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2,057,726

BLOOD TRANSFUSION SYRINGE

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Fig. 1

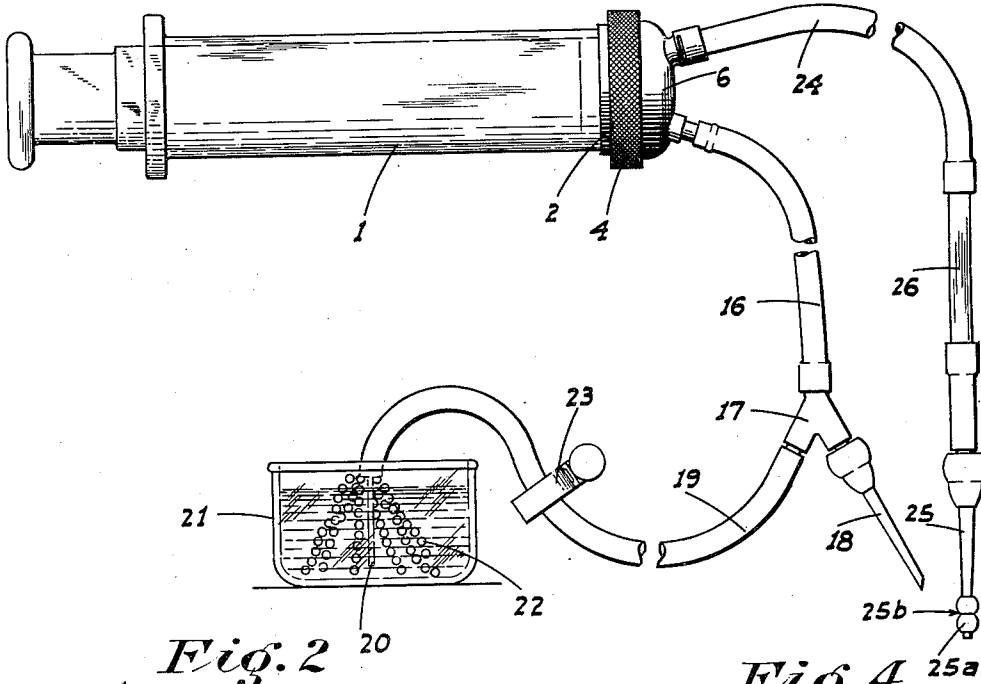


Fig. 2

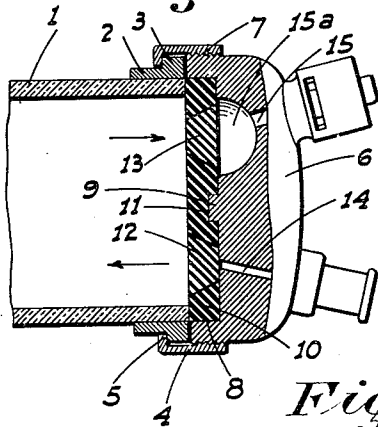


Fig. 3

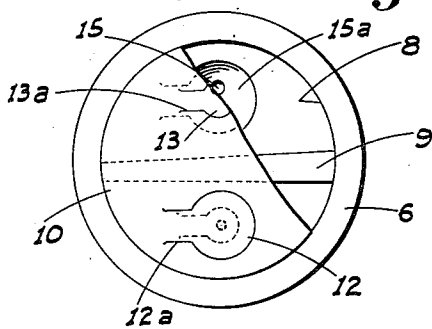
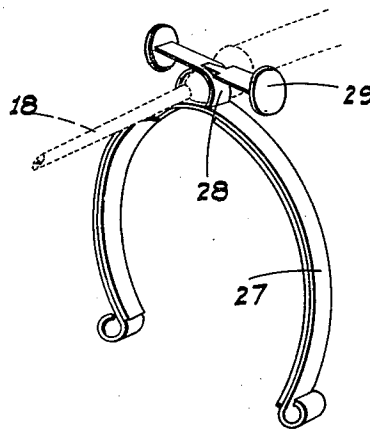


Fig. 4



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BLOOD TRANSFUSION SYRINGE

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5 Claims. (Cl. 128-214)

This invention relates to mechanisms for the direct transfusion of blood from one person to another, and the present application is a continuation in part of my application Serial No. 703,703, filed December 23, 1933.

