United States Patent

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[54] **FAILSAFE APPARATUS FOR ADMINISTERING A PARENTERAL SOLUTION**
4 Claims, 11 Drawing Figs.

[52] **U.S. Cl.** ..... **128/214 C,** 222/67, 222/444
[51] **Int. Cl.** **A61m 05/14**
[50] **Field of Search** 128/213, 214, 214.2, 227, 216; 137/399, 431, 433; 222/67, 436, 444, 491, 158–159

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ABSTRACT: A set for administering a premeasured volume of parenteral solution from a prime fluid supply, utilizing a valve arrangement which prevents the possibility of the prime fluid supply being connected directly to the patient and enables repeat administration without manipulation of an antiair-entrainment valve.

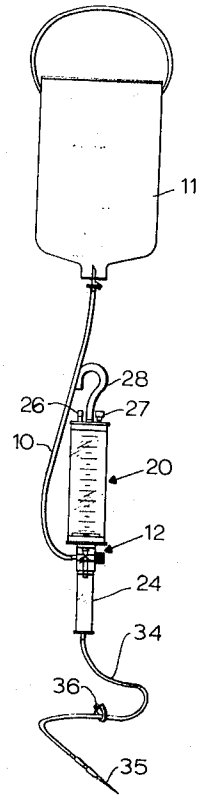

FIG. 1

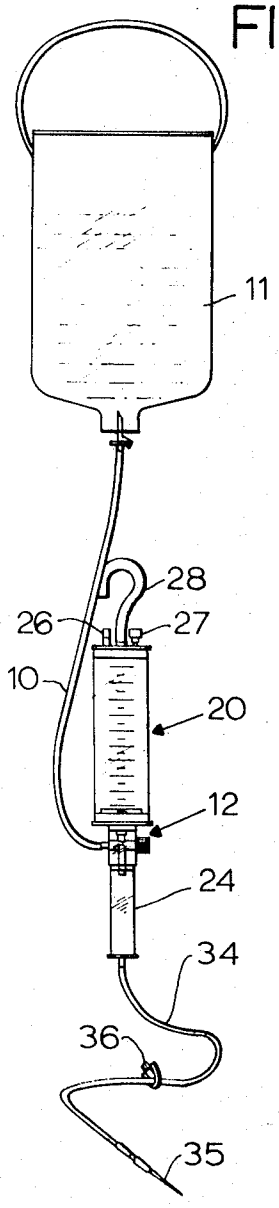

FIG. 2

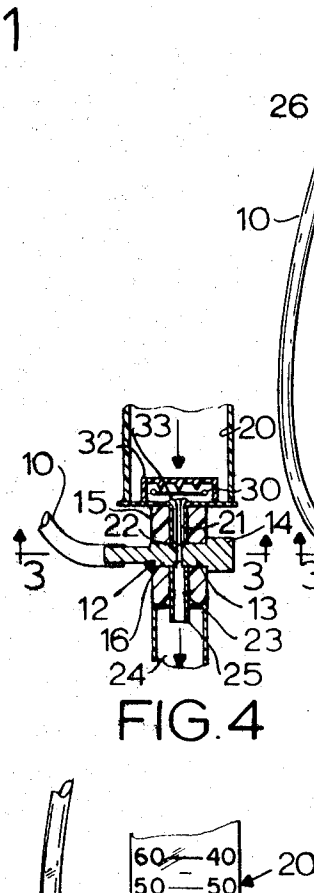

FIG. 4

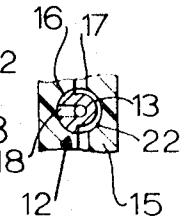

FIG. 5

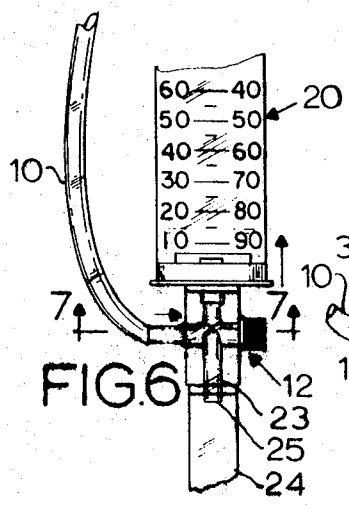

FIG. 6

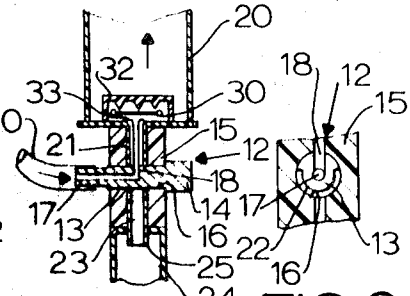

FIG. 8 FIG. 9

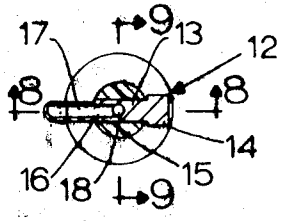

FIG. 7

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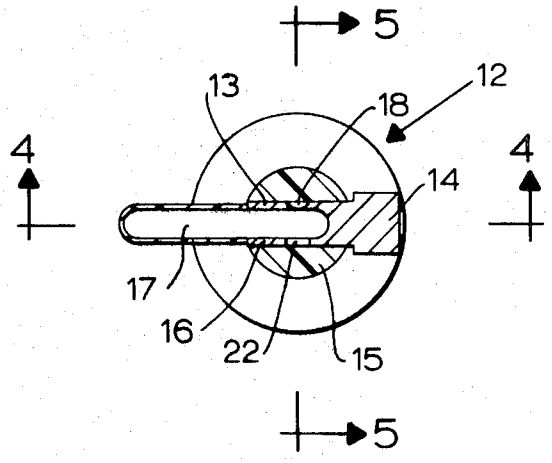

FIG. 3

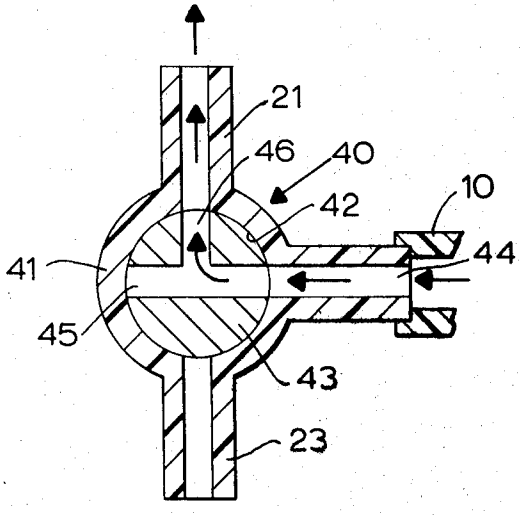

FIG. 10

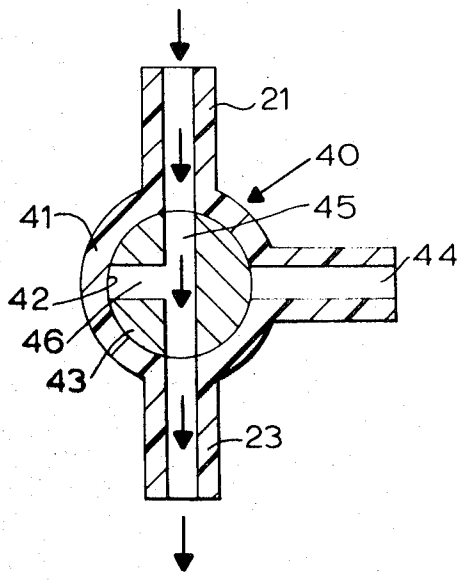

FIG. 11

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FAILSAFE APPARATUS FOR ADMINISTERING A PARENTERAL SOLUTION

This invention relates to an apparatus for administering a parenteral solution and is characterized by being especially safe from the standpoint of the person to whom the solution is being administered.

