

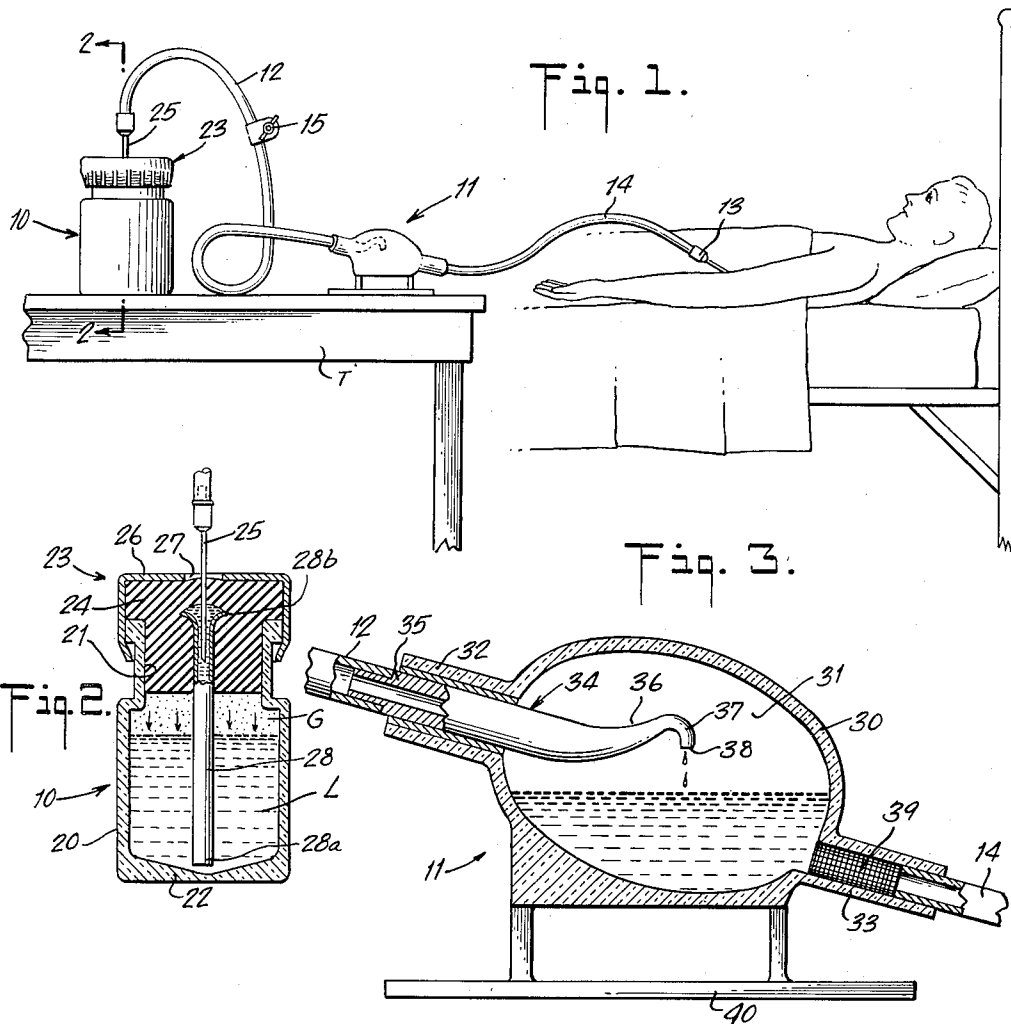
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TRANSFUSION APPARATUS

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TRANSFUSION APPARATUS

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The present invention relates to surgical dosing devices and, more particularly, to apparatus for intravenously administering liquid substances, blood transfusions, and the like.

At present, in carrying out the standard procedure for transfusions, the bottles containing the liquid to be administered are suspended in inverted position from holders above the patient, the air intake needle and the output needle are inserted into the bottle through the closure thereof and the gravity flow of the liquid is throttled to supply about twenty drops of liquid to the needle which is inserted in a vein of the patient. In the case of blood transfusions or the administering of other liquids having a tendency to coagulate, such low rate gravity flow causes the liquid to coagulate and clog the passageways between the liquid supply bottle and the intravenous needle. This necessitates stopping the transfusion and clearing the passageways by running a saline solution therethrough. In addition to requiring apparatus adapted to handle two bottles, one containing the transfusion liquid and the other the clearing saline solution, which complicates the apparatus, the clearing of the passageways delays the transfusion.

Accordingly, an object of the present invention is to provide apparatus of the character indicated herein which overcomes the foregoing objections and disadvantages.

Another object is to provide such apparatus which enables transfusions and the like to be performed much faster and more readily.