Direct transfusion of blood is deemed preferable by leading surgeons as many difficulties are encountered in the use of the indirect methods. However, direct transfusion has heretofore been fraught with certain dangers. The gravest of these is that there is always the possibility of regurgitation of the blood and the flowing back of the blood from the recipient to the donor. If such returning blood is infected it sometimes results that the donor's blood also becomes infected and cases have been known where death of the donor resulted.

The principal object of my invention is therefore to provide a mechanism whereby blood transfusions may be carried out by a safe semi-direct automatic method.

It is also an object of my invention to provide a mechanism of few parts which may be readily assembled and disassembled and which may also be recurrently sterilized without injury to the operative parts.

A further object of the invention is to produce a simple and inexpensive device and yet one which will be exceedingly effective for the purpose for which it is designed.

These objects I accomplish by means of such structure and relative arrangement of parts as will fully appear by a perusal of the following specification and claims.

In the drawing similar characters of reference indicate corresponding parts in the several views:

Figure 1 is a side elevation in somewhat diagrammatic form of the complete assembly.

Figure 2 is an enlarged sectional view of the syringe valve cap.

Figure 3 is a plan view partly broken out of a gasket valve element.

Figure 4 is a perspective view of the combination needle holder and arm clamp.

Referring now more particularly to the characters of reference on the drawing, the numeral 1 designates a graduated glass syringe of the standard Luer type except that the needle end is eliminated and a metal band 2, having an annular flange 3, is fixed about the syringe at that end. An interiorly threaded collar 4 is mounted on the band 2 and has a flange 5 cooperating with the flange 3 to limit the movement of such collar.

A cap 6 has threads 7 to cooperate with the

threaded collar 4 whereby the head may be fastened to the end of the syringe 1. The cap 6 also has an inner annular recess 8 extending diametrically across the bottom of which is a tapered rib 9. An important feature of my invention is comprised in the combination gasket and valve element 10 which fits into this annular recess 8. This element 10 has a tapered groove 11 in one face to fit over the tapered rib 9 so that the gasket can only be disposed in one invariable position within the recess 8. The reason for this will develop as this description is proceeded with.

The gasket valve element 10 is of resilient material such as rubber or the like and of such composition that recurrent boilings thereof for sterilization purposes will not impair its body form or resiliency nor distort the valve elements which are formed therein and which I will now describe. These valve elements comprise flap valves 12 and 13. These valves are formed by cutting through the material of the element 10. Each valve is tapered and the valves are operably connected with the body of the element 10 by the hinge strips 12a and 13a respectively. The taper of the valve 12 is such that suction against the same from the interior of the syringe 1 will open the valve and pressure from within the syringe will close the valve.

Vice versa, the taper of the valve 13 is such that pressure from within the syringe will open the valve while suction from within will close it.

The cap 6 is provided with an inlet opening 14 in communication with the valve 12 and an outlet opening 15 in communication with the valve 13. The outlet 15 is enlarged at 15a to form a cavity for the reception of the valve 13 as it opens whereby the size of the cap 6 may be held to a minimum.

The intake passage 14 is adapted for connection to a length of rubber tubing 16 which at its outer end is connected to a Y-fitting 17. A donor needle 18 is mounted in connection with one branch of this fitting and another length of tubing 19 is connected to the other branch. A fine gauge needle 20 is connected to the outer end of this tube and is adapted to dip into a beaker 21 containing a solution of sterile normal salt or sodium citrate. A cluster-bowl weight arrangement 22 is connected to said end of the tube about the needle. This holds said needle well submerged in the solution without interfering with the flow of the same to the needle and permits a very small stream of the solution to enter the tube 16 along with the blood from the donor, and aids

in flushing the entire apparatus with this operation. A standard form of tube squeezing shut-off device 23 engages the tube 19 so as to stop the flow of the salt solution if desired.