In the administration of intravenous solutions, there are certain instances when it is necessary to limit the fluid volume; for example, infusion to infants and to other small persons must be carefully kept to small volumes, or else their lives are put in danger. Some apparatus on the market have been designed to serve this function, and the best ones have included a rubber float acting as a check valve between the measuring chamber and a drip barrel, to stop fluid flow to the patient when the measuring chamber has been emptied and to insure against the level in the drip barrel being lost. However, these prior art sets have presented the following problems:

1. When it was desired to administer an additional measured volume of the fluid, it was necessary to add fluid to the measuring chamber and then to displace air from the drip barrel by compressing it, in order to unseat the check valve and to reestablish flow. This operation has at times caused the fluid level in the drip barrel to rise to a point where the drops could not be observed, so that the flow rate could not be properly controlled.

2. If the upper tubing clamp were not completely shut off during the infusion, the patient was connected directly to the main fluid supply, and if this were not detected, he could receive too much of the fluid and fatality might result.

The present invention is intended to solve these problems by providing a different way of connecting the measuring chamber with the main fluid supply and the drip barrel with the measuring chamber in a combination such that one cannot at the same time have fluid from the main supply going into the measuring chamber and fluid coming from the measuring chamber to the drip barrel and into the patient. The invention employs a two-way valve which at one time connects a fluid inlet leading from additional stored solution to the volumetric chamber and only at a separate time connects the volumetric chamber to the drip barrel and thence to the patient. The main or prime fluid supply is never connected to the patient.