Another object is to provide such apparatus which is greatly simplified and eliminates the necessity of holders for the bottles.

Another object is to provide such apparatus which is economical to manufacture.

Another object is to provide such apparatus wherein coagulation and clogging of the passageways is eliminated.

A further object is to provide such apparatus wherein the entrapment of air or gas in the liquid substance is prevented and air or gas cannot get into the blood stream.

Other and further objects will be obvious upon an understanding of the illustrative embodiment about to be described, or will be indicated in the appended claims, and various advantages not referred to herein will occur to one skilled in the art upon employment of the invention in practice.

A preferred embodiment of the invention has been chosen for purposes of illustration and description and is shown in the accompanying drawing, forming a part of the specification, wherein:

Fig. 1 is a schematic view illustrating apparatus in accordance with the invention in use.

Fig. 2 is a sectional view taken along the line 2—2 on Fig. 1, illustrating a sealed package containing the liquid to be administered and a pressure medium for dispensing the liquid therefrom.

Fig. 3 is a longitudinal, sectional view of a pressure accumulator and air trap.

Referring to the drawing in detail and, more par-

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ticularly to Fig. 1 thereof, the apparatus shown generally comprises a sealed package 10 containing the liquid to be administered and a pressure medium for dispensing the liquid therefrom, a pressure accumulator and air trap 11 having an inlet connected in fluid flow communication with the package by a tube 12 and having an outlet connected in fluid flow communication with an intravenous needle 13 by a tube 14. A clamp 15 on the tube 12 throttles the flow of liquid therethrough.

In Fig. 2, the sealed package 10 is shown on a somewhat reduced scale in comparison to the accumulator-trap 11 shown in Fig. 3, but in actual practice the sealed package is of a capacity to store all the liquid or a fraction thereof used in performing a transfusion. For example, the package may have a capacity of one pint. The sealed package may be similar in construction to the package shown in my copending application for United States Letters Patent, Serial No. 433,579, filed June 1, 1954, but may be filled in a manner to prevent the pressurizing medium (propellant) from getting into the apparatus downstream of the package, as will be described hereinafter.

The sealed package shown herein comprises a container 20 having an opening 21 and an end wall 22 opposite the opening, a hermetic closure 23 for the container opening including a plug 24 formed of material adapted to be penetrated by a needle 25 connected to the tube 12 and a ring 26 for retaining the plug in the opening having a central aperture 27, a syphon tube 28 carried by the plug 24 having an inlet end 28a closely adjacent the end wall 22 and having an outlet end 28b embedded in the plug to seal the same and accessible to the needle 25 through the aperture 27.

A predetermined quantity of liquid substance L is placed in the container to entrap and compress the air or other gaseous medium G in the upper end thereof. This may be accomplished in a number of ways to cause the compressed air to exert a pressure on the substance to expel the same through the syphon tube 28 when the needle 25 extends therein. As contemplated herein, the quantity of the air in the container is predetermined and adjusted in relation to the capacity of the container and the quantity of the liquid substance, so that the compressed air expands to atmospheric pressure when substantially all of the substance has been expelled except for an amount sufficient to provide a liquid seal between the container end wall 22 and the lower end 28a of the syphon tube. The remaining liquid acts as a safety shut-off valve to prevent air within the container from flowing into the apparatus downstream thereof.

In Fig. 3, the pressure accumulator and air trap 11 is shown as comprising a receptacle member 30 having a chamber 31 therein, which is closed except for an inlet nipple 32 and an outlet nipple 33, which nipples are opposite each other and substantially in alignment. The chamber 31, as shown, is generally ellipsoidal in shape and is tilted with respect to its major axis, so that the inlet nipple is inclined upwardly and outwardly therefrom and the outlet nipple is inclined downwardly and outwardly, with the inlet nipple in the upper portion of the chamber and the outlet nipple in the lower portion of the chamber.

A tubular flow restricting member 34 extends inwardly and downwardly through the inlet nipple in airtight relation and into the chamber 31. The upper exterior end 35 of this member has the downstream end of the tube 12 attached thereto and the lower or inner end thereof is constricted gradually and is curved upwardly slightly at 36 and then downwardly through an arc at 37, like a goose neck, whereby its outlet orifice 38 faces downwardly to meter the liquid into the chamber drop-by-drop.

The upstream end of the tube 14 is fitted and secured

into the outlet nipple, and a filter 39 is disposed in the outlet nipple between the chamber and the end of the tube 14 for collecting any coagulated matter.

The receptacle or chamber member 30 preferably has a flat base or bottom to support the same on a table T (Fig. 1) in the desired position or may be mounted on a suitable stand 40 for so supporting the same (Fig. 3).

