Jan. 10, 1956 R. K. CUTTER 2,730,097

INJECTION MECHANISM

Filed June 19, 1951 2 Sheets-Sheet 1

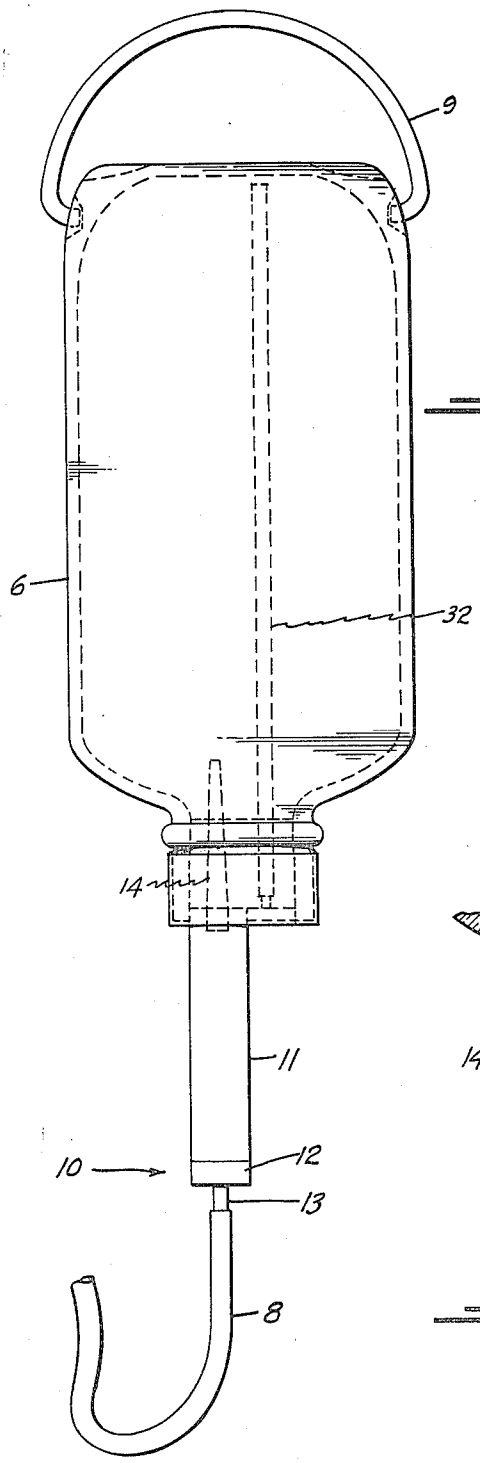


Fig. 1

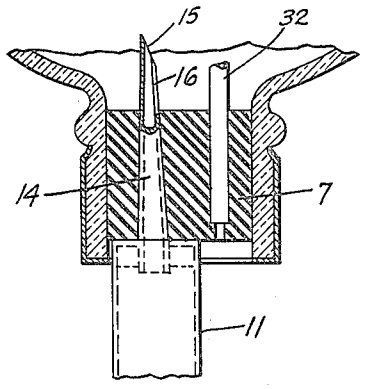


Fig. 2

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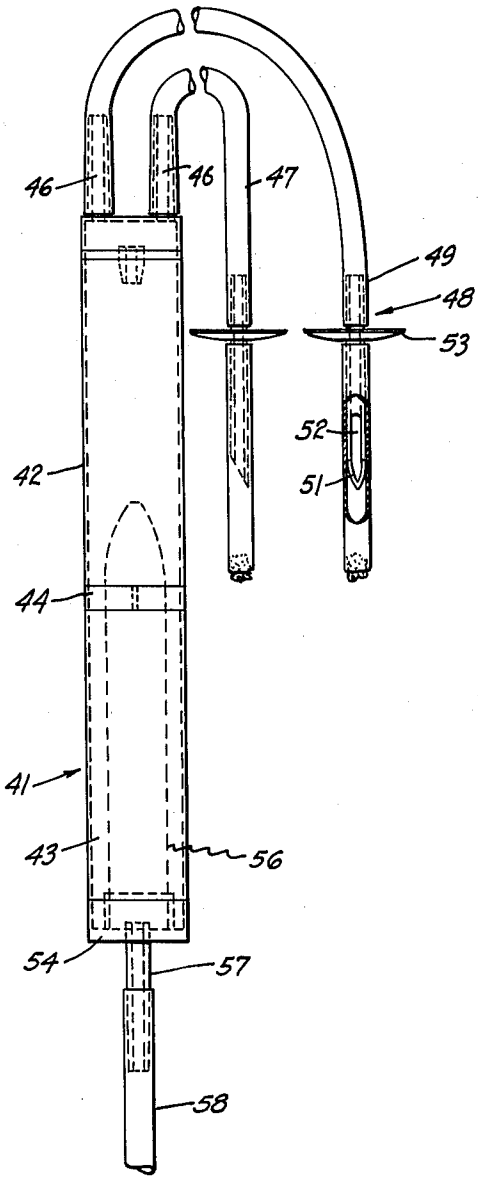


Fig. 3

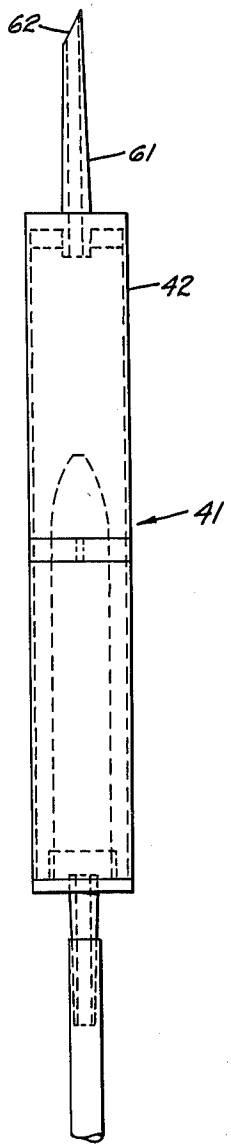


Fig. 4

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INJECTION MECHANISM

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6 Claims. (Cl. 128—214)

This invention relates to apparatus for use in administering a solution, plasma or blood to a patient.

The solution, blood or plasma to be administered is usually prepared and packaged in a sterile glass bottle which is sealed with a resilient stopper. When it is desired to effect the transfusion, a pointed length of glass tubing is inserted in the container by passing it through the resilient stopper; a length of flexible hose is attached to the glass tube, the hose leading to a needle, the latter being placed at a desired location in the patient. To observe the flow of solution, it is desirable to include a transparent chamber between the stopper-piercing glass tube and the hose to provide a flow-meter; this is usually termed a "drip-meter" for the liquid flow rate is usually held to a drop-by-drop release from the bottle. Heretofore, the stopper piercing tube and flow-meter have been made of glass because of the necessity for transparent devices and of sterilizing such devices. In use, particularly in the field or under emergency conditions, serious accidents have resulted from the attempted insertion of the glass piercing element into the stopper, the glass fracturing and cutting the hand of the operator. In addition, difficulty has also been encountered in packaging and transporting the glass piercing and flow-meter elements without breakage.

In accordance with this invention, I provide an apparatus assembly enabling the container stopper to be traversed readily by a non-breakable tubular spike without hazard to the operator and which apparatus can be readily sterilized and thereafter transported as desired without danger of breakage as with a similar unit constructed of glass.

It is in general a broad object of the present invention to provide an improved apparatus set up for administering a solution, plasma or whole blood to a patient.

A further object of the present invention is to provide an improved piercing element and flow-meter arrangement for use with a transfusion flask.

The invention includes other objects and features of advantage, some of which, together with the foregoing, will appear hereinafter wherein the preferred form of device embodying this invention is disclosed.

In the drawing accompanying and forming a part hereof,

Figure 1 is a side elevation elevation illustrating an assembly embodying the present invention.

Figure 2 is an enlarged sectional view through the stopper and piercing element.

Figure 3 is a side elevation of another form of piercing element shown in an arrangement with a flow-meter.

