United States Patent [19]

Price

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[54] **CONTROL DEVICE FOR PARENTERAL LIQUID FEED APPARATUS**

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[52] **U.S. Cl.**..... **128/214 E,** 128/214 C, 137/104, 137/192

[51] **Int. Cl.**..... **A61m 5/00**

[58] **Field of Search** ..... 119/80; 137/104, 137/192; 128/214 R, 214 C, 214 E

[56] **References Cited**

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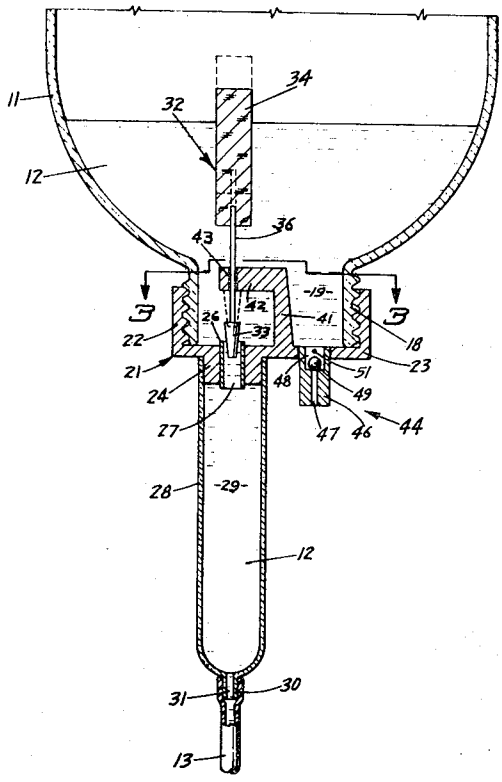
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[57] **ABSTRACT**

A fluid flow control device for an administration set used to introduce parenteral liquids into a patient. The control device has a body releasably attached to a container storing the liquid and connected to a feeding tube for carrying the liquid to a hypodermic needle. A cone-shaped valve connected to a float controls the rate of flow of liquid through a passageway in the body. The valve and float are movably mounted on the body. When the level of liquid in the container is lowered to or reaches a point where the container is substantially empty, an amount of liquid is retained in the container so that limited flow of liquid through the passageway is continued for a period of time.

10 Claims, 4 Drawing Figures



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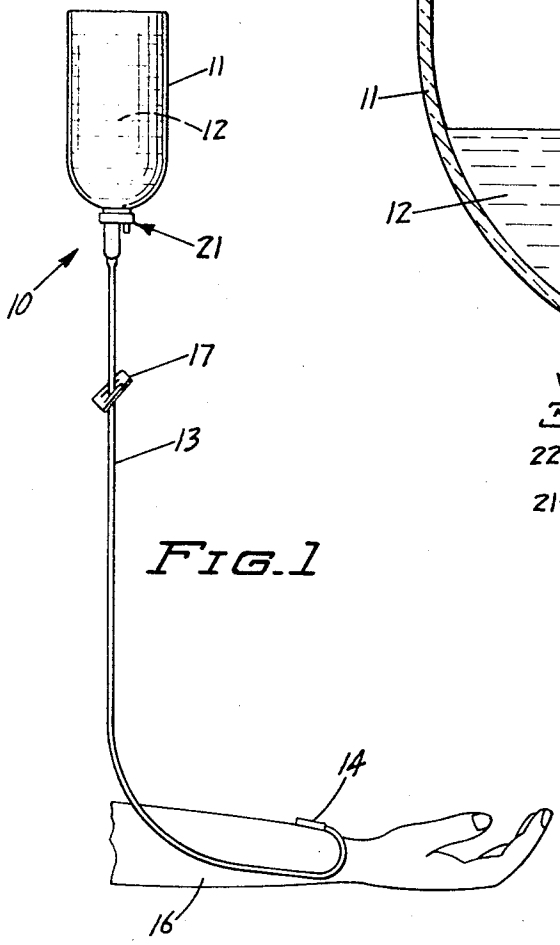


