Sept. 29, 1953 G. R. RYAN 2,653,606

TRANSFUSION APPARATUS

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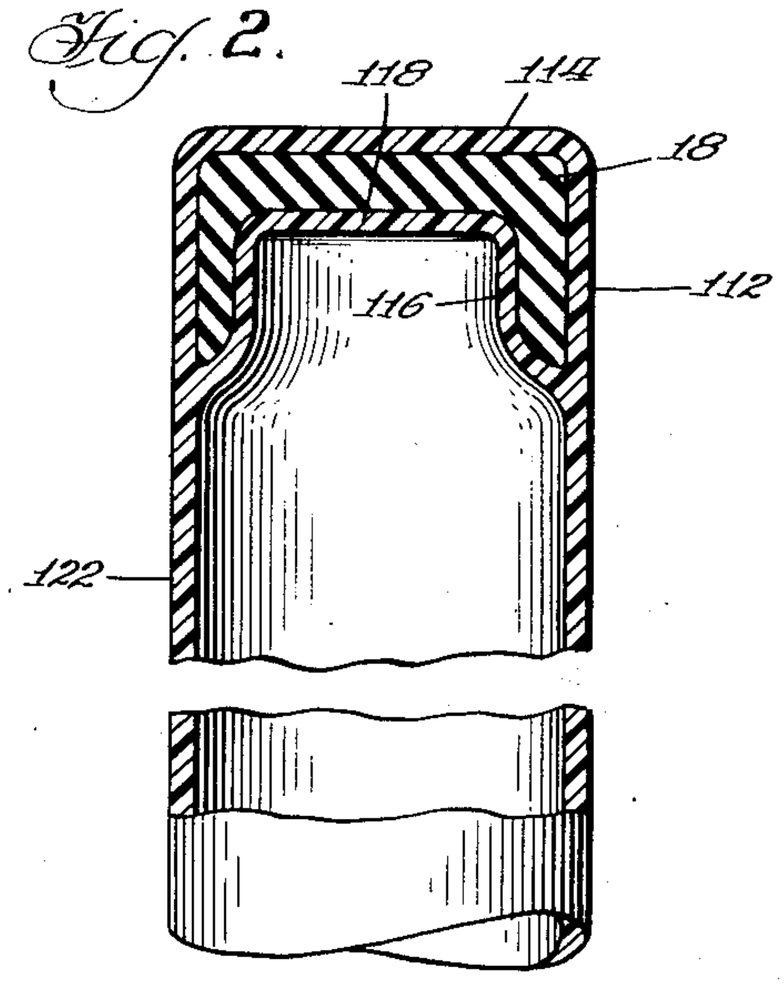
Fig. 2.