In using the apparatus just described, the sealed package 10 is placed on the table T adjacent the patient (see Fig. 1), the clamp 15 in tube 12 being initially closed. The needle 25 is inserted through the plug 24 into the upper end of the syphon tube 28, whereupon liquid L, such as blood, blood plasma, or medicament, will be expelled by the compressed gas G and caused to enter the tube 12 by way of the needle 25. The clamp 15 is then opened to enable the liquid to enter the chamber 31, while the pressure accumulator and air trap 11 is held in a vertical position with the outlet nipple 33 uppermost. After the chamber 31 is about one-half full, the accumulator 11 is placed upon the table in a horizontal position, as shown in Fig. 3, and, as the level of the liquid rises, the air trapped in the chamber above the liquid is compressed and exerts pressure on the liquid to force it through the outlet nipple 33, tube 14, and needle 13 and thus clear the system of air.

The liquid will be discharged from the needle drop-by-drop in accordance with the liquid discharge into the chamber 31, that is, drop-by-drop, so that the person administering the same can readily observe the rate of flow and make any flow changes by varying the pressure on the clamp 15. It might be noted at this point that the air found in the tubes 12 and 14 and chamber 31 is sterile, so that the air entrapped in the chamber is sterile.

After the system has been cleared of air, as hereinbefore explained, the clamp 15 is closed to stop further flow of the liquid and the needle 13 is inserted into a vein of the patient. Upon assurance that the needle has penetrated into a vein, as by flow of blood through the needle into the tube 14 under the patient's venous pressure, the clamp 15 is opened and is adjusted to control the rate at which the liquid enters the chamber 31, for example, at about 20-30 drops per minute.

The pressure accumulated in the chamber now is effective to cause the liquid to be transferred into the vein of the patient at a steady rate and this pressure is supplemented by additional liquid entering the chamber to maintain a constant liquid level in the chamber, whereby the rate of transfusion is maintained.

As previously indicated herein, the pressure of the gas G in the sealed package drops to near atmospheric pressure just about while the remaining liquid is at a level above the lower end of the syphon tube 28, thereby sealing the gas in the container 20. The pressure of the air in the chamber 31 remains effective to expel substantially all of the liquid therein and cause the same to be transfused. In order to prevent such pressure from being dissipated by backing into the flow restricting member 34, it is desirable to close the clamp 15.

As various changes may be made in the form, construction, and arrangement of the parts herein, without departing from the spirit and scope of the invention and without sacrificing any of its advantages, it is to be understood that all matters are to be interpreted as illustrative and not in any limiting sense.

What is claimed is:

1. In apparatus for intravenously administering a liquid substance, the combination of a receptacle containing the liquid to be administered under greater than atmospheric pressure having an outlet, a pressure accumulator and air trap having an inlet in fluid flow communication with said receptacle outlet and having an outlet in the lower portion thereof, and an intravenous needle in fluid flow communication with said last mentioned outlet.

2. In apparatus for intravenously administering a liquid substance, the combination of a receptacle containing the liquid to be administered under greater than atmospheric pressure and having an outlet, a pressure accumulating chamber having an inlet at the upper portion thereof and an outlet at the lower portion thereof, a flow restricting member extending into said chamber inlet and in fluid flow communication with said receptacle outlet for supplying the liquid to said chamber at a predetermined rate, and a needle in fluid flow communication with said chamber outlet for effecting intravenous delivery of the liquid, said chamber being pressurized during the supply of liquid thereto under pressure by causing the air therein to be partially displaced by liquid and compressed above the liquid to provide a pressure head for forcing the liquid through said chamber outlet and into said needle while trapping air above the liquid.

3. An accumulator for intravenously administering a liquid substance comprising a chamber having an inlet in the upper portion thereof and an outlet in the lower portion thereof, and a flow restricting tube extending into said chamber through said inlet for delivering the liquid substance at a predetermined rate, said tube being inclined downwardly and inwardly with respect to said chamber and said tube having a tip at the inner end thereof formed with an upwardly curved, tapered section and a downwardly curved section provided with a flow restricting bore terminating in a downwardly facing metering orifice.

4. A sealed package for intravenously administering a liquid substance comprising a container having an opening and an end wall opposite said opening, a hermetic closure for said container opening, a syphon tube carried by said closure having an inlet end closely adjacent said end wall and an outlet end accessible through said closure, a predetermined quantity of liquid substance in said container, and a compressed gaseous medium for exerting pressure on said substance to expel the same through said syphon tube, a predetermined quantity of said medium being present in relation to the capacity of said container and the quantity of said substance being such as to expand to atmospheric pressure when substantially all of said substance has been expelled except for an amount sufficient to provide a liquid seal between said container end wall and said syphon tube inlet end.

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