Feb. 10, 1948. L. W. DIGGS 2,435,820

TRANSFUSION EQUIPMENT

Filed Sept. 5, 1944

Fig. 1.

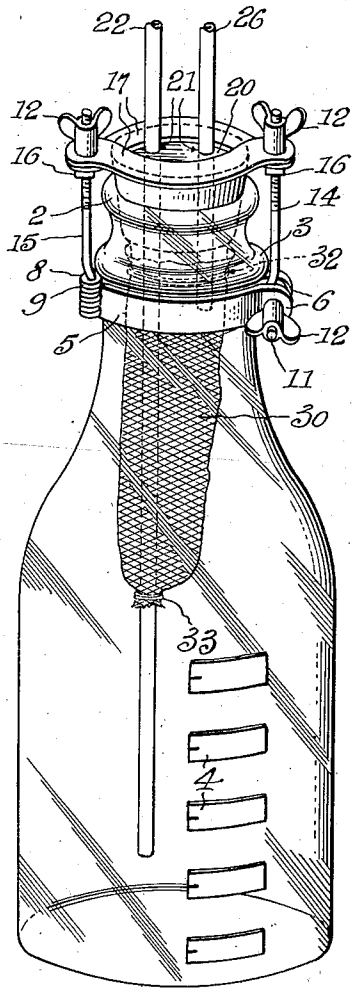
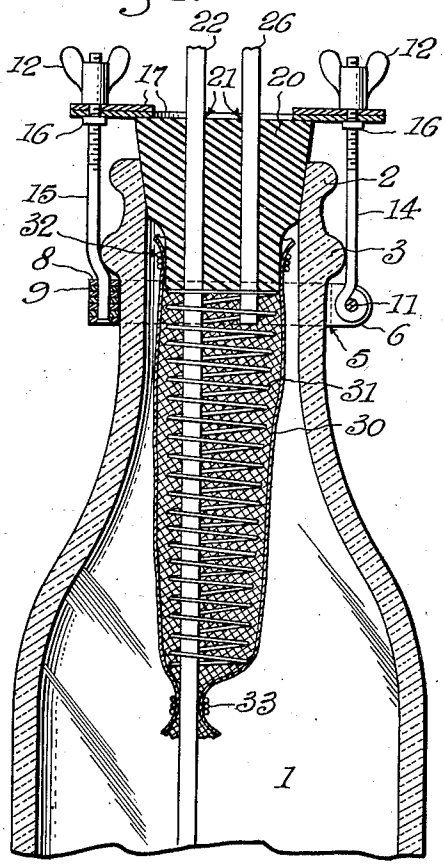


Fig. 2.



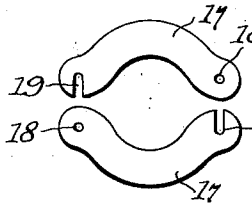


Fig. 3.

Fig. 4.

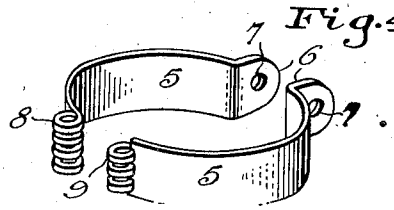
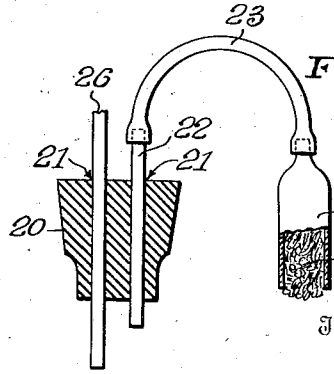


Fig. 5.



Inventor

Lemuel W. Diggs

By Francis H. Vandenburgh and Joseph N. Crane

Attorneys

Patented Feb. 10, 1948

2,435,820

UNITED STATES PATENT OFFICE

2,435,820

TRANSFUSION EQUIPMENT

Lemuel W. Diggs, Whitehaven, Tenn., assignor to the United States of America, as represented by the Secretary of War

Application September 5, 1944, Serial No. 552,759

3 Claims. (Cl. 128—214)

1

This invention relates to blood transfusion equipment and particularly it is directed to a device that may be used in all stages of collecting, storing, processing, and dispensing blood and plasma by changing one small interchangeable assembly for each stage in the process.

