PRESSURE INFUSION APPARATUS

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This invention relates to apparatus for the pressure infusion of liquids and pertains more specifically to apparatus for intravenous injection of solutions under controlled pressure.

Liquids for intravenous injection, such as whole blood, plasma, etc., are conventionally supplied in disposable, sterile, sealed bags or receptacles of transparent, flexible, plastic material having an outlet or delivery tube adapted to be punctured by the coupler of a recipient set. In use, the container is suspended above the patient and the liquid is permitted to flow by gravity into the vein or artery. However, this arrangement is slow, particularly when the container is almost empty, and it is particularly unsatisfactory in cases of severe hemorrhage or shock.

One object of the present invention is to provide an inexpensive device, simple in construction, for applying pressure to such a receptacle filled with liquid for forcing the liquid therethrough.

Another object is to provide apparatus for the pressure infusion of liquid which is readily applied to a disposable, sterile, sealed, plastic receptacle filled with liquid to be infused, without coming in contact with the liquid itself, and of such a nature that it can be readily cleaned.

A further object is to provide apparatus for maintaining a controlled air pressure upon a liquid during infusion thereof without any risk of causing embolism.

Other and further objects will be apparent from the drawings and from the description which follows.

In the drawings:

Fig. 1 is a view in front elevation of one embodiment of the present invention;

Fig. 2 is a view in rear elevation; and

Fig. 3 is a view in vertical section taken along the line 3—3 of Fig. 1.

As shown in the drawings, the device comprises an outer container or bag 10 having an open bottom end. Container 10 may conveniently take the form of an elongated envelope having flexible, substantially inextensible walls, as for example an envelope made of textile fabric, or preferably textile fabric which has been coated or impregnated with a liquid-impervious natural or synthetic rubber or resin composition. As shown in Fig. 2, one wall of the envelope 10 may be in the form of a flexible, transparent, substantially inextensible sheet 12 of plastic material such as plasticized vinyl resin to permit observation of the interior of the envelope during use. A handle 14 may be provided for use in suspending the apparatus from any suitable support 16.

Container 10 is of such a size that it contains a standard flexible, collapsible receptacle or bag 18 (Fig. 3) filled with the liquid to be infused, receptacle 18 being engaged snugly within envelope 10. Receptacle 18 is provided with the usual outlet 20, which may be sealed at its lower end until ready for use, as is well known in the art. The apparatus additionally comprises an expansible bladder 22 having walls of elastic rubbery material and normally having a flattened configuration, and which is of approximately the same length and width as the interior of envelope 10, so as to be substantially co-extensive with one wall of envelope 10. Bladder 22 is provided with two connecting tubes 24, 26, which pass through suitable apertures in the wall of envelope 10. These tubes serve not only the function of permitting inflation and deflation of bladder 22, but in addition assist in maintaining the bladder in position within envelope 10. A flexible, substantially inextensible flap 28, which may conveniently be made of the same material as the wall of envelope 10, such as textile fabric or rubberized textile fabric, and indeed may be integral therewith, extends from the wall of the envelope adjacent bladder 22 and is adapted to be inserted into envelope 10 toward its closed end with the bladder disposed between the flap 28 and one wall of envelope 10. The flap 28 preferably is of approximately the same width as the interior of the envelope or container, and should be at least half as long as the bladders to perform its function satisfactorily. In the embodiment shown in the drawing, flap 28 is substantially of the same length as envelope 10. The face of flap 28 which is adjacent to receptacle 18 may be of a color which contrasts with the color of the liquid contained in the receptacle.

A supporting strap 30 is secured to the exterior of envelope 10 adjacent the connecting tube 24 for supporting a pressure gauge 32 of any conventional design, which may be connected to bladder 22 by means of tube 24. Any suitable source of gas pressure may be connected to bladder 22 through the second tube 26. The source of pressure may comprise simply a conventional reservoir bulb for manual operation, or any suitable source of gas at constant or controlled pressure may be provided if desired.

In order to retain receptacle 18 within envelope 10 prior to inflation of bladder 22, a clenching means is provided in the form of two straps 34, 36 secured to the outside of envelope 10 at opposite edges thereof and provided with connecting means such as buckles 38 at their opposing ends. Straps 34, 36 together with connecting buckle 38 have a total length somewhat less than the width of envelope 10, so that when the buckle is fastened the envelope is cinched or constricted closely about receptacle 18 near its lower end. Straps 34, 36 are preferably elastic so as to permit some variation in the size of receptacle 18. These straps are preferably located near the lower or open end of envelope 10, but above the lower end of receptacle 18, so as to avoid constricting or cocking outlet tube 20.

In use, envelope 10, containing bladder 22 held in place by means of flap 28 extending inwardly toward the closed end of the envelope, as shown in Fig. 3, is slipped over liquid-filled receptacle 18, and buckle 38 is fastened to constrict the open end of the envelope about receptacle 18. The assembly is then hung upon any suitable support, the sealed end of outlet tube 20 is punctured by means of the coupler of the recipient set, which is then connected to the vein or artery of the patient, and the desired pressure is supplied through tube 26 to inflate the expansible elastic bladder 22 so as to exert the desired pressure upon receptacle 18, as indicated by gauge 32. As the liquid flows from receptacle 18, it collapses first at its upper end, permitting the entire liquid contents to flow freely through outlet tube 20 until the receptacle is empty. Observation of the amount of liquid remaining in the receptacle may be made at any time through the transparent plastic window 12 since the liquid level is readily apparent against the contrasting background color of flap 28. Since the pressure in bladder 22 preferably remains constant throughout discharge of the liquid,
the bladder will expand in size as the liquid drains from receptacle 18. Flap 28, being secured to the envelope 10 only at its lower end, slides over the face of bladder 22 adjacent its upper end, thus permitting gradual expansion of the bladder downwardly from its upper end 5 while at the same time releasably securing the bladder in place within the envelope.

Because of the construction of the apparatus, it is impossible to produce an embolism, the pressure upon the liquid in receptacle 18 ceasing as soon as the receptacle is empty.

In another embodiment of the invention, receptacle 18 may be filled with a fluid such as air or other gas and outlet tube 29 may be connected to the interior of a rigid-walled container filled with the blood or other liquid to be infused. The device thus arranged produces a pressure on the surface of the liquid, forcing it into the vein or artery of the patient. By choosing a receptacle 18 with a volume less than the volume of liquid to be infused, the possibility of forcing any air bubbles into the vein or artery is completely avoided, while at the same time a controlled pressure, preferably a constant pressure, is applied to the liquid being infused.

After use of the device, it may readily be removed from receptacle 18 simply by deflating bladder 22 and unbuckling straps 34, 36. Bladder 22 may be removed from the envelope simply by pulling out flap 28, thus permitting the assembly to be readily cleaned.

Although I have herein described specific embodiments of my invention, I do not intend to limit myself solely thereto, but to include all of the obvious variations and modifications within the spirit and scope of the appended claims.

I claim:

1. Apparatus for pressure infusion of liquids comprising an open-ended container having walls of flexible, substantially inextensible material adapted to contain an inner flexible, collapsible receptacle filled with liquid to be infused, an expansible bladder disposed within said container adjacent one wall thereof adapted to be inflated to press against said receptacle in said container to force liquid therefrom, means for releasably securing said bladder in place within said container, and means comprising a cinching strap for restricting said container adjacent its open end for releasably retaining said receptacle in place in said container.

2. Apparatus as defined in claim 1 in which the means for releasably retaining said receptacle in place comprises a cinching strap secured to the outer face of said container adjacent its open end adapted to constrict said container.

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