

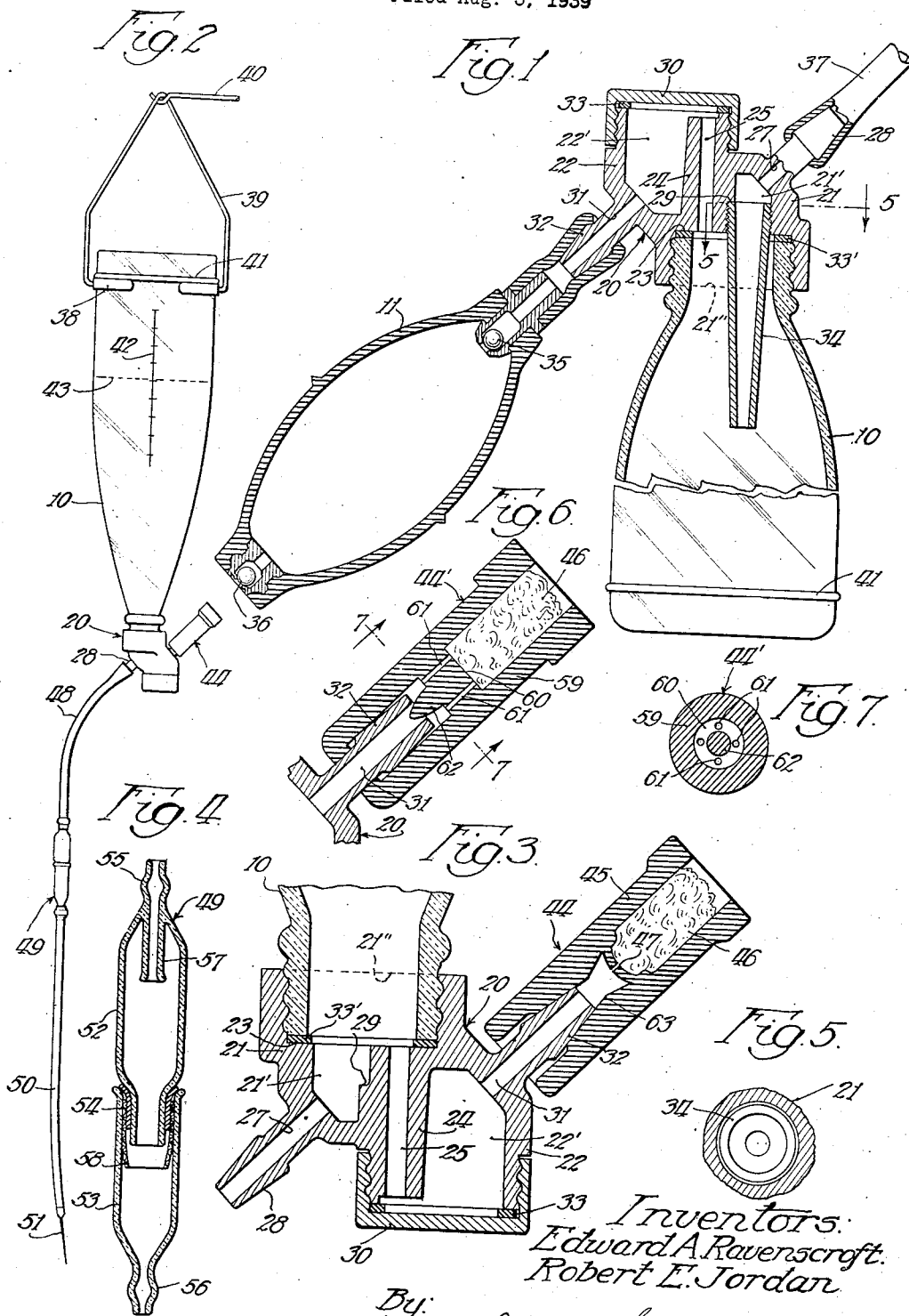
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APPARATUS FOR INDIRECT TRANSFUSION AND VENOCLYSIS

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APPARATUS FOR INDIRECT TRANSFUSION
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The present invention relates to apparatus for indirect transfusion and venoclysis. More particularly, the present invention relates to apparatus including an improved container cap for withdrawing blood and for the intravenous injection of the same or other sterile liquids or mixtures thereof.

Many types of apparatus for indirect transfusion and for venoclysis have been suggested heretofore. Prior apparatus, however, has been found by the medical profession to be crude or complex and to be generally unsatisfactory. The art has long desired a simple apparatus that would serve for withdrawing blood from a donor as well as serve later for intravenous injection into a patient.