5 The outlet passage 15 is connected to another length of rubber tubing 24. A recipient needle 25 is connected to the outer end of this tube, which has a glass observation section 26 of predetermined length interposed therein. The size of the
10 needles used may be changed to suit the operator since they are readily removable from their respective tubes.

In connection with the above apparatus I have provided a combination needle stabilizer and
15 tourniquet. This comprises a spring steel arm band 27 lined with suitable material to prevent slipping on the arm. The band is substantially of horseshoe form and opposite to its opening is formed with a relatively small circular spring
20 clamp 28 to engage a needle at its hilt as indicated in Figure 3. This holds the needle close to the arm and prevents any side swinging or longitudinal movement of the needle. The band when placed over the arm contracts about the same with
25 a reasonably heavy pressure and serves as a tourniquet. The clamp 28 has two finger members 29 pressure against which will spread the clamp to receive the needle.

The above describes in brief detail the mechanical substance of the apparatus, and I shall now
30 describe in some detail the method of using same. The valves 12 and 13 are normally held in closed position by the resilient action of their respective rubber hinges. The valve opening from the suc-
35 tion from the donor permits the blood to flow into the barrel or cylinder of the syringe through the valve 12, but allows none to escape back through this same valve. Thus, with the outward draw
40 of the plunger of the cylinder, blood is drawn from the donor into the cylinder past the valve 12. If the needle 18 is in open communication with the solution in the beaker 21, some of the solution is
45 at the same time drawn into the cylinder. With the reverse action of the plunger, the pressure plus the action of its rubber hinge definitely closes
50 the valve 12 and the accumulated blood is pushed against the valve 13, opening the same against the resilient action of its rubber hinge and the blood is then forced through the tube 24 and
55 needle 25 into the veins of the recipient. Both the valves when at rest are adapted to fit flush on the smooth surface of the gasket 10 so that there is no chance of leakage past the same.

It will be obvious that since the valves 12 and
55 13 are a unitary part of the gasket 10 they must always be placed in the same position to operate as described. This is made to occur by reason of the tapered groove 11 fitting the matching rib
60 9 which compels the gasket to be always inserted in the same position to fit within the recess 8.

Positive isolation of communication between the inlet 14 and outlet 15 in the cap must be maintained and to this end the gasket 10 is of such
65 thickness as to normally extend slightly beyond the outer edge of the recess 8. Thus, as the collar 4 is threaded onto the cap 6, the open edge of the syringe is drawn tight against the gasket 10 and compresses the resilient rubber thereof. This
70 seals it tightly against the face of the recess 8 on each side of the rib 7 and also presses it tightly into engagement with the side walls of the recess. Thus leakage from the inlet to the outlet is obviated and also air is positively excluded from entering the instrument.

75 For the purposes of sterilization the parts may

be easily disassembled by merely retracting the collar 4 from the cap 6.

The needle 25 is specially prepared with a pair of globular elements 25a forming an intermediate crevice 25b into which the fastening ligature
5 presses the wall of the vein as the needle is set in position, whereby to positively prevent forward or backward movement of the needle and hold it positively in one set position.

The observation glass tube 26 permits clear
10 observation of the blood as it is forced into the veins of the recipient and permits quick detection of any accumulated air bubbles in time to prevent the same entering the veins of recipient. In the event air bubbles appear during the pro-
15 cess of operation the needle end of this tube can be quickly disconnected, the bubbles permitted to escape, and reconnection hurriedly made. All the connections of the tubes with the cap and with this observation glass are of a quick detachable
20 type of desired form so that connections and disconnections may be made without seriously interfering with the blood transfusion operation.

The combination tourniquet and needle stabilizer 27 adds a very valuable feature to the com-
25 bination since it serves to hold the hilt of the needle close to the arm of the donor and to prevent wobbling thereof while at the same time forming a very effective tourniquet.

