 19, the recess 18 being enlarged at 20 to receive the outwardly extending flange provided on such end of the device 19. Communicating with the recess 18 is a reduced opening 21 which extends in alignment with the recess 18 towards the outer surface of the stopper to a point just short of such surface leaving the opening 21 and consequently the recess 18 closed to the atmosphere by a relatively thin

layer 22 of the stopper material. The device 19 provides a partition between the opening 21 and the medicinal preparation 17, which partition is provided with the nozzle hereinafter described.

The stopper 15 is also provided on its inner portion with an elongated recess 23 (note Fig. 2) which extends from its inner surface to a point just short of its outer surface leaving a thin layer 24 of the stopper material to seal such recess or opening 23. The main portion of the recess 23 is formed to snugly receive the upper end of a tube 25 which extends downwardly within the container or receptacle 10 to a point adjacent to but spaced from the bottom of the container and which in the use of the apparatus functions as a bleeder tube to admit air to compensate for such fluid as may be drawn out of the container and to maintain a constant atmospheric pressure on top of the fluid so that the same will flow steadily and even, as will hereinafter become more clear. The closed, upper end of the recess or opening 23 is reduced in size to provide an annular shoulder 26 against which the upper end of the tube 25 abuts when the latter is properly inserted into the stopper, thereby affording a positive leak-tight connection as between the tube and the stopper 15.

A third recess or opening 27 extends from the inner surface of the stopper 15 to a point spaced from the outer surface of the stopper a distance approximately equal to the thickness of the stopper flange 16, thereby leaving a layer 28 of rubber sufficiently thick to obtain a self-sealing effect after such layer has been penetrated by a needle.

It will be understood from the foregoing, that the closure for the container 10 includes the stopper 15, the flow indicator device 19 and the tube 25. The flow indicator device 19 is a tube-like member having a length less than the length of the bottle neck 14 and provided at its bottom end with an annularly-shaped wall 29. Integrally formed with the inner peripheral edge of the annular wall 29 and extending up into the interior of the device 19 is an upwardly projecting tube 30. The conformation of the tube 30 is such that when such tube is inverted, it functions as a drip nozzle to cause the fluid passing therethrough to leave in drops. The unit composed of the stopper 15, flow indicator device 19 and tube 25 is applied to the bottle under vacuum after the latter has been filled with the medicated solution 17 to an extent that its level is below the lower end of the flow indicator device 19, as is shown in Fig. 2 of the drawings. With the stopper 15 hermetically sealing the bottle, the entire assembly is sterilized as a unit. The bottle may then be shaken in a manner to completely fill the device 19 with the solution or may be shipped without such operation.

In making the bottle ready for administration, if the flow indicating device is not already filled with the solution, the bottle is shaken until such result is accomplished. A needle is then inserted through the thin wall portion 22 of the stopper allowing air from the atmosphere to enter into the device 19. If a vacuum exists in the bottle, the incoming air will force the solution out of the device 19 through the nozzle 30 until it reaches a level approximately flush with the top of the nozzle, thereby providing visual evidence of the fact that there was a vacuum in the bottle and that, accordingly, its contents had not been tampered with. The needle is then withdrawn and through the punctured wall portion 22 there is

forced a coupling member made of any suitable material, such as metal, hard rubber, "Bakelite," etc. and including an outer flange 32 whose inner transverse surface is adapted to engage with the shoulder formed on the stopper between the recess 18 and the chamber 21, a cylindrical portion 33 which extends through the portion of the stopper in which is formed the chamber 21 and an inner flange 34 for engaging the exterior surface of the stopper. The length of the chamber or opening 21 is such that the rubber material surrounding the same and overlying the recess 18 is sufficiently rigid and strong to support the coupling member and the elements connected to the latter without breaking the seal between such member and the stopper. The distance between the two flanges 32 and 34 is substantially the same as the thickness of the portion of the stopper through which the cylindrical portion 33 of the coupling member extends so that such flanges by their engagement with the annular shoulder formed between the recess 18 and the chamber 21 and the exterior surface of the stopper form a liquid-tight seal with the stopper. It will be noted also that the flange 34 is of larger outside diameter than the flange 32 thereby assuring a proper fit of the coupling member with relation to the stopper 15. The forward end of the flange 32 may be beveled to facilitate the insertion of the coupling member into the opening 21. The inner end of the coupling member is provided with a nipple 35 to which is secured one end of a rubber tube 36, the other end of the latter having attached thereto a needle adaptor 37 for the needle 38.