Previously, it has been necessary to use specially designed surgical equipment for each stage in the blood transfusion process. It is economically impractical to maintain a stock of this special equipment and supplies in sufficient quantities to meet the requirements during major domestic disasters, or emergencies continuously arising as a direct result of modern warfare. Furthermore, special equipment of this type cannot be obtained at or transported to the scene of such disasters and war areas in adequate quantities rapidly enough to be of use in such emergencies. It is, therefore, desirable to perfect a technique for blood transfusion employing a simple device constructed of standard component parts obtainable in relatively large quantities in nearly all localities. It is likewise desirable that the device be adapted for use in each stage of the transfusion process by employing interchangeable assemblies designed to be used successively in association with the major portion of the device which remains the same throughout the process.

Accordingly, it is an object of this invention to provide a device of the class herein described which may be used in all stages of a blood transfusion process by interchanging a series of one component part.

Another object of this invention is to provide a device for collecting, storing, processing, and dispensing blood in a transfusion process wherein the component parts of the device are standard commercial items available in large quantities in nearly all localities.

A further object of this invention is to provide a device of the class herein described that can be easily and economically constructed, and will be efficient and durable in use.

The foregoing and other objects of this invention will be more apparent from reading the specification in conjunction with the drawing forming a part thereof, wherein:

Figure 1 is a perspective view of the device with a dispensing stopper assembly;

Figure 2 is a vertical cross-sectional view illustrating structural details of the device with the dispensing assembly;

Figure 3 is a perspective view of the movable arcuate plates;

2

Figure 4 is a perspective view of the stationary clamp bands; and

Figure 5 is a cross-sectional view of the collecting stopper assembly.

In the drawing, where like members are given the same reference numeral, a bottle 1, of standard "milk" bottle design and preferably the quart size "Dacro" type, is used as a container flask for collecting, storing, processing, and dispensing in a blood transfusion process. In addition to the fact that bottles of this type are found in large quantities in nearly any locality, there are other advantages in using such containers for this process. Among these advantages there may be mentioned the fact that they are relatively inexpensive, the initial cost being low, the replacement cost being negligible since there is little breakage during transportation, cleaning and autoclaving, and they may be reused. They are easily cleaned due to the wide mouth and sloping sides being readily reached with a brush, there are no inaccessible angles or pockets. They are efficiently stored since the sides do not display irregular contours, and the wide bottoms prevent their overturning. Various standard commercial and improvised filters 30 may be used within the bottle for filtering during administering blood and plasma as the mouth is sufficiently wide to receive such assemblies. Standard solid, two-hole and hooded rubber stoppers 20 may be used in collecting, storing, processing, and dispensing assembies employed with these containers 1. The relatively tall, cylindrical shape of the container favors collection of plasma by the sedimentation method. Furthermore, they are made of good quality rseistance glass comparable to the types of special flasks in common use.

Bottles of this design are particularly adapted for use in transfusion processes as the smooth inner neck provides a surface for snug fitting stoppers 20, and the protruding rim 2 around the mouth favors the use of hooded stoppers in the plasma processing stage. The annular ridge 3 on the neck of the bottle provides a grasping surface without contaminating the lips or mouth of the bottle, and also serves as an anchoring ledge or clamp jaw stop for clamping the stoppers 20 into the bottle 1.

The stoppers 20 may be tied in place by a cord passed over the stopper and anchored to the annular ridge 3. It is essential, however, that the stopper seals be air-tight to avoid contamination, and hence a stopper clamping assembly has been provided in the form of a stationary member 5 secured to the bottle 1 and a movable member 17

associated with the stationary member 5. Specifically, this clamping assembly is composed of a pair of semi-circular bands 5, a bolt 11, winged nuts 12, and eye bolt 14, a headed bolt 15, and a pair of arcuate plates 17.