FIG. 1

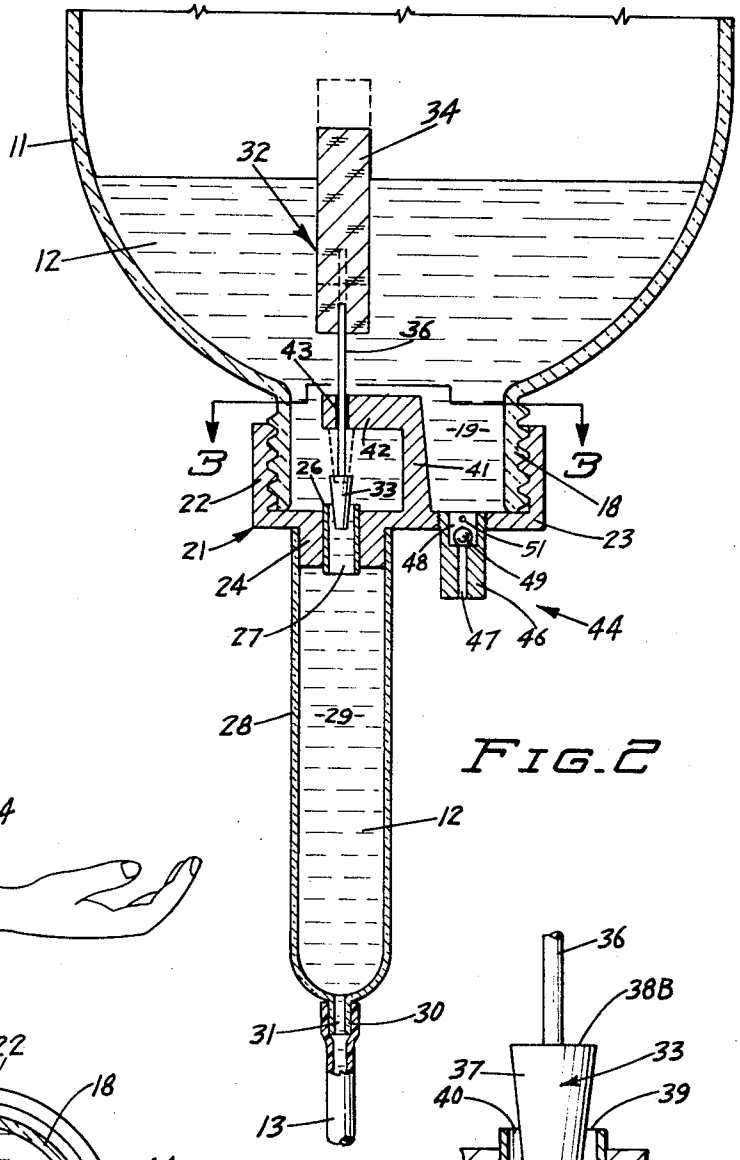


FIG. 2

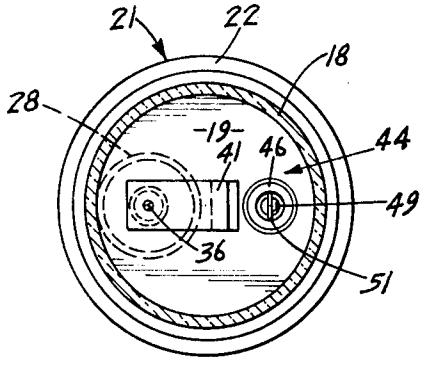


FIG. 3

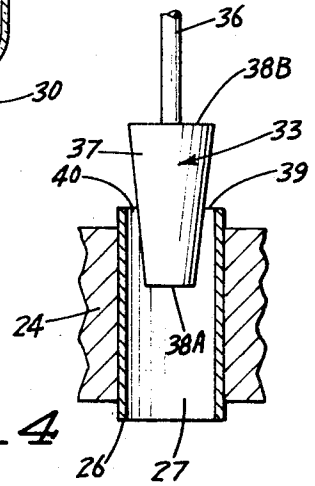


FIG. 4

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CONTROL DEVICE FOR PARENTERAL LIQUID FEED APPARATUS

BACKGROUND OF INVENTION

Intravenous liquids are administered by gravity feed from an elevated and inverted container storing the liquid. The liquid is delivered from the container into a vein of a patient through a feed tube coupled to a hypodermic needle. Check valve devices have been developed to stop administration of the parenteral liquid when the liquid is nearly exhausted. These units are designed to abruptly stop the flow of fluid to prevent the danger of air or other gases being passed from the unit to the patient. Martinez discloses in U. S. Pat. No. 2,784,733 a float-type check valve operative to stop the flow of fluid in an administration set. A similar type valve is disclosed by Bernstein in U. S. Pat. No. 3,227,173. Other types of valves, as flexible diaphrams have been employed to close off or seal the outlet opening of an apparatus for administering a parenteral solution. An example of this diaphram-type valve is shown in U. S. Pat. No. 3,216,419. When the valve structures in all of these intravenous devices are closed, the fluid flow is terminated.

SUMMARY OF INVENTION

The invention is directed to a fluid flow control device for an administration set for parenteral liquids. The device is operable to reduce the rate of flow of liquid in conjunction with the level of liquid in the container attached to the administration set. The control device has a body in the form of a cap that is attached to the outlet portion of the container. The body has an outlet passageway for directing a liquid to a collector member connected to a tube carrying the hypodermic needle. Liquid control means is movably mounted on the body for controlling the rate of flow of liquid through the passageway when the level of liquid in the container approaches the body. The control means has a movable valve that is insertable into the passageway which restricts the flow of liquid through the passageway at a reduced rate. For example, the flow rate can be reduced to four or five drops per minute. This flow rate allows the intravenous opening in the hypodermic needle to remain open for a period of time. This period of time is sufficient for the attendants to change the container before the liquid runs out. The position of the valve is controlled with a float located in the bottom portion of the container. The body has a support slidably supporting a connecting rod secured to the float and the valve.

An object of the invention is to provide a parenteral liquid feed control device that will automatically reduce the flow rate of intravenous liquid flowing through the tube connected to the hypodermic needle when the level of liquid in the container approaches the bottom of the container. A further object of the invention is to provide a liquid feed control device that is a one-piece assembled unit which is attachable to the conventional container storing the liquid.