With the several parts of the apparatus assembled, a needle is then inserted through the wall portion 24 of the stopper to allow air to be admitted through the tube 25 to the space above the solution 17 when the bottle is in inverted position as is shown in Fig. 1 of the drawings. Should the physician also desire to add medicinal material to the solution in the container, this can be accomplished by inserting the needle of a syringe containing a solution of the material through the wall portion 28 of the stopper and into the opening 27. When the medicinal material has been discharged into the bottle and the needle withdrawn the self-sealing action of the rubber material in the wall portion 28 will effectively close the opening made by the syringe needle against leakage of the contents of the bottle through such opening. The bottle can then be shaken with a rotary motion about its longitudinal axis to thoroughly mix the added material with the solution 17 without causing any portion of such solution to be forced back into the flow indicator device 19.

With the parts thus prepared the bottle 10 is hung in inverted position on a suitable support such as the hook 13 shown in Fig. 1 of the drawing. By inverting the bottle 10, the solution remaining in the flow indicator device 19 between the outer wall and nozzle 30 thereof falls to the bottom of the chamber formed by the device 19 and the stopper to form automatically a reservoir 40 of the solution which effectively seals this end of the chamber against the passage of air therethrough. The shut-off clamp 39 provided on the tube 36 is then opened temporarily to fill up the tube with the solution and to ready the apparatus for use. After the needle 38 has been inserted into the patient, the clamp 39 is operated to permit the solution to flow therethrough at the rate desired. The rate of flow can read-

ily be ascertained by counting the drops of solution falling from the tip of the nozzle 30 into the reservoir 40 and then adjusting the clamp to provide the required flow of solution.

It will be observed from the foregoing that the present invention provides a receptacle unit which includes the receptacle, stopper, flow indicator device and bleeder tube and which is assembled as a unit and sterilized at the place of manufacture. The flow indicator device is of simple, inexpensive construction, being preferably made of thin glass although obviously other suitable materials may be employed in its manufacture. While the device is relatively fragile, it is safe-guarded against any possible damage due to the fact that it is entirely contained within the container 10 which is relatively sturdy and strong and offers effective protection for such device against jars or impacts which may occur in the handling or transportation of the container unit. In this connection, the rubber stopper 15 effectively functions as a shock absorber to soften the effects of any external shocks on the flow meter device. As a sterilization of the container unit takes place after it has been filled with the medicinal solution and the parts assembled, the hermetic sealing action of the stopper 15 will maintain the flow meter device in a sterile condition until the contents of the container are used, thus eliminating any danger of contamination in so far as the flow meter device itself is concerned. It should be noted also that the flow meter device is so formed with relation to the stopper that the two in their assembled condition provide a chamber which has a three-fold purpose. In the upright position of the container and with the chamber filled with the medicated solution, the puncturing of the thin wall portion 22 closing such chamber to the atmosphere will cause the intruding air to drive the solution out of such chamber through the nozzle 30 and thereby give visual evidence of the fact that a vacuum existed in the container and that the contents had not been tampered with. As has been previously explained, the solution, as a result of this operation, is forced out of the nozzle 30 until it reaches a level approximately flush with the top of the nozzle. The construction of the nozzle with respect to the spaced interior surface portions of the wall 19 of the device, in the region of such nozzle, is such as to provide an annularly shaped chamber portion capable of holding sufficient of the residual fluid or solution to form a reservoir 40 of the medicinal solution at the opposite end of such device when the device is in inverted position (see Fig. 1). When the apparatus has been all assembled and the receptacle unit inverted for use, the residual solution remaining in such chamber falls to the opposite end of the chamber to provide automatically a reservoir of medicinal solution which functions as a fluid seal to seal the discharge end of the drip chamber against the entry of air from the infusion tube. Accordingly when the clamp 39 is opened to ready the apparatus for use, the air in the infusion tube will not enter the flow meter device but will be driven toward and out of the other end of the infusion tube by the solution of the reservoir flowing into such tube. As the solution of the reservoir will be replaced by the solution in the bottle at the same rate that it is drawn off through the infusion tube, the reservoir will remain constant in volume and continue to function effectively as a seal against the entry of air from the infusion tube into the chamber of

