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SAFETY CUTOFF VALVE FOR LIQUID ADMINISTERING APPARATUS

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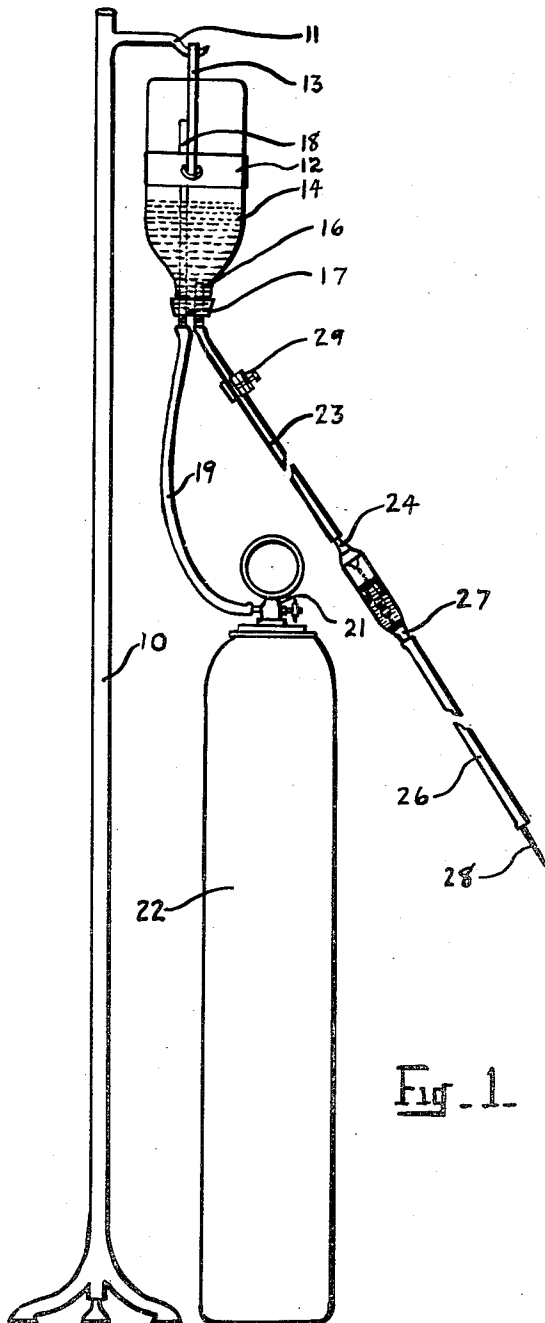


Fig. 1.

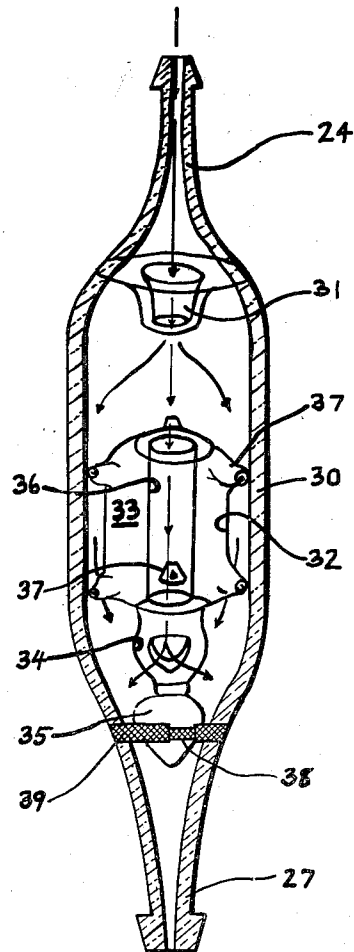


Fig. 2.

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SAFETY CUTOFF VALVE FOR LIQUID
ADMINISTERING APPARATUS

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5 Claims. (Cl. 128—214)

My invention relates to apparatus for supplying liquids for intravenous administration, and has particular reference to means for preventing the accidental administration of gases, such as oxygen, which are often employed to accelerate the liquid transfusion.

The principal object of my invention is to provide a device which will permit uninterrupted flow of a liquid until a predetermined amount thereof will have been administered from a container therefor to a body receiving a transfusion, at which time further flow into said body of any gas that was employed to accelerate such liquid movement automatically will be prevented.

Another object is to provide such a device which is easily employed and foolproof in its operation.

Still another object is to provide such a device which shall have a low initial cost, and shall with ordinary care have a long and useful life.