The principal object of our invention is to provide a practical apparatus for indirect transfusion and venoclysis free from the disadvantages found in apparatus available heretofore.

Another object of our invention is to provide a simple and improved cap adaptable for use in both indirect transfusion and venoclysis apparatus.

Other objects of the invention will be apparent from the following description.

Reference is made to a co-pending application of Edward A. Ravenscroft, Serial No. 73,862 filed April 11, 1936, directed to "Apparatus for venoclysis" in which the air inlet conduit of the container, due to a special nipple arrangement, is provided with a loop extending below the outlet nipple, and to a co-pending application of Edward A. Ravenscroft, Serial No. 174,535, filed November 15, 1937, directed to "Apparatus for venoclysis", in which the air inlet is provided with a special type one-way valve. The present invention is based upon the discovery of a new and improved cap for the container and one-way check valve which may be used for indirect transfusion as well as venoclysis.

In the accompanying drawing forming a part of the specification—

Fig. 1 is a longitudinal section through a container and cap provided with a suction bulb arranged for withdrawing blood for indirect transfusion.

Fig. 2 is a side elevation of the same container and cap arranged for intravenous injection of blood or for venoclysis.

Fig. 3 is an enlarged longitudinal section through our novel cap provided with a check valve element for intravenous injection or venoclysis.

Fig. 4 is an enlarged longitudinal section showing

ing a dripper-filter for intravenous injection of blood.

Fig. 5 is an enlarged fragmentary section taken on line 5—5 of Fig. 1, showing the inner or upper end of an extension tube that is inserted into the cap when withdrawing blood for indirect transfusion.

Fig. 6 is a longitudinal section of a modified form of check valve element which may be substituted for that shown in Fig. 3.

Fig. 7 is a cross section taken on the line 7—7 of Fig. 6.

Referring to the drawing, a glass bottle or flask 10 serves as the container for the blood or other sterile liquids. In indirect transfusion for withdrawing blood, the container 10 is upright, and the cap is provided with a suction bulb 11, as illustrated in Fig. 1. In intravenous injection or venoclysis, the container is supported in an inverted position, and the cap is equipped with a check valve element such as 44 (Figs. 2 and 3) or 44' (Figs. 6 and 7).

The container cap, designated as a whole by 20, and preferably made of molded resinous material, is shown in upright position in Fig. 1, in which position it transfers blood from the donor to the bottle 10, and in inverted position in Figs. 2 and 3, in which position it transfers the contents of the bottle 10 to the donee or patient undergoing the transfusion. It comprises two integral limbs 21 and 22 relatively offset both lengthwise and sideways and chambered and bored as follows: The limb 22 is formed with a chamber 22' of substantial size with which communicates the bore 31 of an inclined nipple 32. The open end of limb 22 is externally threaded to receive a cover 30 for closing the chamber 22', a gasket 33 being inserted between the cover 30 and the end of the limb to insure a liquid tight joint. The limb 21 is formed with a somewhat smaller chamber 21', that communicates with a diametrically enlarged and internally threaded socket 21'' that receives the threaded neck of the bottle 10, a gasket 33' being interposed between the end of the bottle neck and an annular shoulder 23 at the inner end of the socket 21'' to insure a liquid tight joint. With the closed upper end of chamber 21' communicates the bore 27 of an inclined nipple 28 that extends in an opposite direction to the nipple 32 and is substantially parallel to the latter. In a partition wall 24 that is common to both limbs of the cap is a straight bore 25 that forms a flow duct between the two chambers. The provision of the removable cover 30 facilitates thorough cleaning of the chambers and ducts after

each use. A portion of the side wall of chamber 21' is tapped to receive the upper threaded end of an extension tube 34, and in said side wall is a stop shoulder 29 to limit the inward movement of the extension tube. The purpose of the extension tube 34 is to prevent coagulation of the blood that would otherwise trickle down the side wall of the container 10.

It will be observed from the foregoing that the chamber 22', the intermediate passageway 25, and the chamber 21' form a generally N-shaped duct in the cap, with the opposite ends of which the bores of the nipples 32 and 28 respectively communicate.

For withdrawing blood for indirect transfusion the apparatus is arranged as shown in Fig. 1. In this arrangement, passageway 31 serves as the air outlet duct from the cap and container and passageway 27 serves as the blood inlet duct to the container. Suction bulb 11, provided with the ordinary ball check valves 35 and 36, is attached to nipple 32 and serves as a means for withdrawing air from the container. The lowering of the pressure in the container facilitates the flow of blood from the donor. The inlet nipple 28 connects by means of a conduit tube 37 and a needle (not shown) to a vein of the blood donor.