Some fluids foam when introduced from the top of the measuring chamber, and foaming makes accurate measurement impossible. This foaming does not take place in the present invention where the fluid is introduced into the bottom of the measuring chamber.

An understanding of the importance of these features and other objects and advantages of the invention will appear from the following description of a preferred form thereof.

In the drawings:

FIG. 1 is a view of elevation of an apparatus for administering parenteral solution, embodying the principles of the invention.

FIG. 2 is an enlarged view in elevation of the measuring chamber and drip barrel, joined by a valve according to this invention, the valve being in the position connecting the measuring chamber to the drip barrel.

FIG. 3 is an enlarged view in section taken along the line 3—3 in FIG. 2 and FIG. 4.

FIG. 4 is a fragmentary view in section taken along the line 4—4 in FIG. 3, but reduced in scale.

FIG. 5 is a view in section taken along the line 5—5 in FIG. 3.

FIG. 6 is a fragmentary view similar to FIG. 2, with the valve in the position connecting the prime fluid solution supply to the measuring chamber and simultaneously preventing flow from the measuring chamber to the drip barrel.

FIG. 7 is a view in section taken along the line 7—7 in FIG. 6.

FIG. 8 is a fragmentary view in section taken along the line 8—8 in FIG. 7.

FIG. 9 is a view in section taken along the line 9—9 in FIG. 7.

FIG. 10 is an enlarged view in section of a modified form of valve usable in the present invention.

FIG. 11 is a similar view with the valve in a different position.

The elements are preferably made from transparent plastic materials. A tubing 10 conducts prepared parenteral solution from a main supply container 11 to a control valve 12. The control valve 12 is a two-position valve; it may have a cylindrical member 13 with a handle 14, that is rotatable in a housing 15 with a cylindrical bore 16. An axial central passage 17 is connected directly from the tubing 10 to a radial portion 18 that in one position (FIG. 6–9 leads into the lower end of a calibrated measuring chamber 20 through a passage 21, and in the other position (FIG. 2–5) the radial passage 18 is cut off from the passage 21. In that other position, a semicircular peripheral passage 22 connects the passage 21 to a passage 23 that leads directly into the upper end of a drip barrel 24, by a drip outlet 25. The semicircular passage 22 is cut off from the passage 21 when the radial passage 18 is connected to the passage 21. The valve 12 is purposely made so that at no time can the passage 21 be connected simultaneously to both passages 18 and 22.

The measuring chamber has an air vent 26 and a medication inlet 27 and is suspended from the tube 10 by a noncommunicating support member 28. A rubber float 30 may be provided to act as a check valve, in connection with a float retainer cage 32. This float valve 30 is elevated from the upper end 33 of the passage 21 when the chamber 20 is being recharged through the tube 10 and valve passages 17 and 18. When closed, it allows a slow drop-by-drop passage of fluid from the chamber 20 to flow by the valve passage 22 and the passage 23 into the drip chamber 24.

The lower end of the drip chamber 24 leads by a conduit 34 to a hypodermic needle 35. A conventional flow valve 36 may be used to regulate the rate of flow from the drip chamber 24 to the patient.

In use, the tubing 10, being connected to the main fluid supply 11, supplies fluid to the measuring chamber 20 when the valve 12 is in the position shown in FIGS. 6 to 9, but not otherwise. To begin with, at least 20 cc. of fluid is allowed to flow through the tube 10 and the passageways 17, 18 and 21, to unseat the check valve 30 and flow into the chamber 20. After the chamber 20 has received about 20 cc. the valve 12 is then moved to the position shown in FIGS. 2 to 5, and fluid supply from the tube 10 is cut off, while the measuring chamber 20 is then open to the drip barrel 24 through the passageways 21, 22, and 23. By adjusting the flow valve 36 a desired drip level is established in the drip barrel 24. The conduit 34 is filled with fluid until air bubbles are cleared and the drip barrel 24 is partially full. This volume in the drip barrel 24 then prevents air bubbles from entering the conduit 34, all this being prior to any administration to the patient.

The valve 12 is then returned to the position of FIGS. 6–9, and fluid is caused to flow from the main supply 11 into the measuring chamber 20 until the desired volume is obtained for administration to the patient. The needle 35 may then be injected into the patient and the valve 12 returned to the position shown in FIGS. 2 to 5, and the measured amount is enabled to flow slowly by drops into the drip chamber 24, and from the drip barrel 24 through the conduit 36 to the patient. Since the valve 12 has two operating positions and since in between these positions it is cut off in both ways, it is impossible for the main supply of fluid to be connected directly to the patient.

