Feb. 15, 1949. J. E. MEAGHER 2,461,558

TRANSFUSION APPARATUS

Filed Dec. 15, 1945

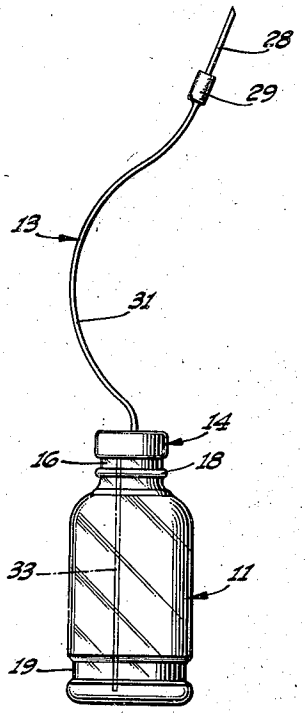


Fig. 2.

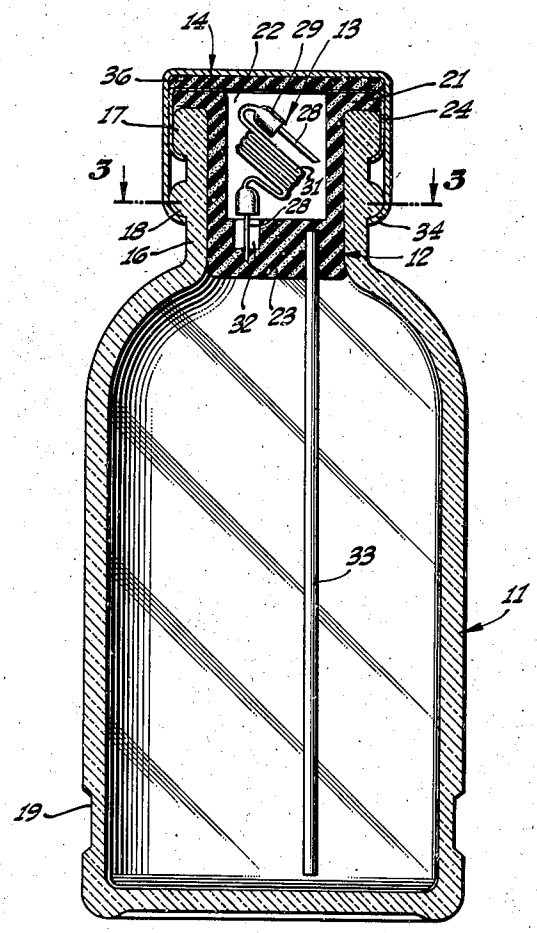


Fig. 1.

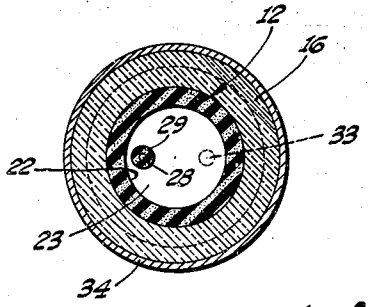


Fig. 3.

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TRANSFUSION APPARATUS

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18 Claims. (Cl. 128—214)

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This invention relates to a new and improved self-contained kit for withdrawing and storing animal fluids. More specifically, the invention comprises an economically manufactured kit including a fluid-receiving bottle, a set of accessories including a hypodermic needle and tubing, a storage compartment for the accessories, and means to seal the entire kit.

In the process of drawing, storing and administering blood, it is very important that the complete cycle from the donor to the recipient be carried out under absolutely sterile and aseptic conditions. Since it is present practice to store large quantities of blood in a "blood bank" for use when necessary, rather than obtain a donor each time a patient requires a blood transfusion, it is imperative that all bacterial or other harmful organisms be excluded from the blood during the storage period. Otherwise contamination occurs which renders the substance unfit for use.

Likewise, when whole blood is used for preparing plasma or serum, any contamination of the original blood will result in the loss of the entire pooled lot of plasma or serum, which loss may cost hundreds of dollars.