IN THE DRAWING

FIG. 1 is an elevational view of an intravenous liquid feeding apparatus having the liquid feed control device of the invention;

FIG. 2 is an enlarged elevational sectional view of the liquid control device mounted in assembled relation with a liquid storing container;

FIG. 3 is a sectional view taken along the line 3—3 of FIG. 2; and

FIG. 4 is an enlarged sectional view of the liquid feed control valve of FIG. 2.

Referring to the drawing, there is shown in FIG. 1 a parenteral or intravenous liquid feeding apparatus, indicated generally at **10**, in position for gravity feed of the liquid to a patient. The apparatus **10** is secured to the neck or open end of a bottle or container **11** storing the intravenous fluid **12** being administered to the patient. The lower end of the apparatus includes an elongated, flexible feed tube **13** of rubber, plastic, or the like. The feed tube **13** is connected to a hollow hypodermic needle **14**. The needle **14** has its forward portion inserted into the arm **16** of the patient. A pinch valve **17**, or similar control valve, carried by the tube **13**, controls the flow rate of liquid through the tube. The pinch valve **17** may be replaced by flow meters measuring the rate of intravenous infusion of the parenteral liquid. Examples of suitable flow meters are shown in U. S. Pat. Nos. 3,348,543 and 3,587,313.

In use, the container **11** is replaced when the supply of fluid in the container **11** has been exhausted. Prior to the present invention, the gravity-type intravenous administrators were provided with check valves which terminated the infusion to eliminate admission of air into the feed tube. When the flow of intravenous fluid is terminated, the needle becomes clogged. A new needle is needed to continue the feeding of subsequent amounts of liquid. Replacing the container and needle requires additional time and subjects the patient to additional pain.

As shown in FIG. **2**, the container **11** has an open neck or end **18** having external threads. The neck **18** surrounds the outlet passageway **19** of the container **11**. The liquid feeding apparatus **10** has a generally cup-shaped body, indicated at **21**, that is releasably mounted on the open end of the container **11**. The body **21** has an annular flange **22** provided with internal threads that cooperate with the external threads on the neck **18** so that the body is threaded onto the end of the container. A generally flat wall **23**, integral with flange **22**, closes the container passageway **19**. The wall **23** has an outwardly directed boss or projection **24** having an opening carrying a hollow cylindrical member or tube **26**. The tube **26** has a longitudinal outlet passage **27** for carrying liquid from the container through body **21**.