When it is desired to administer additional volumes of fluid, the valve 12 is simply returned to the position of FIGS. 6 to 9, cutting off flow to the drip chamber 24 while refilling the measuring chamber 20 to the desired level, and the process is repeated by once again turning the valve 12. In prior art sets, in order to refill safely, it was necessary to pinch the tubing under the drip chamber 24 with one hand and squeeze the drip chamber 24 with the other hand to make the rubber float 30 rise, or in some other way to manipulate the rubber float 30

until it rises. In this invention, the float **30** is automatically unseated when the valve **12** is open to fluid supply.

While the preferred arrangement is the two-position valve **12** at the very bottom of the chamber **20** as shown, this is not always necessary. If desired, in place of a single two-way valve, two valves permanently connected together for operation, so that one must be closed before the other is opened, may be employed, and then one valve may be at a different location from the other, so long as the connection is physically maintained. However, the embodiment shown is usually more convenient.

FIGS. **10** and **11** show a modified form of two-position valve means **40** for connecting the conduit **10** to the measuring chamber **20** in a first position only, while connecting the measuring chamber **20** to the drip barrel **24** in a second position only. Here, a valve housing **41** has a cylindrical bore **42** in which a cylindrical valve member **43** is rotatable. The passages **21** and **23** are vertical and are part of the housing **41**, which also has a horizontal passage **44** connected to the tube **10**. The valve member **43** has a through passage **45** and a tee passage **46**. When the tee passage **46** is in line with the passage **21** and the passage **45** aligned with the passage **44**, the measuring chamber **20** can be refilled, but nothing can pass to the drip barrel **24**. When the through passage **45** is vertical, the drip barrel **24** is connected to the passage **21** of the measuring chamber, but the tee passage **42** is then cut off.

To those skilled in the art to which this invention relates, many changes in construction and widely differing embodiments and applications of the invention will suggest themselves without departing from the spirit and scope of the invention. The disclosures and the description herein are purely illustrative and are not intended to be in any sense limiting.

What is claimed is:

1. An apparatus for administering a parenteral solution, including in combination:

a fluid supply container,

a measuring chamber below said container and having a lower end,

a drip barrel below the lower end of said chamber,

a conduit connected at an upper end to said fluid supply container and having a lower end connected to a point below said chamber and above said barrel,

two-position valve means connected to the lower end of said measuring chamber and having a first position in which and only in which it connects said chamber to said conduit and having a second position in which and only in which it connects said measuring chamber to said drip barrel, said valve means having means positively preventing flow of fluid from said conduit to said drip barrel at any time, said apparatus having means connected to the drip barrel for attaching to and supplying parenteral solution to a patient.

2. An apparatus for administering a parenteral solution comprising:

a fluid supply container,

a measuring chamber below said container and having a lower end,

a drip barrel below the lower end of said chamber,

a first conduit leading from said fluid supply container connected to a point between the chamber and barrel,

two-position valve means connected to the lower end of said measuring chamber and having a first position in which and only in which it connects said chamber to said first conduit and having a second position in which and only in which it connects said measuring chamber to said drip barrel, said valve means having means positively preventing flow of fluid from said first conduit to said drip barrel at any time;

check valve means inside said measuring chamber at said lower end just above said two-position valve means,

passageway means leading to said two-position valve means and closed by said check valve means when said measuring chamber is empty, said passage means leading from said measuring chamber via said two-position valve means when it is in its said second position to said drip barrel through an orifice drip;

a second conduit connected to said drip barrel at one end, said second conduit adapted to be connected to a patient at its other end; and

a control valve on said second conduit to regulate fluid flow to the patient.

3. The apparatus of claim **2** wherein said check valve means comprises

a retainer cage at the lower end of said chamber above the upper end of said passageway means and having an upper wall spaced above said upper end,

a float retained in said cage and forced upwardly toward said upper wall when fluid flows into said chamber from said first conduit via said two-position valve, and

means provided by incomplete seating of said float on said upper end for allowing slow drop-by-drop passage of fluid from said chamber into said passage means when said two-position valve is in said second position.

4. An apparatus for administering a parenteral solution, including in combination:

a fluid supply container having a first conduit leading from a lower end thereof,

a measuring chamber below said container and having a lower end with a second conduit connected thereto,

a drip barrel below the lower end of said chamber with a third conduit leading to the upper end thereof,

two-position valve means connected to said second conduit and having a first position in which and only in which it connects said second conduit to said first conduit and having a second position in which and only in which it connects said second conduit to said third conduit, said valve means having means positively preventing flow of fluid from said first conduit to said third conduit at any time said drip barrel having means extending from the lower end thereof for attaching and supplying parenteral solution to a patient.

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