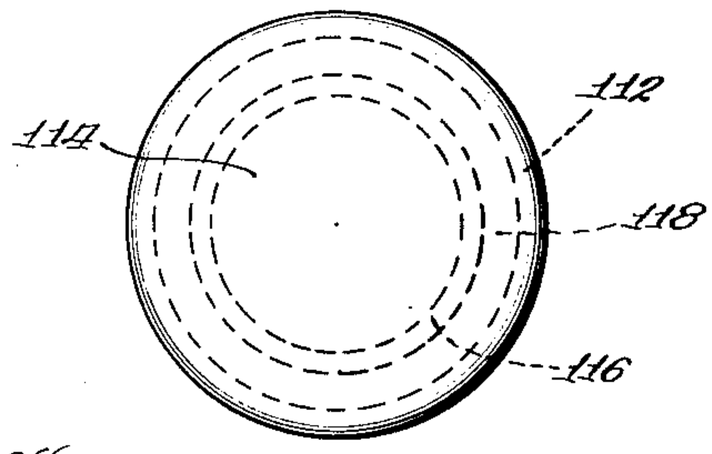
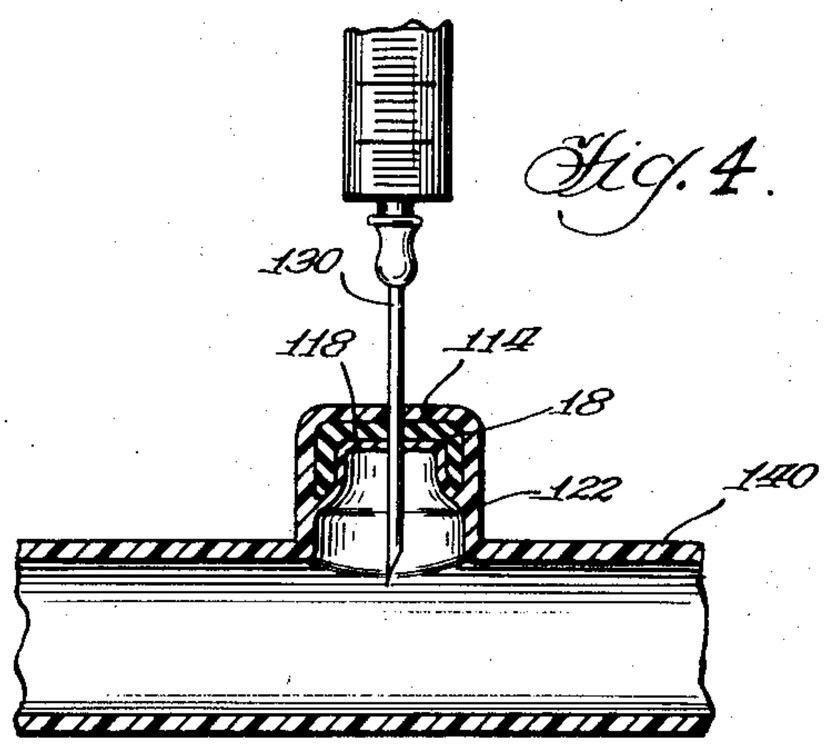


Fig. 3.

Fig. 4.



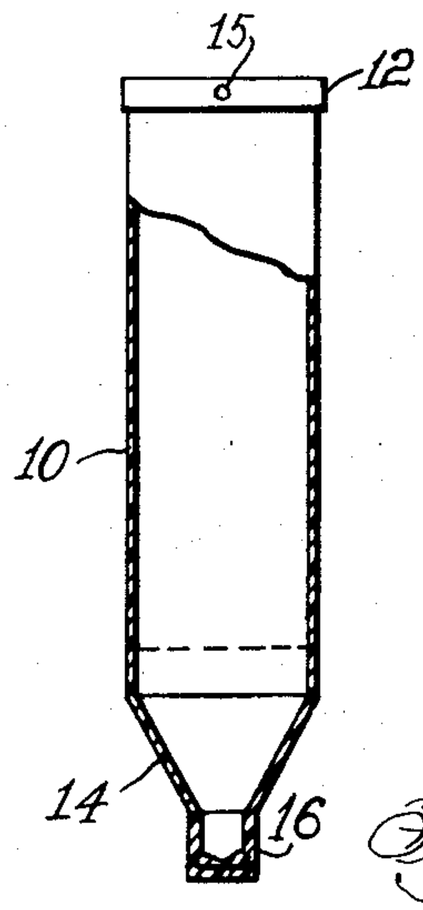


Fig. 1.