An elongated, cylindrical member **28** having a chamber **29** for collecting the fluid discharged through the passageway **27** is attached to the boss **24**. The member **28** is transparent material, as glass or plastic, and has a cylindrical upper end that is located in a tight sealed relationship with the external face, or surface, of the boss **24**. The bottom of the member **28** has an outwardly directed nipple **30** having an outlet passageway **31**. The feed tube **13** is mounted on the nipple **30** so that the liquid flows from chamber **29** through the passage **31** into the feed tube **13**.

The rate of flow of liquid **12** from the container **11** into the cylindrical member **28** is controlled with a fluid control means indicated generally at **32**. Control means **32** has a valve **33** connected to a float **34** or similar buoyant member with a linear rod **36**. The valve **33** has

a generally cone shape with a smooth, downwardly and inwardly tapered circular outer surface **37**. The lower end **38A** of the valve **33** has a generally flat circular shape and a diameter approximately one-half the diameter of the upper end **38B** of the valve **33**. The longitudinal length of the valve **33** is approximately twice the diameter of the upper end **38B**. The inside diameter **39** of the tube **26** is slightly larger than the diameter of the upper end **38B** of the valve **33**.

As shown in FIG. **4**, as the valve **33** moves into the passageway **27**, there is a continuous annular space **40** between the outer surface **37** of the valve and the inside wall of the tube **26**. This space **40** permits restricted flow of fluid through the passageway **27** during the closing of the valve **33**. As shown in FIG. **2**, as the fluid level in container **11** approaches the body **21**, the float **34** lowers the valve **33** into the passageway **27**. This restricts the flow of fluid through the passageway **27**. The annular space **40**, being relatively small, permits the continued flow of liquid at a reduced rate of, for example, approximately four or five drops per minute. Other flow rates can be used to achieve limited flow through needle **14**. This allows the intravenous opening in the hypodermic needle to remain open for approximately 30–45 minutes. This time interval provides nurses or other personnel sufficient time to change the container **11** before all the fluid is dispensed. The advantages of this type of operation are that it saves considerable time in administration of intravenous fluids and eliminates the necessity of changing needles.

The valve **33** is aligned with passageway **27** with a support **41** having a laterally directed portion or extension **42** spaced from and extended over the passageway **27**. The extension **42** has a longitudinal hole **43** for slidably receiving the rod **36**. This support **41** is secured to the inside face or surface of the wall **23** of the body **21**. The body **21**, support **41** and extension **42** can be a one-piece member of metal, plastic, or similar material. The valve **33** is located on the lower side of extension **42**. The float **34** is located on the upper side of extension **42** and extends into the lower portion of the container **11**. As shown in broken lines, when the level of liquid in the container is high, the float **34** holds the valve **33** in engagement with the lower side of the extension **42**. When the valve **33** is in this position, the passageway **27** is entirely open, permitting the free flow of fluid from the container **11** through the passageway **27** and into the chamber of the cylindrical member **28**.

The body **21** carries an air check valve assembly indicated generally at **44**. Check valve assembly **44** has a cylindrical member **46** that is threaded into a suitable hole in the wall **23**. The member **46** has a passageway **47** leading to a chamber **48** open to the inside of the body **21**. A check valve in the form of a ball **49** is located in the chamber **48**. A pin **51**, or similar retaining structure, is used to hold the ball **49** in floating assembled relation with the member **46**. The ball **49** blocks the opening to the passageway **47** so that the liquid **12** does not flow through the check valve. Reduced pressure in the container **11**, caused by lowering the level of liquid in the container, will cause air to move into passageway **47** to displace the ball, thereby allowing air into the container. Other types of one-way check valve assemblies can be used to permit air to replace the dispensed fluid in container **11**.