For intravenous injection or venoclysis, the apparatus is arranged as shown in Figs. 2 and 3, the container being supported in an inverted position by means of an open-ended spring support comprising a circular metal band 38 provided with an adjustable bail or handle 39 hung on any suitable support such as represented at 40. The band 38 which is open-ended and thus may be readily placed over the container after the cap and tubing are in position, bears against a circumferential bead 41 on the container, which bead holds the container in place. The container for use in both indirect transfusion and venoclysis may be provided with graduated markings 42 for measuring liquid 43. In this arrangement passageway 27 serves as the liquid outlet aperture and passageway 31 serves as the air inlet aperture. A check valve element designated as a whole by 44 (Fig. 3) comprising a molded tubular body portion 45 of rubber containing porous air filtering material 46, and a rubber slit diaphragm valve 47 extending across the bore of the body is attached to nipple 32 and serves as an air inlet as the liquid drains from the container. When using the apparatus for venoclysis or intravenous injection the bulb 11 is removed. The outlet nipple 28 connects by means of conduit 48, dripper-filter 49 and conduit 50 to needle 51. Dripper-filter 49 (Fig. 4) comprises an upper body 52 and a lower body 53 held together by a rubber sealing sleeve 54, the upper and lower body sections being provided with nipples 55 and 56 which engage tubes 48 and 50 respectively, as illustrated in Fig. 2. The upper nipple is provided with a short drip tube 57 located within the upper body, the drip tube being of aid in judging the speed of flow of fluid from the container to the patient. The flow of the injection fluid may be controlled by the usual adjustable pinch clamp not shown. The blood filter is provided with screen gauge 58 and is used as a precaution to be sure that the blood going to the patient is free from clots.

In the operation of the apparatus for indirect transfusion, the apparatus is first arranged as shown in Fig. 1. In withdrawing blood, the operator first opens a sterile ampoule of sodium

citrate solution or other anti-coagulation solution and draws the required amount of this solution into the container by means of pumping on the rubber suction bulb. The needle (not shown) is then inserted into the donor's veins with sterile precautions in the usual manner. The blood flows from the donor through the needle, conduit 37, passageway 27 and nipple 28, chamber 21' and extension tube 34, and into the container. During this operation the container is preferably grasped in one hand in such a manner that the bulb 11 can be squeezed with two fingers while holding the container with the thumb and other fingers. Held in this manner, it is easy to shake the container or flask so as to swirl the incoming blood around and allow for proper admixture with the citrate solution in order to prevent possible coagulation. As previously mentioned, tube 34 is used to direct the flow of blood away from the side of the flask or container where it might possibly coagulate before reaching the main mass of blood in the flask below. Having completed the removal of blood from the donor, the flask with associated apparatus is then taken to the bedside of the patient to receive the blood, or it may be stored according to well established practice until needed.

To administer the blood to the patient, the extension tube 34 is removed unless there is enough blood in container 10 to make removal of tube 34 unnecessary and the suction bulb is replaced by the check valve element, as shown in Fig. 2. The removal of tube 34 necessitates the removal of the cap, and, to prevent possible contamination of the blood in the container by impurities in the air, should the cap remain separated from the container for any appreciable length of time, a plug of cotton treated with a sterilizing medium is temporarily inserted in the neck of the container. If check valve element 44 is used, the air passes through the filtering material 46, rubber slit valve 47, passageway 31 of nipple 32, chamber 22', and duct 25 into the container as the sterile liquid flows out of the container through chamber 21', passageway 27 of nipple 28, conduit 48, filter 49, conduit 50, needle 51, and into the patient. From the above it will be apparent that the improved cap may be used for withdrawing blood, or injecting blood in indirect transfusion, or straight venoclysis work.

In Figs. 6 and 7 we show another form of check valve element designated as an entirety by 44'. This comprises a tubular rubber molded body 59 adapted to telescopically engage with the nipple 32 and formed with a bridge 60 across its bore, through which bridge are formed a plurality of small air ducts 61. The bridge 60 has on its lower side an integral tapered teat 62 located in line with the passageway 31 of nipple 32 and functioning as a valve or stopper for said passageway when the body 59 is pushed downwardly on the nipple as far as it will go. In this position the annular outer end of the nipple also closes the lower ends of the air ducts 61, so that there is a double seal against the escape of liquid. When later the administration to the patient begins, the valve body 59 is drawn outwardly to the position shown in Fig. 6, and this permits inflow of air to replace the liquid drawn off.