the flow meter device while the infusion tube is being filled with the solution and during the use of the apparatus. By thus utilizing the residual solution which is formed in the flow meter device as a result of the vacuum testing step, to form automatically a reservoir simply by inverting the bottle and without any special manipulation or equipment, the removal of air from the infusion tube is greatly simplified. Furthermore, during the operation of the apparatus, the reservoir of medicinal solution which remains of constant volume will prevent air from being drawn into the tube in the event the rate of flow is suddenly increased. Finally, when the apparatus is in actual use, such chamber functions in the nature of a drip chamber for the drops of solution formed by the nozzle 30. In this connection it should be noted that due to the fact that the flow indicator device is surrounded by the solution in the bottle, such solution will magnify the size of the drops thereby enabling the operator to observe the drops more readily. Because of this arrangement also, an operator in one glance can observe not only the rate of flow but also the volume of solution remaining in the container, thereby rendering the operation of the apparatus more simple and accurate. In assembling the apparatus for use, all that is necessary is to insert the coupling member into the punctured wall portion 22 of the stopper, the construction of such member and the stopper being such that such operation can be accomplished readily without error and that a liquid-tight seal will be provided as between the coupling member and the stopper. Due also to this construction, the parts connecting the container unit to the needle can be simplified and there is reduced to a minimum the number of parts required to be assembled and sterilized by the operator, the danger of injury by breakage of parts and the possibility of contamination and loss of the medicated solution.

While the foregoing specification and the accompanying drawing describes and shows a preferred embodiment of the invention, it will be obvious to those skilled in the art that various changes and modifications may be made therein without departing from the spirit of the invention or the scope of the appended claims.

We claim:

1. The combination of a receptacle, a stopper for the receptacle, said stopper being provided with a recess having its open end on the underside of the stopper and extending toward the upper surface thereof to a point just short of such surface leaving a thin, readily penetratable layer of the stopper material closing such recess to the atmosphere, and a flow indicating device mounted in such recess and depending into the receptacle, the lower end of said device being provided with an internal, upwardly projecting tube-like portion formed to cause fluid passing there-through, when said receptacle is turned to the inverted position, to leave the tip thereof in the form of drops.

2. The combination defined in claim 1, in which the stopper material at the upper end portion of said recess provides an annular shoulder spaced from said thin layer and against which the upper end of said device abuts.

3. In combination with a receptacle, a stopper having a recess extending from the underside thereof towards the upper exterior surface of the stopper, and a flow indicating device mounted in said recess, the lower end of said device being provided with an internal, upwardly projecting

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nozzle and the upper end of said device being open, the portion of said stopper at the inner end of the recess forming together with said device, a drip chamber through which fall drops of fluid discharged from said nozzle in the inverted position of the device.

4. The combination defined in claim 1 in which said flow indicating device is of substantial uniform diameter throughout and is provided at its bottom end with an annularly-shaped wall, and in which said tube-like portion is integral with the inner peripheral edge of said wall.

5. The combination of a receptacle having a neck portion, a medicinal solution contained therein under vacuum, a stopper for the receptacle, a flow indicating device carried by the stopper and depending into the neck of the receptacle, said device having a length relative to the length of the neck portion of the receptacle such that it is suspended free of the solution in the container and being provided at its lower end with an internal, upwardly projecting nozzle, and means hermetically sealing the upper end of said device from the atmosphere.

6. The combination of a receptacle, a medicinal solution contained therein under vacuum, a stopper for the receptacle having a recess extending from the underside thereof towards the upper, exterior surface of the stopper, a flow indicating device mounted in said recess and depending into the receptacle, said device having a length such that it is suspended free of the solution, and being provided at its lower end with an internal, upwardly projecting nozzle, said stopper having a second recess extending from the underside thereof towards the upper, exterior surface thereof, and an air tube mounted at its upper end in said recess and extending for a substantial distance towards the bottom of said receptacle.

7. The combination of a receptacle, a stopper for the receptacle, said stopper being provided with an opening extending from the underside thereof towards the upper, exterior surface of the stopper and being reduced in dimensions at its upper end portion to provide an annular shoulder spaced from such upper surface, a flow indicating device mounted in such recess and depending into the receptacle, the upper end of said device abutting against said shoulder and the lower end thereof being provided with an internal, upwardly projecting tube-like portion formed to cause fluid passing therethrough, in the inverted position of said device, to leave the tip thereof in the form of drops, a coupling member extending through the reduced upper end portion of said recess, said coupling member having an outer flange adapted to engage with said shoulder, an inner flange spaced from said outer flange to engage the upper, exterior surface of said stopper and a nipple portion projecting beyond said second flange and adapted to receive the end of a tube.

8. A dispensing apparatus comprising an open mounted receptacle for the liquid to be dispensed, a closure for the mouth of the receptacle formed of material which can be penetrated by an instrument, liquid to be dispensed within the receptacle but incompletely filling the same, the portion of the container which is not filled with liquid being under a lower pressure than the atmosphere, and a chambered indicating device connected with the closure and extending completely within the receptacle so as to be protected thereby before, during and after use and having

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an opening through which the liquid can enter into the chamber, whereby upon puncturing the closure for the mouth of the receptacle to establish communication between the chamber of the indicating device and the atmosphere the inrush of air due to the reduced pressure within the container will force liquid out of the opening in said indicating device.

