

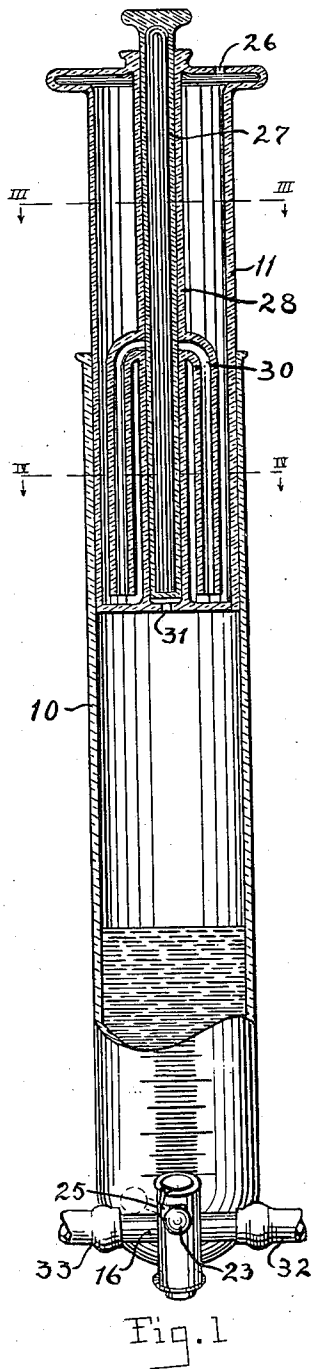
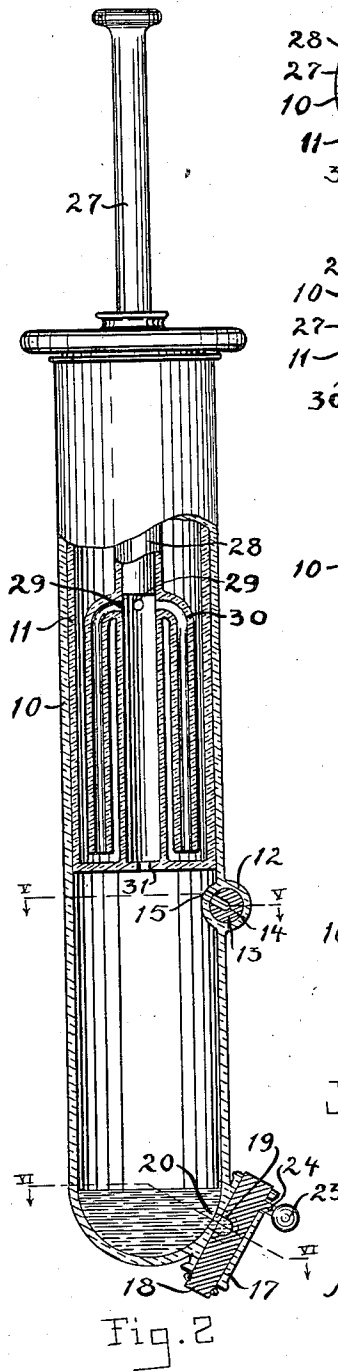
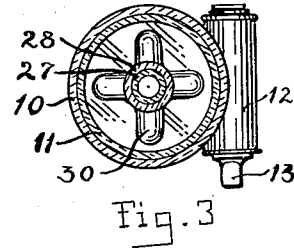
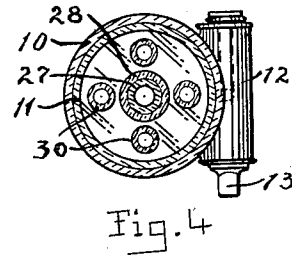
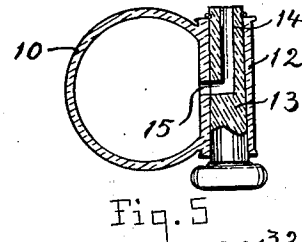
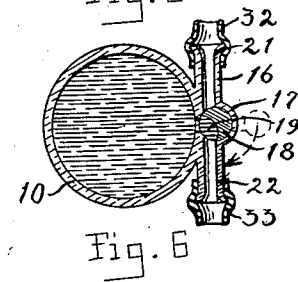
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BLOOD TRANSFUSION SYRINGE

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BLOOD TRANSFUSION SYRINGE

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7 Claims. (Cl. 128—214)

This invention has for its primary object the provision of a syringe particularly adapted for use in direct blood transfusion and having means for supplying a definite quantity of an anticoagulant liquid to a measured amount of the blood to be transfused.