These and other objects of my invention will be understood by reference to the accompanying drawings wherein:

Fig. 1 is a schematic illustration of an apparatus for the compressed gas-accelerated, intravenous administration of the desired liquid, which incorporates my novel safety device; and

Fig. 2 is a full-size, longitudinally sectioned view of my novel automatic fluid cut-off valve.

It has been shown that the process of intravenously administering liquids can be accelerated by means of compressed gas which is administered into the container of liquid and by its pressure therein forces the liquid out of the container. This is done, for example, in cases where the need for blood, plasma, saline solution, is so imperative that administration by gravity flow is too slow. The one great drawback of this technique has been the danger that the liquid will be emptied so rapidly from the container that, before the attendant will disconnect the mechanism and stop the flow, the gas itself will gain entrance to the circulatory system of the patient receiving the transfusion. Medical cases on record have indicated that when such accidents occur, a gas embolism forms in the patient's bloodstream, and as a result death almost invariably occurred. My invention is a positive means for preventing such accidents from happening whenever my novel device is employed, and this will become clear from the following description thereof.

Fig. 1 shows a convenient support 10 having a hanger 11 from which is suspended, by means of a clamp 12 and ring 13, a liquid container 14. The container is inverted so that the contents thereof can freely flow out of an exit tube 16 that extends from within the container, through a two-holed rubber stopper 17, to the exterior. An entrance tube 18 is fitted through the other hole in the stopper, and is of sufficient length to extend almost to the closed end (or bottom) of the container.

A rubber tube 19 connects tubes 18 to an outlet cock 21 of a cylinder 22 containing compressed gas, preferably oxygen. Another rubber tube 23 connects tube 16 to the inlet end 24 of my novel device. Still another rubber tube 26 connects the outlet end 27 of my unique apparatus to a hypodermic needle 28. Optionally, a tube clamp 29 may be employed on tube 23 (as illustrated) or on tube 26 to stop or regulate the flow of liquids therein. This serves as an additional control which avoids the need for changing the adjustment of the compressed gas cock 21 after a transfusion has been started.

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Now that my invention has been described in situ, i. e., with respect to the other, conventional parts of a liquid-administering apparatus, a closer examination of my unique improvement's construction is in order. Referring to the Fig. 2 illustration my device will be seen to consist essentially of a tube having an inlet end 24, an outlet end 27, a central, expanded chamber 30, and a float member 32. Preferably, there is provided a tubular port 31 at the juncture of inlet 24 and chamber 30. This port 31 serves to direct the flow of liquids entering inlet 24 centrally through chamber 30 and has another useful function which will become apparent as the description proceeds.

The float member 32 is free to move rotatively and axially to and from inlet 24 and outlet 27. Member 32 consists of a substantially cylindrical compartment 33 which contains sealed-in air, and a pair of depending arms 34 terminating in a hollow, conical valve 35. Extending axially through this sealed compartment is a tube 36 which is open at both ends. Extending laterally from the exterior of compartment 33 are a number of projections 37, preferably two or more equally spaced from each other, which serve to space the float from the walls of chamber 30. These projections 37 assure ready axial movement of the float and, more important, that the float will at all times be properly centered. In the illustrated form six projections 37 have been employed.

The arms 34 which depend from compartment 33 converge together and at their juncture, integrally connected therewith, is conical valve 35. This valve has a specially ground or otherwise prepared surface 38 circumscribing it. The ground surface 38 is capable of forming a liquid and air-tight seal when in flush contact with a similarly ground surface 39 that forms a valve seat on the interior wall surface at the juncture of chamber 30 and outlet 27.

Having described the component parts of my novel apparatus, those skilled in the art will be quick to appreciate how simple and foolproof is its operation. When connected in the line as shown by Fig. 1 between the liquid source and the ultimate body receiving the same, float valve 32 initially is in the Fig. 2 position. Clamp 29 is opened to allow the liquid in container 14 to flow down through tubing 23, past inlet 24 and port 31 and into chamber 30. As long as float valve 32 is in the Fig. 2 position, the liquid will not be able to get past the seal between surfaces 38—39. To open this seal, the entire inventive device of Fig. 2 is inverted so that the outlet end 27 and a portion of tube 26 connected thereto are raised higher than inlet 24.