9. A portable metering type of dispensing apparatus for administration of fluids to a patient comprising a receptacle for containing the liquid to be dispensed and having a single opening therein, a removable closure for the opening in said receptacle, a substantially cylindrical element contained within the receptacle and directly mounted on the closure and extending into the receptacle, means within the receptacle providing a drip opening for escape of the liquid from the receptacle into the cylindrical element in the form of drops, means for admitting air above the liquid in the receptacle, and means providing a restricted opening for the escape of the liquid from the cylindrical element through said closure.

10. A metering type of dispensing apparatus for administration of fluids to a patient comprising a receptacle adapted to contain a body of liquid to be dispensed and having a single opening therein in the form of a mouth, means for closing said opening, a device supported directly by said closing means having an opening for causing drop-by-drop flow of the liquid to be dispensed disposed entirely within the receptacle so as to be mechanically protected thereby and also protected against contamination, and means for admitting air above the liquid in the receptacle, the inner extremity of the flow indicating device being in communication with the body of liquid in the receptacle during drop-by-drop flow of the liquid and the outer extremity of the flow indicating device being adjacent the mouth of the receptacle.

11. In a dispensing apparatus for administration of fluid to a patient, the combination of a receptacle substantially all of which is capable of receiving liquid, and a flow indicating device disposed substantially entirely within the receptacle so as to be mechanically protected thereby, said device comprising a hollow member provided with an outlet opening at one end, a nozzle within the receptacle and extending into the space in said hollow member adjacent the opposite end thereof, the distance between the end of said nozzle within said member and the said opposite end of said member when said opposite end is in a downward position being sufficient to form a chamber capable of holding sufficient liquid to cover the outlet opening of said member when the receptacle is turned to inverted position.

12. A dispensing apparatus comprising an open mouthed receptacle for the liquid to be dispensed, a closure for the mouth of the receptacle, an air vent tube extending from the closure into the receptacle, a hollow member connected with the closure and extending away from the closure substantially entirely into the receptacle in a substantially vertical position when the receptacle is disposed with its mouth facing downwardly so as to be mechanically protected by the receptacle, a wall closing the upper end of the said member, said wall having an opening therethrough in the vertical direction and a rim encircling the opening of sufficient size to break the surface tension of liquid passing through the opening from the receptacle into the hollow chamber and cause the formation of freely falling drops when the

rate of flow of the liquid through the opening is insufficient to form a continuous stream.

13. A dispensing apparatus for administration of fluid to a patient comprising a receptacle provided with a neck portion and a mouth and a main body portion, a closure for the mouth of the receptacle, an air vent tube extending from the closure into the receptacle, a hollow member extending away from the closure into the neck of the receptacle but not substantially into the main body portion thereof, the said hollow member being positioned substantially vertically when the receptacle is disposed with its mouth facing downwardly, a wall closing the upper end of said member, said wall having an opening there-through in the vertical direction, a rim encircling the opening of sufficient size to break the surface tension of liquid passing through the opening from the receptacle into the hollow member and cause the formation of freely falling drops when the rate of flow of the liquid through the opening is insufficient to form a continuous stream, whereby substantially all of the liquid within said receptacle will be enabled to flow through said opening.

14. A dispensing apparatus for administration of fluids to a patient comprising a receptacle for containing the body of liquid to be administered and having a flat surface for stably supporting

the receptacle when it rests thereon, a closure for said receptacle, means whereby an outlet can be established through said closure, means entirely within the receptacle forming a partition between said outlet establishing means and said body of liquid, an opening disposed in said partition whereby liquid from the said body flowing from the opening at a rate insufficient to provide continuous flow will leave the opening in the form of drops and means providing for admission of air to a point above the said body of liquid to permit the drops to issue from the opening.

15. A dispensing apparatus for the administration of fluids to a patient comprising a receptacle in the form of a substantially flat bottomed bottle having a mouth for containing the body of fluid to be administered, a closure for the mouth of said bottle, means entirely within said bottle forming a partition between said closure and said body of liquid, an opening disposed in said partition whereby liquid from the said body flowing from the opening at a rate insufficient to provide continuous flow will leave the opening in the form of drops, and means providing for admission of air to a point above the said body of liquid to permit the drops to issue from the opening.

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