Technics have been evolved by the medical profession with the intention of reducing such losses. These so-called "closed technics" involve the use of a sterile container, either evacuated or under atmospheric presure, a length of sterile tubing with connectors at each end, one of which is a hollow needle, and a valve mechanism for regulating the flow of blood from the donor to the sterile container. These technics however have many disadvantages. The operation of connecting an external sterile tube set to the sterile container can, and frequently does, result in contamination and even in the damage of equipment through improper use. The complete sterilization of the equipment is difficult to accomplish yet anything less than complete sterilization is dangerous. Considerable time is required in the cleaning operation and special equipment is necessary therefor. The parts of the equipment which are adapted for reuse are relatively expensive and are frequently misplaced and lost or broken, involving considerable expense. Many similar problems were overcome by my development of the device described in my copending application, Serial Number 609,286, filed July 17, 1945, and entitled Parenteral fluid container and dispenser, and I have now developed comparable apparatus for use in transfusions.

With the above problems and difficulties in

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mind, it is an object of the present invention to provide a unitary kit or package for blood transfusions which is ready for use at all times and requires no extra equipment or accessories.

It is another object of the invention to provide a self-contained unit in which the administrative set comprising the needle and tubing is a part of the unit and is positioned in and sterilized therewith, being designed for a single use.

It is another object of the invention to provide a transfusion unit in which the blood-storing space is self-sealing to eliminate the necessity of providing seals and the danger of infection resulting from careless handling.

Referring now to the drawings in which a preferred embodiment of the invention is illustrated:

Figure 1 comprises a vertical section through a unit constructed in accordance with the present invention;

Figure 2 is a side elevation of the unit in condition for use; and

Figure 3 is a transverse horizontal section taken on the line 3—3 of Figure 1.

The self-contained blood withdrawing and storing unit constructed in accordance with the present invention comprises four principal parts. They are a receptacle 11, a stopper 12, an administrative set 13, and a sealing cap 14.

The container or bottle 11 is preferably made of glass, or any suitable material which may be rendered aseptic, and is formed with a reduced cylindrical neck 16. The latter is provided exteriorly with inner and outer spaced circumferential enlargements or beads 17 and 18. The bottle may be of any desired capacity and is preferably provided near its base with a circumferentially extending groove 19 adapted to receive an encircling strap or clamp.

Within the bottle neck 16 a resilient stopper 12 is positioned in sealing relationship. The stopper is formed of rubber or similar resilient material, is flat surfaced at its inner end which comprises the actual closing surface for the interior of the bottle, and has a circumferential flange 21 at its top which rests upon the rim of the neck 16 in sealing relationship. An open topped central compartment 22 is provided in the stopper 12 above a bottom wall 23 of considerable thickness. The stopper is firmly held in place in the bottle by means of a ring 24 which overlies the flange 21 and extends down and around the neck 16 to curve under the outer bead 17.

Within the compartment 22 is positioned a set of administrative accessories comprising a pair of hypodermic needles 28 fixedly secured in the

enlargement 29 at the opposite ends of a tube or conduit 31. The latter is preferably positioned in the compartment in a coiled or stacked condition. One needle 28 extends into but not through the thickened bottom wall 23 of stopper 12, as illustrated in Figure 1, the wall being recessed at 32 to receive the tube enlargement 29 upon the reception of a downward force and in order to permit the needle to extend into the sealed interior of the bottle. Tube 31 is of sufficient diameter to permit blood to flow therethrough and the strength of its wall structure prevents collapse in the presence of a vacuum within the bottle 11.

Also positioned within the bottle and carried with its upper end sealed in the bottom wall 23 of stopper 12, is a vertical rigid tube 33 which extends substantially to the lower end of the bottle for a reason which will be explained.

The unit construction is completed by the presence of a cup-shaped sealing cap 14 overlying the compartment 23 with its side wall enclosing the bottle neck and extended inwardly, as at 34, to underlie the lower bead 18. Within the top of cap 14 and carried thereby is a resilient sealing wafer or disc 36 which is compressed against the top surface of ring 24. Cap 14 may preferably be formed of a light, destructible metal or of a plastic and may be positioned upon the bottle in any well known manner.

The unit is sold in the sealed condition illustrated in Figure 1. The parts within the bottle are sterilized and aseptic and air has been exhausted from the bottle to create a vacuum therein. In placing the unit in use, the cap 14 is first removed and the free needle 28 withdrawn from the compartment 23. This is accomplished without actual physical contact with the needle, the operator instead grasping the enlarged end 29 of the rubber tube 31. The needle is inserted into the patient in the usual manner and bottle 11 supported in a position to receive the blood. The physician or attendant then exerts a downward force upon the head of the needle 28 carried by the stopper and forces the inner end thereof into the interior of the bottle. The vacuum within the bottle is immediately effective to draw blood from the patient.