In constructing the clamp assembly, a standard pipe clamp is first obtained to be used as the stationary jaw. The usual type of such clamp is a pair of semi-circular bands 5 having one end of each bent outwardly forming a flange 6 substantially perpendicular to the curvature of the band. In the flanges 6 are apertures 7 adapted to receive a bolt 11 and nut 12 assembly fastening the bands 5 together at this end by threaded engagement of the bolt 11 and winged nut 12. The other end of the bands 5 are usually secured together in a similar manner or hinged together. When hinged together, that end of each of the bands 5 is provided with registering eyelets 8 and 9 respectively. This latter type is the most common and is used for illustrating this invention, however, the other type of pipe clamps can be used equally as well. This clamp is placed around the neck of a bottle 1 just below the annular ridge 3. An eye bolt 14 is placed between the flanges 6 in such a manner that when the bolt 11 is inserted, it passes through the eye of the bolt 14 securing it to the pipe clamp. If the other end of the clamp bands 5 is provided with flanges and a bolt and nut assembly, eye bolts may be secured thereto; if, however, a hinge joinder is employed, the hinge pin is removed and a long shank bolt 15 inserted in its place. The pipe clamp is now securely attached to the bottle with the bolts 14 and 15 extending upwardly by tightening the bolt 11 and nut 12 assembly. The movable member of the clamp assembly comprises two arcuate plates 17 having an aperture 18 in one end of each for pivotally mounting them on one of the bolts 14 and 15. The other end of each plate 17 is provided with a slot 19 adapted to pivotally hook over the other bolt. The winged nuts 12 are threaded onto the bolts 14 and 15 moving the plates 17 towards the bottle, and if desired lock nuts 16 may be threaded onto the bolts 14 and 15 before the plates 17 are inserted thereon to prevent tensional buckling of the plates 17.

The above described part of the device, namely the container and clamp, remains the same throughout all the stages in the transfusion process, and stopper supported assemblies are the interchangeable parts used in different stages of the process. A collecting stopper assembly, see Fig. 5, consists of a rubber stopper 20 having glass air-tube 22 and glass blood-tube 26, inserted in apertures 21 provided in the stopper 20. A flexible transparent rubber tube 23 connects an air filter 24 filled with absorbent cotton 25 to the air tube 22. Attached to the blood tube 26 is a flexible transparent rubber tube, not shown, adapted to receive a transfusion needle.

The dispensing stopper assembly resembles the collection assembly, see Fig. 2, in that it also has a stopper 20 having apertures 21, an air tube 22 connected by a flexible tube 23 to an air filter 24 filled with absorbent cotton 25, and a blood tube 26 connected to a transfusion needle, not shown; but, located interiorly the bottle 1 is a filter 30, that filters the blood entering the blood tube 26. When commercial stainless steel blood filters are available, one may be used by securing it to the blood tube 26 with a one hole stopper, however, when not available, a filter that is practical, inexpensive, and easily constructed from materials that are available may be provided, see Figs. 1 and 2. This filter consists of a supporting form 31, such as a helical coil spring, wrapped several times, usually four or more, with surgical gauze 30. The filter gauze 30 is slipped over the tubes 22 and 26 and the stopper 20 and tied thereto with a cord 32 such as umbilical tape. The other end of the filter gauze 30 is closed by tying it to the protruding stem of the air-tube 26 with tape 33.

In the preparation for and operation of collecting blood, the bottle 1, having strips of adhesive 4 marked with indicia lines placed on the outside at predetermined levels, is equipped with the stopper clamping assembly with clamping plates 17 pivoted outwardly. A collecting stopper assembly, see Fig. 2, is inserted in the bottle 1, and an 18 inch flexible tube, not shown, is attached to the blood-tube 22. The clamping plates 17 are pivoted over the top of the stopper 20 and around the bolts 15 and 16. The stopper 20 is then securely seated in the bottle 1 by the action of the clamping plates 17 against the stopper 20 by threaded engagement of the bolts 14 and 15 and the winged nuts 12. The assembled device is then wrapped in a cloth bag and autoclaved. When blood is to be collected, the device is removed from its wrappings, 100 cc. of 2.5 solution of sodium citrate placed in the bottle, a sterile needle attached to the blood tube 26 and the blood collected by gravity while the device is resting below the level of a donor's arm. During collection, the blood is gently agitated by hand or by the use of a mechanical shaker if one is available. After 500 c. c. of blood has been collected, the flexible tube is clamped with two hemostats, one near the glass tube 26 and the other near the needle. The winged nuts 12 are then unscrewed slightly and the clamping plates 17 pivoted outwardly releasing the collecting stopper assembly. This assembly is then removed and a sterile solid rubber stopper with a paper cover is inserted in the bottle 1 and clamped in place with the clamping assembly as before. The capped container is then labeled and immediately placed in a refrigerator. The blood trapped in the flexible tube between the hemostats is equally divided into two dry, sterile test tubes, one for serologic tests and the other for typing and cross matching.