It will be obvious that my double acting valve
30 structure controlled as it is by the back and forth movement of the plunger presents an automatic feature for withdrawing the blood from the donor, then definitely shutting off any communi-
35 cation between the blood and the donor, and then forcing this donated blood through the opposite valve into the veins of the recipient. This is done by the mere action of the plunger itself and obviates the necessity of manipulation, or watch-
40 ing to see that the valves are opened and closed at the proper time as is a necessary requisite in connection with the use of other types of
45 apparatus in order to make sure that there is no return of the blood of the recipient into the veins of the donor. By reason of this valve arrange-
50 ment it is absolutely impossible for the blood to flow back into the syringe from the recipient, or to flow back from the syringe to the donor—which situation presents a most important factor of safety. The operation of the mechanism may
55 also be stopped at any time without any possible chance of regurgitation of blood.

Another important feature of my invention is that by reason of the special arrangement shown, the syringe may be of sufficient capacity to
55 facilitate the operation of the transfusion of blood with a considerably lesser number of mechanical movements in the transfusion of a given amount of blood over those required in other known apparatus. At the same time, there is
60 offered all the advantages of a syringe of lesser capacity.

While I have specified the cap 6 as being made of suitable material, it will be preferably made of chromium plated metal. This cap being re-
65 movably mounted on the syringe cylinder, and the tubes and inspection glass being all associated through the medium of quick detachable couplings, there is afforded an apparatus which is easily assembled or disassembled for cleansing and
70 sterilization. Also, the specific arrangement and organization of the apparatus is such that all the parts may be made durable and at minor expense.

From the foregoing description it will be readily 75

seen that I have produced such a device as substantially fulfills the objects of the invention as set forth herein.

While this specification sets forth in detail the present and preferred construction of the device, still in practice such deviations from such detail may be resorted to as do not form a departure from the spirit of the invention, as defined by the appended claims.

Having thus described my invention what I claim as new and useful and desire to secure by Letters Patent is:

1. In a blood transfusion syringe, a syringe barrel, a cap on the barrel having spaced inlet and outlet passages, a resilient and flexible gasket-disc between the barrel and cap, the adjacent surfaces of the disc and cap contacting with each other over substantially the entire area of the disc, and spaced and relatively opposed inlet and outlet flap valves formed integral with and cut through the material of the disc to provide communication between the barrel and the corresponding cap passages; the outlet valve opening outwardly and the inner face of the cap having a recess therein larger than the outlet valve to enable the same to open into said recess.

2. In a blood transfusion syringe, a syringe barrel, a cap on the barrel having spaced inlet and outlet passages, a resilient and flexible gasket-disc between the barrel and cap, spaced and relatively opposed self-closing inlet and outlet flap valves formed integral with and cut through the material of the disc to provide communication between the barrel and the corresponding cap passages, and means between the cap and disc to form a seal preventing communi-

cation between the inlet valve and outlet passage, and between the outlet valve and inlet passage.

3. A blood transfusion syringe comprising a syringe body, a cap on the body having spaced inlet and outlet passages, a gasket removably interposed between the cap and body, the gasket having spaced openings to match the passages, self-closing inlet and outlet valves for said openings mounted in fixed non-removable relation with the gasket, said valves respectively opening inwardly and outwardly of the body, and a tapered rib across the bottom of the cap, the gasket having a tapered groove to match the rib.

4. A blood transfusion syringe comprising a syringe body, a cap on the body having spaced inlet and outlet passages, a gasket removably interposed between the cap and body, the gasket having spaced openings to match the passages, self-closing inlet and outlet valves for said openings mounted in fixed non-removable relation with the gasket, said valves respectively opening inwardly and outwardly of the body, and cooperating elements on the gasket and cap arranged to enable the gasket, when being mounted in place, to be disposed only in a predetermined position relative to the cap.

5. A blood transfusion syringe comprising a syringe body, a cap on the body having spaced inlet and outlet passages, a gasket removably interposed between the cap and body, the gasket having spaced openings to match the passages, and self-closing inlet and outlet valves for said openings mounted in fixed non-removable relation on the gasket; said valves respectively opening inwardly and outwardly of the body.

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