Upon the bottle being filled with the predetermined quantity of blood, the inner needle 28 is drawn from the stopper 12 whereupon the natural resilience of the material instantly seals the opening and the contained fluid is insured against contamination. The administrative kit comprising the two needles and their conduit 31 can then be discarded, having served its purpose.

In emptying the bottle, the container is preferably inverted so that the end of tube 33 within the bottle is positioned above the fluid level. A hypodermic needle is then inserted through the bottom wall 23 into the end of tube 33 to provide for the entrance of air into the space above the contained fluid. A second needle is inserted through the stopper 12 at the recess 32 and the fluid is conducted therethrough by the action of gravity.

In the described preferred embodiment the liquid-containing space within bottle 11 was evacuated of all air to create a vacuum effective to draw the blood into the bottle. The unit is usable, however, in the absence of the vacuum. In such a case, the operation previously described is applicable but with the following variation.

The bottle will be filled by the action of gravity and so must be placed at a level below the patient. Further, the entrance of fluid will displace air from the bottle which must be permitted to escape. Accordingly a third needle would be inserted through the bottom wall 23 to permit this escape.

While the particular apparatus herein shown and described in detail is fully capable of attaining the objects and providing the advantages hereinbefore stated, it is to be understood that it is merely illustrative of the presently preferred embodiment of my invention, and that I do not mean to limit myself to the details of construction or design herein shown, other than as defined in the appended claims.

I claim:

1. Apparatus for withdrawing and storing animal body fluids comprising a container, a resilient stopper sealing an aperture in said container and formed with a compartment therein substantially wholly within said container, an administering set positioned in said compartment including a hypodermic needle and means to penetrate said stopper to connect said set interiorly to the sealed interior of said container, and means sealing said compartment, whereby said apparatus in its completely assembled form may be sterilized as a unit, and said sterility maintained until the instant of inserting said hypodermic needle in a patient.

2. Apparatus for withdrawing and storing body fluids comprising a container having an opening, a resilient closure in the opening of said container formed with an open-sided compartment, an administering set including a flexible fluid-carrying tube and a closure-penetrating element on the end thereof extended partially through said closure and adapted to be pressed entirely therethrough so as to connect the interior of said tube with the interior of said container, and a removable closure sealing the open side of said compartment.

3. Apparatus for withdrawing and storing body fluids comprising a container having an opening, a resilient stopper sealing said opening and formed with an outwardly opening compartment, an administering set including a length of non-collapsible flexible tubing with hypodermic needles seated in its ends positioned in said compartment, one of said needles being adapted to extend through said closure into said container, a rigid tube sealed in said closure and extended substantially to the opposite wall of said container and adapted to serve as an air conduit for incoming air upon the inversion of said container and the insertion of a third needle through said closure to open thereinto, and a removable closure sealing said compartment.

4. Apparatus for withdrawing and storing body fluids comprising a bottle having a reduced neck formed exteriorly with spaced beads, a flanged hollow rubber stopper seated in said neck in air-tight relationship and formed with a compartment therein, an administering set positioned in said compartment comprising sterile needles connected to the opposite end of a length of flexible tubing, a sealing ring overlying said flange and the outer of said beads to secure said stopper in place, and a removable sealing cap including a sealing disc overlying said ring to close said compartment in air-tight relationship, said cap extending around said neck to overlie the inner of said beads.

5. Apparatus for withdrawing and storing body fluids comprising a container formed with an opening, a resilient stopper sealing said opening and formed with an open-ended compartment therein substantially wholly within said container, having a recessed but initially imperforate bottom wall adjacent the interior of said container, an elongated flexible tubing having enlarged ends into which hypodermic needles extend, one of said needles being adapted to extend through said bottom wall and into said container upon the movement of the adjacent enlarged end of the tubing into the recess in said wall, and means to seal said compartment.