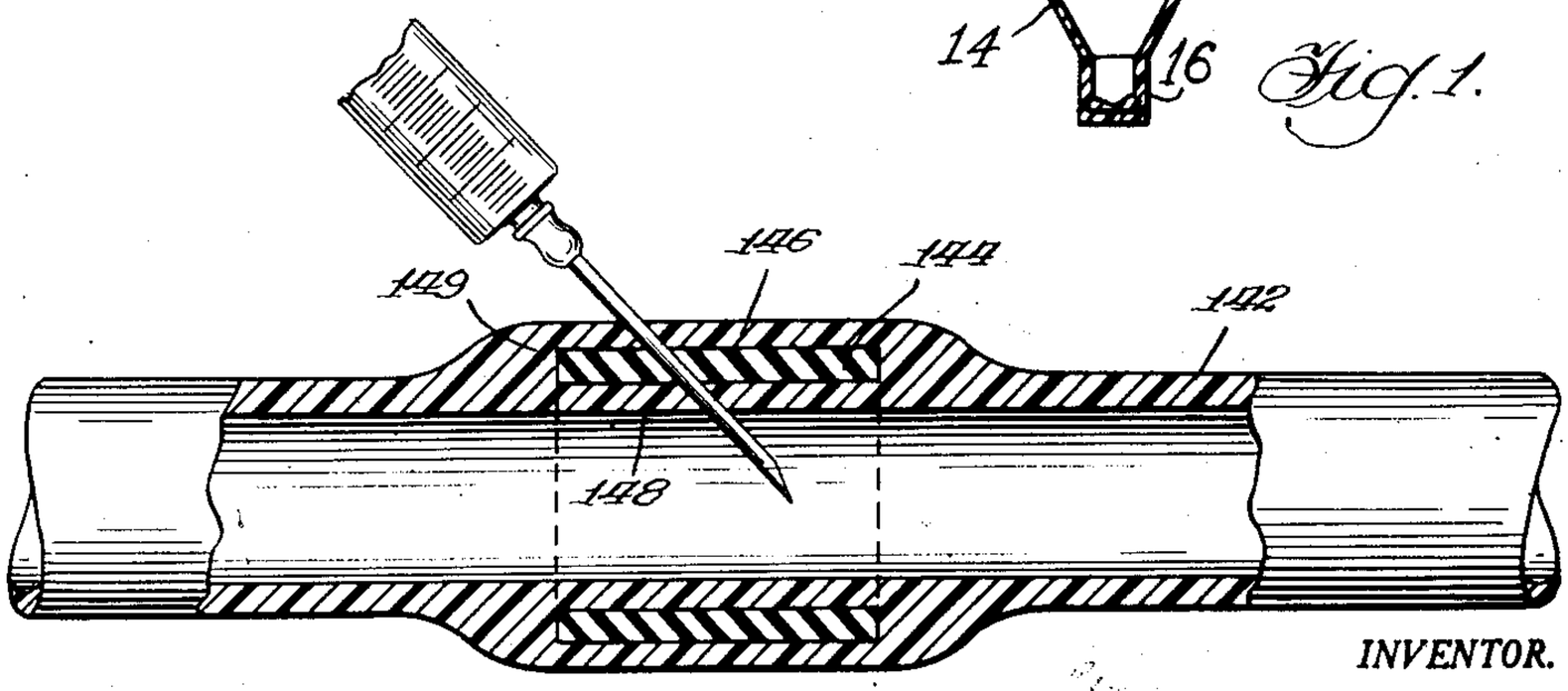


Fig. 5.

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TRANSFUSION APPARATUS

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12 Claims. (Cl. 128—214)

1

The present invention relates to new and improved transfusion apparatus and more particularly to apparatus for blood and blood plasma transfusions.

Transfusions of blood are very old in medical science, but comparatively recent innovations have led to the indirect transfusion techniques in common use today. That is, instead of transfusing blood directly from the donor to the receiver, the blood is taken from the donor and stored in a container until it is subsequently needed, with storage times up to as long as three weeks. Blood plasma has also recently come into wide-spread use, necessitating changes in transfusion technique.

Generally, the apparatus currently available for both blood and plasma transfusions, consists of a formidable array of equipment, including several bottles, aspirators, air filters, etc., and in instances comprises dozens of separate pieces and parts necessary to make a single transfusion. Such apparatus is obviously very expensive and difficult to handle, requiring special technical personnel with specialized training.

I have invented a new and improved apparatus for blood and blood plasma transfusions, which eliminates much of the standard equipment, and also eliminates the need for a replacement of fluid by air in the containers. The apparatus of the invention comprises a flexible bag of synthetic plastic, which inflates and deflates automatically as fluid enters or leaves the bag, eliminating the contact of the fluid with air. In the simplest form the bag has integral receiving and dispensing tubes, and is a complete one-piece transfusion apparatus.