In operation, with the container **11** in an inverted gravity feed position, as shown in FIGS. **1** and **2**, the liquid **12** will exert lifting or buoyant forces on the float **34**, thereby holding the valve **33** in engagement with the extension **42** and keeping the passageway **27** open. The liquid **12** flows through the passageway **27** into the chamber **29**. The feed line **13** delivers the liquid to the hypodermic needle **14** which discharges the solution to the vein of the patient. As the level of the liquid in the container **11** approaches the neck of the container, the flow control apparatus **10** functions to reduce the flow rate of liquid dispensed from the container. The float **34** moves down with the level of liquid, thereby moving the valve **33** downwardly into the passageway **27**. The shaft **36**, being linearly guided in the hole **43**, directs the valve into the upper end of the tube **26**. The valve **33**, having a continuous cone-shaped surface, restricts the rate of flow of liquid through passageway **27**. The valve **33**, being smaller than the passageway **27**, does not at anytime stop or block the flow of liquid. The flow is reduced so that it continues at a rate of, for example, approximately four or five drops per minute. Other reduced flow rates can be used to maintain limited feeding of liquid to the needle **14**. This will continuously supply liquid to the feeding tube so that the hypodermic needle will remain open. The slow rate of feed will insure that no air or other gases are allowed to enter the feed line **13**. Also, the reduced flow rate of liquid provides the attending personnel sufficient time to remove the control device from the substantially empty container and place it on a full container so that the feeding of the fluid to the patient can be continued without the necessity of replacing the needle.

The invention has been described with respect to the preferred embodiment. It is understood that various changes in size and material are within the purview of the invention as defined in the appended claims.

The embodiments of the invention in which an exclusive property or privilege are claimed are defined as follows:

1. A parenteral liquid feed control device connectable to a container for storing parenteral liquid and a tube means to deliver the liquid to a needle comprising: body means mountable on the container to receive parenteral liquid, said body means having an outlet passageway for said liquid; means connected to the body means and adapted to be connected to the tube means to carry said liquid from the outlet passageway of the body means to the tube means; and liquid control means movably mounted on said body means for controlling the rate of flow of liquid through the passageway, said control means having a valve member movable toward the passageway to allow limited flow of liquid through said passageway when the level of the liquid in the container reaches a point whereby an amount of liquid is retained in the container so that the limited flow of liquid through said passageway is continued for a period of time, said valve member being of a size smaller than said passageway whereby a limited amount of fluid continues to flow through the passageway when the valve member is located in said passageway.

2. The liquid feed control device of claim **1** wherein: said body means includes a cup-shaped member releasably attachable to the container.

3. The liquid feed control device of claim **1** wherein: said means connecting the body means to the tube means comprises an elongated cylindrical member having a chamber for accumulating liquid.

4. The liquid feed control device of claim 3 wherein: said body means has an outwardly directed boss, said elongated hollow cylindrical member having an end mounted on said boss.

5. The liquid feed control device of claim 1 wherein: said liquid control means includes a float positionable in said container when the body means is attached to the container, and means movably mounted on the body means connecting the float to the valve member.

6. The liquid feed control device of claim 1 wherein: said valve member has a cone-shaped outer surface that is smaller than said passageway, whereby fluid continues to flow through said passageway when the valve member is located in the passageway.

7. The liquid feed control device of claim 1 wherein: said body means has a support member projected toward the container, said support member having a portion spaced from and extended over said passageway, said liquid control means including a float located adjacent the container side of the portion of the support, said valve being located adjacent the opposite side of said support, linear rod means slideably positioned in a hole in said portion of the support connected to the float and the valve member to linearly align the valve member with the passageway.

8. The liquid feed control device of claim 7 wherein: said valve member has a downwardly converging cone-shaped outer surface and a transverse cross sectional area smaller than the transverse cross sectional area of the passageway whereby fluid continues to flow through said passageway when the valve member is located in the passageway.

9. The liquid feed control device of claim 7 wherein: said body means has an outwardly directed boss, said means connecting the body means to the tube means comprising an elongated hollow cylindrical member having an end mounted on said boss.

10. The liquid feed control device of claim 7 including: an air check valve assembly mounted on said body means operable to permit air to flow into the container to replace the liquid drained from the container.

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