A further object of the invention is to provide an instrument in which air may be interposed between the piston and the blood to prevent contact of the piston with the blood, the device being transparent to enable the operator to observe the progress of the injection.

Other objects and advantages of the invention reside in the simple, durable, and efficient features of construction and arrangements of parts, enabling the device to be readily sterilized and its manufacture to be relatively inexpensive.

In the drawing illustrating a preferred embodiment of the invention, Figure 1 is a longitudinal section showing the piston partly withdrawn from the cylinder or barrel, the lower end portion being shown in elevation; Fig. 2 is a longitudinal section in a plane at right angles to that of Fig. 1, the piston being at the lower limit of inward movement and the piston plunger being partly withdrawn; Fig. 3 is a transverse section on the plane III—III of Fig. 1; Fig. 4 is a transverse section on the plane IV—IV of Fig. 1; Fig. 5 is a similar section below the piston and through the air valve on the section planes V—V of Fig. 2; and Fig. 6 is a similar section through the lower end of the barrel and through the liquid valve on the planes represented by the bent line VI—VI of Fig. 2.

The apparatus illustrated comprises a barrel or cylinder 10 within which slides a piston 11, both preferably being of glass to permit the operator to see the amount and location of the liquids contained therein. The outer periphery of the piston and the inner periphery of the cylinder will be formed with a ground and fluid-tight joint throughout the range of movement of the piston within the cylinder.

The wall of the cylinder at a point just beyond the limit of inward movement of the inner end of the piston has a transverse tapered passage 12 ground to form a seat for a correspondingly tapered valve plug 13 having a passage 14 therein adapted in one position of the valve to register with a passage 15 through the wall of the cylinder. Near the lower end of the cylinder is a transverse tube 16 having both ends shaped to receive flexible tubing leading to intravenous needles (not shown) of any suitable construction known to those familiar with the art. Secured to the barrel

and to the tube 16 transversely of the tube is a valve receptacle 17 having a tapered bore ground to form a seat for a tapered valve 18 having a notch 19 adapted to register with a passage 20 in the wall of the barrel 10 and to register simultaneously with either half 21 or 22 of the passage through the tube 16. The valve 18 has a knob 23 on a stem 24 serving as a lever to rotate the valve, a slot 25 in the wall of the receptacle 17 acting to limit the angular movement of the stem and to position the valve notch 19. When the stem is in an intermediate position between the ends of the slot 25, the valve may be withdrawn from the receptacle, the stem passing through an outlet formed in the side of the slot.

The piston 11 is made hollow to serve as a receptacle for an anticoagulant liquid such as a solution of sodium citrate in water which may be introduced into the piston through an opening 26 in its top. A plunger 27 is fitted for sliding movement within a cylindrical chamber 28 formed coaxial with the piston and secured thereto at its ends. A plurality of openings 29 are formed in the sides of the chamber 28 approximately midway of its length and from these opening tubes or conduits 30 are shown as extending nearly to the bottom of the interior of the piston 11. A small opening 31 in the bottom of the chamber 28 leads to the interior of the barrel 10. The piston is shown in the drawing as free from liquid, but before beginning a transfusion operation, a suitable quantity of citrate solution will be introduced through the opening 26.

A flexible tube 32 attached to one end of the tube 16 may have its needle inserted into the vein of the donor, the valve 18 being positioned to cause the notch 19 to form a communication between the passage 21 and the passage 20 into the barrel, and the piston being at its inward limit of movement as indicated in Fig. 2. Withdrawal of the piston 11 to the position shown in Fig. 1 will allow blood to flow from the donor into the barrel of the syringe as indicated in the lower portion of Fig. 1, the valve 13 being closed while the piston is being pulled outward. If a sufficient quantity of blood is not obtained at the first stroke, the valve 13 may be rotated to allow air to escape from the port 15 through the passage 14 while the piston 11 is pushed inward and after closing the valve 13, the piston may be withdrawn again until the blood within the barrel reaches the desired graduation. Ordinarily, the valve 18 need not be closed on such a supplemental stroke, since the valve 13 will allow the excess air to flow out freely as the piston moves inward.