6. A device for withdrawing and storing body fluids, which includes: a container having an opening therein; a cup-shaped resilient closure having a central compartment substantially wholly within said container, fitting in said opening with a sealing fit, the open end of said closure being outermost; a flexible tube located within said compartment of said closure; a hypodermic needle within said compartment, connected to one end of said tube; means connected to the other end of said tube adapted to penetrate said closure, said means being located within said compartment and held by engagement with said closure in a position to be extended into said container by pushing on the adjacent end of said tube; and sealing means extending across the open end of said compartment and held to said container with a sealing fit.

7. A device for withdrawing and storing body fluids, which includes: a container having an opening therein; a cup-shaped resilient closure mounted in said opening with a sealing fit, the open end of said closure being outermost, and the opposite end thereof having a recess extending toward but not into said container; a flexible tube located within the compartment of said closure; a hypodermic needle within said compartment, operatively connected to one end of said tube; means connected to the other end of said tube, adapted to penetrate said closure to establish a fluid connection into said container, said means being located in said recess and extending into but not through said closure, whereby pushing on the adjacent end of said tube will force said means into said container; and sealing means extending across the open end of said compartment and releasably held to said container.

8. A device as described in claim 7 in which the end of said tube adjacent said penetrating means is adapted to fit into said recess with a sealing fit, whereby a fluid connection may be established between the interior of said container and said tube, but not between the interior of said container and said compartment.

9. A device for withdrawing and storing body fluids which includes: a container having an opening therein; a cup-shaped resilient closure fitting in said opening with a sealing fit, having a central compartment substantially wholly within said container the open end of said closure being outermost and held in position therein by engagement with said closure; an administering set located within said compartment; a tube extending from the interior of said container to said closure and partially through the latter, whereby one end of said tube is sealed by said closure, but may be opened by inserting a needle through said closure to open into said tube; and removable means sealing said compartment.

10. A device for withdrawing and storing body

fluids which includes: a container having an opening therein; a cup-shaped resilient closure within said opening, having lateral walls which bear against the sides of said opening with a sealing fit, and having a transverse wall extending across the inner end of said closure to form a compartment therein substantially wholly within said container, the container side of said transverse wall having a recess therein extending toward but not into said compartment; an administering set located within said compartment and held in position therein by engagement of one of its ends with said transverse wall; a tube extending substantially from the remote end of said container, into said recess whereby one end of said tube is held in said recess and sealed by said closure; and removable means sealing said compartment.

11. A device for withdrawing and storing body fluids which includes: a container having an opening therein; a cup-shaped resilient closure within said opening, having lateral walls which bear against the sides of said opening with a sealing fit, and having a transverse wall extending across the inner end of said closure to form a compartment therein, the container side of said transverse wall having a recess therein extending toward but not into said compartment, and the compartment side of said transverse wall having a recess therein laterally spaced from said first-mentioned recess, said last-mentioned recess extending toward but not into said container; an administering set located within said compartment and including means held in position by engagement with said last-mentioned recess, adapted to penetrate the bottom of said last-mentioned recess while establishing a sealing fit with the walls thereof; a tube extending substantially from the remote end of said container into said first-mentioned recess, whereby one end of said tube is held in said first-mentioned recess and sealed by said closure; and removable means sealing said compartment.

12. A device for withdrawing and storing body fluids, which includes: a container having an opening therein, and having spaced external beads formed around said opening; a cup-shaped resilient closure within said opening, having lateral walls which bear against the sides of said opening with a sealing fit, and having a transverse wall extending across the inner end of said closure to form a compartment therein, the container side of said transverse wall having a recess therein extending toward but not into said compartment, and the compartment side of said transverse wall having a recess therein laterally spaced from said first-mentioned recess, said last-mentioned recess extending toward but not into said container; a flexible tube located within said compartment; a hypodermic needle within said compartment, operatively connected to one end of said tube; means connected to the other end of said tube, adapted to penetrate said closure to establish a fluid connection into said container, said means being located in said first-mentioned recess and extending into but not through said closure, and the adjacent end of said tube being adapted to fit into said first-mentioned recess with a sealing fit, whereby pushing on said adjacent end of said tube will force said penetrating means into said container to establish a fluid connection between the interior of said container and said tube, but not between the interior of said container and said compartment; a tube

extending substantially from the remote end of said container into said first-mentioned recess, whereby one end of said tube is held in said first-mentioned recess and sealed by said closure; a sealing ring extending over the ends of said closure and fastened by the nearer of said beads to secure said closure in place; and a removable sealing disc extending over said ring to close said compartment, fastened by the other of said beads.