It is important in emergency blood transfusions that the apparatus be simple and immediately available. The apparatus of my invention may be packaged and sterilized at the source of manufacture as a complete ready-to-use transfusion unit.

Referring to the drawings:

Fig. 1 is a section of a device according to the invention;

Fig. 2 is an enlarged section of the needle adapter;

Fig. 3 is the plan view of the device of Fig. 2;

Fig. 4 is a section of the device of Fig. 2, indicating one of its uses;

Fig. 5 is a section of a modified needle adapter.

The device of Fig. 1 comprises a main tube portion 10 hermetically sealed at the upper end 12, and sealed at the opposite end by converging walls 14 integral with a tubular extension, or needle adapter 16. I prefer to make the bag of transparent or translucent flexible plastic material to allow the contents of the bag to be observed. The needle adapter 16 is integral with the wall 10, and comprises a soft, pliable, elastic cup or core 18, completely embedded in plastic layers 114, 118 as shown in Fig. 2, which layers are integral with the side walls of the adapter 16. For the ordinary transfusion about 500 cc. of blood is used, and it is preferable to employ a bag of about 600 cc. capacity. A suitable size is about two inches in diameter and about 10 inches long.

2

In taking blood from a donor or in giving it to a receiver, no air comes into the bag, as it collapses and expands automatically as the blood leaves or enters the bag. The blood, therefore, does not come in contact with air and possible contamination is thereby averted.

Storage bags according to the invention may be made from an extruded tube, by sealing the ends of the tube; by folding a sheet of plastic, and sealing the ends and the open side to form the bag; or by dipping a mandril shaped like the bag into a liquid plastic. The dipped-tube type of manufacturing lends itself readily to a very uniform article. The seal 12 is made by compressing the sides of the tube together and heat-sealing.

The material used for making the bag and the tubing is preferably transparent or translucent, and must be flexible to allow the bag to inflate and collapse. Commercial synthetic thermoplastic resins such as cellulose resins, polystyrene, vinyl polymers and like plastics are suitable for use in making the transfusion apparatus. It is preferable not to use rubber as rubber tends to coagulate blood quicker than does a synthetic plastic, however, it may be used if the coagulation time is not important.

The needle adapter shown in the enlarged sectional view in Fig. 2 comprises an elastic, soft rubber, cup-shaped member 18 which is completely coated with synthetic plastic. The coating comprises an exterior side wall 112, exterior end wall 114, interior side wall 116, and an interior end wall 118 of synthetic plastic, integrally formed to completely enclose the core 18. The coating is integral with the tubing 122.

The adapter of Fig. 2 may be used to close the end of the tube or it may be joined onto the side of a piece of tubing, forming a side adapter as shown in Fig. 4. A standard hypodermic cannula 130 may be pushed through the adapter, entering the end wall 114 through the cup-shaped member 18 and through the interior end wall 118. When the cannula is withdrawn, the rubber member effectively seals the puncture.

The side adapter of Fig. 4 is made by cutting

a hole into the length of tubing 140, and the adapter, which is made with a very short tube wall 122, is welded over the hole in the tubing.

The adapter of Fig. 5 comprises a main tube wall 142 of plastic material and a rubber sleeve portion 144 embedded in the enlarged wall portion 146. The adapter of Fig. 5 is made by dipping a cylindrical mandril into liquid plastic until the desired wall thickness at 148 is obtained. After the plastic has set, the rubber sleeve 144 is slipped over the mandril and the coating 149 can be added by dipping or by local applications of successive coats.

The adapter shown in Fig. 4 may be attached to a receiver tube of a transfusion device for use as an emergency inlet. For instance, it may be attached to a length of tubing conveying a parenteral fluid to a recipient, so as to be available in the event that a supplementary drug is needed during the transfusion. Likewise, the adapter of Fig. 5 may be attached to a receiver tube for adscititious medication.