Figure 4 is another form of piercing element and flow-meter.

In a preferred embodiment shown in Figures 1 and 2 in the drawing, a glass bottle container 6 is shown suspended from a hasp 9 from a suitable fixed support, the container being filled with the fluid to be transferred to the patient. The container 6 has a resilient stopper 7

closing and sealing the container; usually stopper 7 is covered by a removable cap structure which protects stopper 7 and the container contents, but this has been omitted from the drawing since it is removed immediately prior to use. The form of seal or stopper can vary and that shown is merely typical of the heavy closures employed to seal the container.

To transfer the contents of the container 6, a flexible tube 8 is provided having a hollow needle (not shown) at one end which is inserted into the patient at a desired location, usually into a vein. The other end of the tube 8 is connected to the container 6 and, in accordance with this invention, connecting means, generally indicated at 10, is provided. The connecting means includes a tubular member 11 having a plug 12 at one end sealed in the tubular member and having a nipple 13 over which an end of the tube 8 is placed; plug 12 can include one or more nipples 13 as desired so that a desired number of tubes 8 can be attached. The other end of the tubular member 11 has a hollow piercing element or spike 14 thereon formed integrally with the tubular member and being in the form of a truncated cone terminating in a sharpened end 15. A narrow cut 16 extends axially of the conical spike end 15 to facilitate piercing of the resilient stopper 7 and to provide a primary filter in the bottle 6, the spike being of a length sufficient to ensure that it extends above the stopper and into the container.

In use, the container 6 is filled, stoppered and sealed to maintain its contents under completely aseptic conditions. Flexible tube 8 is attached to the connecting means 10 and the unit is then sterilized, piercing element 14 being covered with a removable aseptic cover protecting element, the end of tube 8 being similarly protected; these covers are removed, a sterile, hollow needle being attached to the other end of tube 8 while piercing element 14 is forced into and through the resilient stopper and into the contents of container 6. Because of the strong but non-breakable character of the transparent tubular member 11, the piercing element 14 can be forced into position without hazard of breaking in the hand of the manipulator. Air vent 32 admits air into container, the vent taking any suitable form.

In Figure 3, I have shown a modified form of apparatus including a drip meter 41 made up of two tubular sections 42 and 43 fitted and sealed together as at 44. Section 42 includes two spaced inlet tubes 46 from which flexible tubing 47 extends to each of the tubular piercing or spike elements generally indicated at 48. Each spike includes an outlet portion 49 over which flexible tubing 47 is extended. The other end of the tubular spike 48 is sharpened as at 51, the end including an axial split or cut 52; the sharpened end is formed by cutting the end along a plane at about 45° to the spike axis. A flange 53 is provided intermediate the ends of the spike so that an operator can place his fingers on the outlet portion 49 and against the flange to force the spike element into and through a stopper in a container.

Drip-meter 41 includes a plug closure 54, closing tubular section 43 and supporting one or more tubular nylon screens 56 therein to provide a filter for filtering the solution passing the drip-meter to outlet 57 and into tube 58. Before use, the assembled device is suitably sterilized, the ends of the spike elements 48 being covered with sterile covers as is the end of the tube 58. This apparatus enables two different fluids to be fed in rapid succession or together, as desired.

In the form of device shown in Figure 4, the flow-meter 41, like that previously described in connection with Figure 3, is shown, but in this instance the upper section 42 is provided with an integral single hollow spike element 61 having a sharpened split end 62 thereon for insertion into a container, as desired.

In accordance with this invention, the piercing element and flow-meter are made of polystyrene to provide strong units which can be sterilized. In addition, the polystyrene spike possesses such rigidity that it can be forced into and through the rubber stopper to traverse the stopper, being aided in this by the split or cut along the side of the spike. The split or cut in the end portion of the spike which projects above the stopper also acts as a filter and an aid to feeding the fluid continuously when clots are present in the fluid. This enables the sterile piercing element to be forced through the rubber without need for application of a sterile lubricant, a feature of considerable importance in the field and emergency use. While polystyrene is the preferred material, one can also use cellulose acetate, cellulose acetate butyrate, a methacrylate polymer such as Lucite or ethyl cellulose, as the material for the drip-meter and spike. A spike formed of these materials need not first be wet, as must glass, to pass the rubber stopper.