When the desired amount of blood is in the barrel, the valve 18 may be turned to close the passage 21 and to open the passage 22. The valve 13 may then be opened to permit air to enter beneath the piston 11, so that when the plunger 27 is withdrawn, suction caused thereby will not act to cause blood from the recipient to be introduced into the barrel. Withdrawal of the plunger 27 to a point above the ports 29 will cause suction in the tubes 30, drawing a small quantity of citrate solution from the hollow interior of the piston into the chamber 28, the opening 31 being large enough to admit air to permit outward movement of the plunger but preferably being small enough to prevent outflow of the liquid except when the plunger is pressed downward below the openings 29. The operator can observe the amount of citrate solution drawn into the chamber and when the proper quantity has entered, the valve 13 will be closed and the plunger will be pressed downward to force the solution out through the port 31 into the blood within the barrel. The piston 11 may now be pressed inward to force the blood and citrate mixture from the barrel through the passage 22 and the tube 33 attached to the other end of the tube 16 from the tube 32. When the tube and its intravenous needle is filled, the needle will be inserted into the vein of the recipient and the mixture of blood and citrate solution injected until only a little more remains in the barrel than will close the outlet port 20, as shown in Fig. 2. The notch 19 will then be in the position shown in Fig. 6. The transparent barrel will allow the operator to see clearly when the blood has been brought to its lowest limit, and movement of the piston will then be stopped to avoid forcing air into the recipient. With both needles remaining in place, the valve 18 may be turned to close the passage 22 and to open the passage 21, whereupon a second quantity of blood may be taken from the donor, and, after turning the valve 18 again, injected into the recipient, citrate solution being added if desired or omitted at the will of the operator. It will be evident that after blood has been withdrawn from the donor into the barrel to the desired amount, the valve 18 may be turned with the notch 19 out of registration with either the passage 20 or the passage 22 while the operation of supplying citrate solution is in progress, and with this arrangement, the valve 13 need not be opened, the air in the barrel expanding enough to permit the plunger 27 to be withdrawn above the openings 29. After the citrate has been withdrawn from the hollow piston into the chamber, measured, and forced into the barrel, the valve 18 will be turned to bring the notch into the position of Fig. 6, and the mixed blood and citrate solution can then be injected into the recipient.

It will be seen that the air remains in the barrel 10 at all times between the end of the piston and the surface of the blood, so that the piston need never touch the blood, the quantity of air being within easy control of the operator by the use of the valve 13.

Both valves may readily be removed from their seats, the plunger 27 taken out of the piston and the piston out of the barrel for sterilization, and all may easily be returned for use.

Since the piston in use will be held with the valve 18 downward so that the blood will cover the port 20, the end of the syringe remote from the piston may be called the lower end.

Many modifications in details of construction and arrangement of parts may obviously be made without departure from the essentials of the invention as claimed.

I claim:

1. A syringe comprising a barrel, a piston longitudinally slidable in the barrel and having a hollow interior for an anticoagulant solution, a chamber within the piston having a port communicating with the barrel and having a port communicating with the hollow interior of the piston, and a plunger slidable within the chamber to withdraw solution from the piston and to deliver it into the barrel.

2. A syringe comprising a barrel, a piston slidable in the barrel and having a hollow interior for an anticoagulant solution, a chamber within the piston having a port communicating with the barrel and having an intake port communicating with the hollow interior of the piston at a point remote from the port to the barrel, and a plunger slidable within the chamber to a point beyond the intake port to withdraw solution from the piston into the chamber, the plunger acting to close the said intake port on its return stroke and to force solution from the chamber into the barrel.

3. A structure as in claim 2, having a conduit for solution extending from the intake port to a point near the lower end of the hollow interior of the piston.

4. A syringe comprising a barrel, a piston slidable in the barrel, the barrel being provided near its lower end with a transverse tubular member having inlet and outlet passages, the barrel having a port communicating with the passages of said tubular member, and a three-way valve mounted within the tubular member at the port to connect the port with either the inlet or the outlet passage.

5. A structure as in claim 4 having an air valve in the barrel between the port and the piston.

6. A syringe comprising a barrel having a valved outlet, a piston longitudinally slidable in the barrel and having a hollow interior for an anticoagulant solution, a chamber within the piston having a port communicating with the barrel, a conduit having an outlet communicating with the chamber at a point remote from the port between the chamber and the barrel and having an inlet adapted to receive solution placed within the piston, and a plunger slidable within the chamber toward and from said port to close and open the outlet of said conduit, the arrangement being such that sliding movement of the plunger in the chamber away from said port will open the outlet of said conduit and act to draw the solution into said chamber and sliding movement of said plunger toward said port will force solution in said chamber through said port into said barrel after closing said outlet.

7. A structure as in claim 6 having an air valve in the barrel between the outlet of the barrel and said piston.

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