This maneuver causes float 32 to slide back towards port 31, thus breaking the seal between surfaces 38—39. Immediately, the liquid already in chamber 30 passes through tube 36 and around compartment 33 (see directional arrows in Fig. 2), past valve 35 and through outlet 27, tube 26 and needle 28. The apparatus is then promptly restored to its normal position as shown in the drawings. The liquid, having gotten below the valve, will now be found to support (as shown in Fig. 1) the float member which is made buoyant by the air sealed in compartment 33 and in conical valve 35. Consequently the liquid will continue to flow from container 14 and eventually through needle 28 as long as there remains sufficient liquid in chamber 30 to buoy up float member 32. When the liquid is almost exhausted, a point will be reached where such buoyance ceases and, due to gravity, the float will drop into the Fig. 2 position once again so that the seal between surfaces 38—39 is reformed. This re-sealing shuts off further flow of the remaining liquid and the gas behind it, and thus very effectively and positively the gas is prevented from getting past outlet 27 and into the patient.

Other modifications will of course suggest themselves to those skilled in the art. For example, in the illustrated sample of my device I have constructed the apparatus entirely out of glass. However, it will be obvious that other well-known materials such as plastics, etc., may be employed. Nor need the apparatus be restricted to the specific form here shown by way of illustration as many other forms could be employed and yet remain in keeping with the spirit and scope of the

present invention. Further, it is not necessary to use the device only when administering liquids under pressure as it will work just as effectively and be just as useful when such administration is made under normal atmospheric pressure. In fact, the only limits to my invention are those hereinbelow set forth in the appended claims.

I claim:

1. For use in the intravenous injection of liquids, a container in which is stored a liquid that flows therefrom when the container is inverted, a tube for conducting the liquid which flows therefrom connected at one extremity to said container, a hypodermic needle connected to said tube's other extremity for conducting the liquid passing therethrough to the venous passages of the body into which it is to be injected, and liquid flow controlling means connected in the line between said tube's extremities, said liquid flow-controlling means comprising a tubular upper inlet end, a tubular lower outlet end, an expanded chamber intermediate said ends, a float member contained in said chamber, said float member having an opening extending axially therethrough substantially in alignment with the upper inlet and lower outlet ends, and a conical valve extending from said float member for releasably entering into a sealing relationship with the lower outlet end's interior surface, whereby the liquid which enters said flow-controlling means causes the float member to move away from said outlet end so that the liquid passes thereby and exits through the outlet end and through said hypodermic needle until such time when the liquid supply falls below a predetermined minimum necessary to support said float member spaced apart from said outlet end, whereupon the float member drops and the conical valve reenters the lower outlet end into sealing relationship with the outlet end's internal surface and prevents admission of any further matter into said injected body.

2. For use in the intravenous injection of liquids, a container in which is stored a liquid that flows therefrom when the container is inverted, a tube for conducting the liquid which flows therefrom connected at one extremity to said container, a hypodermic needle connected to said tube's other extremity for conducting the liquid passing therethrough to the venous passages of the body into which it is to be injected, and liquid flow-controlling means connected in the line between said tube's extremities, said liquid flow-controlling means comprising a tubular upper inlet end, a tubular lower outlet end, and ex-

panded chamber intermediate said ends, a float member contained in said chamber, said float member having a pair of depending arms, and a conical valve supported by the extremities of said float member's depending arms for releasably entering into a sealing relationship with the lower outlet end's interior surface, whereby the liquid which enters said flow-controlling means causes the float member to move away from said outlet end so that the liquid passes thereby and exits through the outlet end and through said hypodermic needle until such time when the liquid supply falls below a predetermined minimum necessary to support said float member spaced apart from said outlet end, whereupon the float member drops and the conical valve reenters the lower outlet end into sealing relationship with the outlet end's internal surface and prevents admission of any further matter into said injected body.

3. The apparatus of claim 1 in which a tubular port is secured in the region of juncture between the inlet end and the chamber so as to obstruct entrance into the chamber except for a central passageway through the port, whereby liquids entering the inlet end are centrally directed through the port and through the float member's axial opening thus to facilitate the flow of liquid from the inlet to the outlet ends.

4. The apparatus of claim 1 in which the float member's largest cross-section is less than that of the chamber, and at least two projections extending laterally from the float member's exterior surface and spaced apart a substantial distance from each other, whereby to space the float from the walls of the chamber.

5. The apparatus of claim 3 in which the float member's largest cross-section is less than that of the chamber, and at least two projections extending laterally from the float member's exterior surface and spaced apart a substantial distance from each other, whereby to space the float from the walls of the chamber.

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