In practice, the container is filled and packaged separately while the flow-meter and flexible tube or tubes are also made up as a separate unit, the end of each tube and piercing element being suitably enclosed in separate, sterile covers to protect these until the device is ready for use.

From the foregoing, I believe it will be apparent that I have provided a relatively novel, simple and improved transfusion apparatus. Although only one cut or slot is shown in the spike, two or more can be included as desired.

I claim:

1. In a fluid feeding device of the character described, including a container having a resilient pierceable stopper therein and a flexible tube, means for connecting the flexible tube to the container comprising a transparent tubular member having one end thereof connected to said tube and a closure at the other end of said tubular member having a needle-like conical tubular piercing projection thereon, said projection having its terminal end truncated at an angle to the longitudinal axis of the projection and having a narrow slot cut along one side thereof from said terminal end to facilitate piercing of said resilient pierceable stopper and extend beyond the stopper and into the container to establish and provide communication with said tube and act as a filter for fluid flowing from said container.

2. In a fluid feeding device of the character described including a container having a resilient rubber pierceable stopper therein and a flexible tube, means for connecting the flexible tube to the container comprising a transparent tubular member formed of a material selected from the group consisting of cellulose acetate, cellulose acetate butyrate, a methacrylate polymer, ethyl cellulose and polystyrene, said member having one end thereof connected to said tube and a closure at the other end of said tubular member having a needle-like truncated conical tubular piercing projection thereon with a narrow slot cut along the side thereof to facilitate piercing of said resilient pierceable stopper and extend beyond the stopper and into the container to establish and provide communication with said tube and to filter fluid flowing from the container.

3. In a fluid feeding device of the character described including a container having a resilient rubber pierceable

stopper therein and a flexible tube, means for connecting the flexible tube to the container comprising a transparent tubular member formed of a material selected from the group consisting of cellulose acetate, cellulose acetate butyrate, a methacrylate polymer, ethyl cellulose and polystyrene, said member having one end thereof connected to said tube and a closure at the other end of said tubular member having a tubular piercing projection thereon with its end cut off along a plane at about 45° to the longitudinal axis thereof and having a narrow slot cut along the side thereof to facilitate piercing of said resilient pierceable stopper to establish and provide communication with said tube and filter fluid flowing from the container.

4. In an apparatus of the character described, a rubber stopper piercing element consisting of a tublar conical spike of a material selected from the group consisting of cellulose acetate, cellulose acetate butyrate, a methacrylate polymer, ethyl cellulose and polystyrene, said conical spike being truncated at an agle to the longitudinal axis of said conical spike to provide a piercing end, said piercing end being slotted from the end thereof axially to an intermediate point along the spike.

5. In an apparatus of the character described, a rubber stopper piercing element consisting of a tublar conical spike of a material selected from the group consisting of cellulose acetate, cellulose acetate butyrate, a methacrylate polymer, ethyl cellulose and polystyrene cut off at one end along a plane at about 45° to the axis of the spike to provide a piercing end on the spike, said spike having its piercing end slotted from the end thereof axially to an intermediate point along the spike.

6. In a fluid feeding device of the character described including a container having a resilient rubber pierceable stopper therein and a flexible tube, means for connecting the flexible tube to the container comprising a transparent tubular member formed of a material selected from the group consisting of cellulose acetate, cellulose acetate butyrate, a methacrylate polymer, ethyl cellulose and polystyrene, said member having one end thereof connected to said tube and a closure at the other end of said tubular member having a needle-like truncated conical tubular piercing projection thereon with a narrow slot cut along the side thereof from a lower portion of the truncated face on said needle-like conical piercing projection to facilitate piercing of said resilient pierceable stopper and extend beyond the stopper and into the container to establish and provide communication with said tube and to filter fluid flowing from the container.

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