The collected blood in storage may be disposed or plasma processed in the same container device in which collected and stored by employing the proper stopper assembly. Plasma can be aspirated from sedimented blood in the collecting and storing device by removing the stopper and inserting a pipette protected by an inverted funnel or gauze. If a hooded rubber stopper is used for the collecting assembly, the closed technic for the collection of plasma as described by Strumia, McGraw and Reichel (Am. J. Clin. Path. 11:175–194 and 288-306) can be followed.

In order to administer the blood from the same device in which it was collected and stored, the solid stopper with its paper cap is removed and a sterile dispensing stopper assembly, see Figs. 1 and 2, is inserted and clamped in place. This despensing assembly may be the same as the collecting assembly with a filter 30 added, providing the length of the air-tube 22 is such that it may be adjusted to function when the bottle 1 is upright for collecting and inverted for dispensing. When the blood is to be administered, the inverted administering device may be suspended in a metal or wire rack or placed in a cloth jacket and suspended from a

hook on a bedside solution stand. The advantage of a substantially cylindrical filter surface 30 being positioned interiorly rather than exteriorly the container 1 is that Febrin webs tend to fall around the filter to the bottom of the inverted container 1 without clogging the pores of the filter.

Having thus described my invention, what I claim as new and wish to obtain by Letters Patent is:

1. Blood-transfusion apparatus comprising a mounting means adapted to be received in a container under air-sealing relation therewith, a pair of spaced tubes positioned in the mounting means and extending therethrough and a filtering assembly comprising an elongated resilient support and a filtering medium enveloping the said support, the filtering assembly being mounted on the mounting means and enclosing the tubes of the pair, one of the said tubes being a relatively long tube adapted to extend through and beyond the filtering assembly, the other tube of the pair being a short tube opening into the filtering assembly, the relatively long tube being adapted to extend into the container to a point closely spaced from the bottom of the container when the apparatus is assembled, the short tube being adapted to be a blood-supply tube, and means for securing the filtering assembly to the long tube for holding the filtering assembly in position.

2. Blood-transfusion apparatus comprising an assembly including a mounting means adapted to be received in a container under air-sealing relation, a pair of spaced tubes positioned in the mounting means, and a tubular filtering unit comprising a resilient supporting member and a filtering medium enveloping the supporting member and mounted on the mounting means, the filtering unit enclosing the pair of tubes, one

of which opens into the filtering unit and the other of which tubes extends through and beyond the filtering unit, and means securing the filtering unit to the tubes.

3. Blood-transfusion apparatus comprising a mounting means adapted to be received in a container under air-sealing relation, a pair of spaced tubes positioned in the mounting means, and a tubular filtering assembly comprising a helically coiled spring-supporting member, an envelope of filter fabric enveloping the spring-supporting member to form a tubular filtering body, the said filtering assembly being positioned around the said pair of tubes, one of the tubes of the pair opening into the tubular filtering body, the other tube of the pair extending through and beyond the filtering body, and means for securing the filter fabric to this latter tube, the filtering assembly being mounted on the mounting means, the said mounting means having an end portion of smaller diameter than the remainder of the mounting means, the smaller end portion being adapted to receive the filter assembly and to define a clearance for the filter assembly between the mounting means and container when the apparatus is assembled for use.

LEMUEL W. DIGGS.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,366,664	Judkins	Jan. 25, 1921
2,121,123	Erikson et al.	June 21, 1938
2,212,318	Gee	Aug. 20, 1940
2,222,123	Schwab	Nov. 19, 1940
2,231,418	Trotter	Feb. 11, 1941