13. A device for withdrawing and storing body fluids which includes: a container having an opening; a resilient closure in the opening of said container formed with an open-sided compartment; an administering set including a flexible tube and a closure-penetrating element on the end thereof extended partially through said closure and adapted to be pressed entirely therethrough so as to connect the interior of said tube with the interior of said container; a rigid tube sealed in said closure and extending substantially to the opposite wall of said container and adapted to serve as an air conduit for incoming air upon the inversion of said container and the insertion of a needle through said closure to open thereinto; and a removable closure sealing said compartment.

14. A device for withdrawing and storing body fluids which includes: a container having a reduced neck; a hollow rubber stopper seated in said neck in air-tight relationship and formed with a compartment therein; an administering set including a flexible tube and a stopper-penetrating element on the end thereof extended partially through said stopper and adapted to be pressed entirely therethrough so as to connect the interior of said tube with the interior of said container; a sealing ring overlying the outer end of said stopper to secure the latter in place; and a removable sealing cap including a sealing disc overlying said ring to close said compartment in air tight relationship, said cap extending around said neck.

15. A device for withdrawing and storing body fluids which includes: a container having a reduced neck; a resilient closure in the opening of said container formed with an open-sided compartment located substantially wholly within said container; an administering set including a flexible tube and a closure penetrating element on the end thereof located within said compartment, and held in position by engagement with said closure prior to penetration of the latter; a rigid tube sealed in said closure and extending substantially to the opposite wall of said container and adapted to serve as an air conduit for incoming air upon the inversion of said container and the insertion of a needle through said closure to open thereinto; a sealing ring overlying the outer end of said stopper to secure the latter in place; and a removable sealing cap including a sealing disc overlying said ring to close said compartment in air tight relationship said cap extending around said neck.

16. A device for withdrawing and storing body fluids which includes: a container having a reduced neck; a resilient closure in the neck of said container formed with an open-sided compartment; an administering set including a flexible tube and a closure penetrating element on the end thereof extending partially through said closure and adapted to be pressed entirely therethrough so as to connect the interior of said tube with the interior of said container; a rigid tube sealed in said closure and extending substantially to the opposite wall of said container and adapted to serve as an air conduit for incoming air on the inversion of said container and the insertion of a needle through said closure to open thereinto; a sealing ring overlying the outer end of said closure to secure the latter in place; and a removable sealing cap including a sealing disc overlying said ring to close said compartment in air tight relationship, said cap extending around said neck.

17. A device for use with a container in withdrawing and storing body fluids, which includes: a closure member adapted to fit within an opening of said container to make a sealing fit therewith, having a central compartment whose inner end is closed by a transverse wall with a recess therein; an administering set located within said compartment, comprising a flexible tube and a wall penetrating member attached to the end thereof, held in said recess by engagement with said wall, said recess and said tube being so correlated that the latter makes a sealing fit with the walls of said recess when inserted therein; and a removable cover closing the compartment in said closure.

18. A device for use with a container in withdrawing and storing body fluids, which includes: a closure member adapted to fit within an opening of said container to make a sealing fit therewith, having a central compartment therein; a transverse wall across the inner end of said closure member, having a recess extending partially through said wall from said compartment toward the interior of said container; a flexible tube located within said compartment; a wall penetrating element located in said recess, extending partially through said wall, and attached to one end of said tube, the portion of the latter surrounding said element being so correlated with said recess as to make a sealing fit with the walls of the latter when in said recess; and a removable cover closing the outer end of said compartment.

JAMES E. MEAGHER.

REFERENCES CITED

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

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2,333,684	Schwab	Nov. 9, 1943
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Certificate of Correction

February 15, 1949.

Patent No. 2,461,558.

JAMES E. MEAGHER

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows:

Column 5, lines 66 and 67, claim 9, strike out "and held in position therein by engagement with said closure" and insert the same in line 68, after the word "compartment" and before the semi-colon;

and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 16th day of August, A. D. 1949.

[SEAL]

THOMAS F. MURPHY,
Assistant Commissioner of Patents.