Others may readily adapt the invention for use under various conditions of service by employing one or more of the novel features disclosed or equivalents thereof. For instance, the bag may have one full length tube permanently attached and one self-sealing needle adapter. An additional third self-sealing needle adapter increases the adaptability of the equipment. For instance, with such a third adapter the attendant physician could add digitalis or some other drug to the contents of the bag as the administration is being made, to take care of emergency or other symptoms developing in the patient during the administration. The ratio of length to diameter may be varied at will, and the intake and delivery connections may be at opposite ends. As at present advised with respect to the apparent scope fo my invention I desire to claim the following subject matter.

I claim:

1. In a transfusion device, the combination which comprises: an imperforate, flexible, collapsible bag; a self-sealing flexible needle adapter; and a flexible structure integrally attaching and uniting said adapter to and with said bag to form part of the integument thereof and afford access to the contents of said bag by means of a cannula.

2. In a transfusion device, the combination which comprises: an imperforate, flexible, collapsible bag; said bag having an integral projection; and a self-sealing needle adapter built into said projection; said adapter having a soft, self-sealing, elastic core completely enclosed by the material of the walls of said projection.

3. A self-sealing fitting for a flexible synthetic plastic article comprising: a soft, elastic core of predetermined shape; said core being completely enclosed by a coating of the synthetic plastic; said core being of material adapted to yield and permit penetration by a hypodermic cannula, and to completely close again after said cannula is withdrawn.

4. A self-sealing fitting for a flexible synthetic plastic article comprising; a soft, elastic core of predetermined shape; said core being completely enclosed by a coating of the synthetic plastic; said coating being integral with the main body of the synthetic plastic article; said core being of material adapted to yield and permit penetration by a hypodermic cannula, and to completely close again after said cannula is withdrawn.

5. A self-sealing needle adapter for synthetic plastic tubing comprising; a soft rubber core member completely enclosed by a coating of the synthetic plastic; said core being of material adapted to yield and permit penetration by a hypodermic cannula and to close again completely after said cannula is withdrawn; said member being so positioned that a cannula thrust through it can find its way into the space inside said tubing.

6. An adapter according to claim 5, wherein the said coating is integral with the walls of the said tubing.

7. An adapter according to claim 5, wherein the coated rubber member is cup-shaped and completely closes the end of the said tubing.

8. An adapter according to claim 5, wherein the rubber member is annular and encircles said tubing.

9. In a transfusion device, the combination which comprises: an imperforate, flexible, collapsible bag; and a barrier of soft self-sealing material adapted to yield and be penetrated by a cannula and to close again upon withdrawal of such a cannula; said barrier being integrally attached to the wall of said bag with the bag wall lying both outside and inside said barrier.

10. In a transfusion device, the combination which comprises: an imperforate, flexible, collapsible bag; and a barrier of soft self-sealing material adapted to yield and be penetrated by a cannula and to close again upon withdrawal of such a cannula; said barrier being integrally attached to the wall of said bag with the bag wall lying outside said barrier; said bag having at least one end portion of reduced transverse dimensions; said barrier being arranged in a transverse plane at the end of said reduced portion.

11. In a transfusion device, the combination which comprises: an imperforate, flexible, collapsible bag; and a barrier of soft self-sealing material adapted to yield and be penetrated by a cannula and to close again upon withdrawal of such a cannula; said barrier being integrally attached to the wall of said bag with the bag wall lying inside said barrier; said bag having at least one end portion of reduced transverse dimensions; said barrier being arranged in a transverse plane at the end of said reduced portion.

12. In a transfusion device, the combination which comprises: an imperforate, flexible, collapsible bag with an integral projection extending outwardly therefrom; a self-sealing flexible needle adapter extending transversally of the outer extremity of the said projection; and flexible means integrally attaching and uniting said adapter to and with said projection, whereby access to the contents of the bag is afforded by means of a cannula penetrating said adapter.

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