When the check valve 44 is used, the rubber slit valve 47 prevents the liquid from flowing out of the air inlet when the container is first inverted and before a partial vacuum is created therein by the initial discharge of the contents of the container through the venoclysis tubing. As soon as

established, the partial vacuum opens the rubber slit valve and allows an even, uniform stream of air or air bubbles to flow into the container as the latter empties.

5 When the check valve element 44' is used, before inverting the container the valve body 59 is pushed inwardly on the nipple 32 until the valve seat 62 plugs the nipple passageway 31 and the outer end of the nipple closes the holes 61 and this prevents leakage of liquid past the valve when inverting the container. As soon as the flow from the container has created a partial vacuum in the container, the body 59 of the check valve is drawn outwardly a slight distance, as shown in Fig. 6, and this opens the valve and allows air to enter the container. In practice we have found this form of check valve somewhat more reliable than the rubber slit form, although the latter, when accurately made, gives 15 satisfactory results, and has the advantage of being entirely automatic.

It is important to note that the chamber 22' is of substantial size and that this chamber in the inverted position of the cap and container, 25 is filled with liquid before any of the latter can pass out through nipple 32. Because of this arrangement, the cap functions satisfactorily for the administration of liquid to the patient without any check valve attached to nipple 32 after 30 the partial vacuum is initially established in the container. Specifically, as air enters the container through conduit 25, it reduces somewhat the partial vacuum and allows liquid to flow down through conduit 25 and partially fill the chamber 22'. In so doing it creates additional vacuum in the container and the back flow of liquid into the chamber 22' ceases. As the contents of the container continue to discharge throughout outlet nipple 28 and attached venoclysis tubing, the vacuum increases in the container and the liquid trapped in the chamber 22' gradually flows up through conduit 25 until more air is admitted and then the cycle repeats.

Because of this unique function of chamber 22' we have, in our apparatus, retained the ease 45 of making multiple container hook-ups for continuous venoclysis. For example, assuming the first container to be in operation and the liquid therein flowing into the patient's veins, the procedure would be as follows: The second container with a cap 20 attached as shown in Fig. 1 is first brought up adjacent the first container. The check valve element 44 or 44' is then removed from the inlet nipple of the first container and 55 placed in a corresponding position (on nipple 32) on the cap of the second container. The outlet nipple 28 communicating with chamber 21' of the cap of the second container is then connected by means of a conduit to the inlet nipple 32 of the cap of the first container. The second container is then inverted and hung on the stand alongside the first container.

We have found that Bakelite or other non-corrosive material which will withstand repeated 65 sterilizations is preferable for use in molding the cap. The check valve element 44 on the other hand is preferably made of rubber or like material with a flexible or rubber slit valve comprising an inwardly bowed diaphragm provided with a slit 70 molded therein. The bore of this check valve element is preferably provided with an annular restriction or ledge 63 which protects valve 47 and keeps it out of contact with nipple 32. The bore of the check valve element should be large 75 enough at its outer end to accommodate a small

amount of porous filtering material 46 such as sterilized cotton or the like.

Our new apparatus is compact, the new cap and check valve element making it unnecessary in venoclysis to use long tubing leading to an air inlet or filter elevated above the liquid in the container. Our apparatus in addition, makes it unnecessary to insert glass air inlet tubes from the cap to the bottom of the container. The use of such tubes has long been recognized as unsatisfactory due to the leakage of the liquid therefrom when the container is first inverted and also due to the ease with which glass delivery tubes slip from the cap resulting in a loss of liquid. An additional advantage of the present 15 apparatus is that the rubber in contact with the solution is reduced to a minimum.

It will be understood that our invention is not limited to the exact preferred embodiments above described, but detail changes in structure and arrangement may be resorted to within the scope and coverage of the claims.

We claim:

1. In an apparatus for indirect transfusion and venoclysis, the combination with a container cap 25 comprising a body having a lower open end internally threaded to screw onto the threaded neck of a bottle container, said body formed with a generally N-shaped duct, and having a nipple communicating with one end of said duct adapted to receive a tube leading from a blood donor in the upright position of said cap and container and a tube leading to a donee or patient in the inverted position of said cap and container, and having another nipple communicating with the 35 other end of said duct adapted to receive a suction member in the upright position of said cap and container, of a check valve element adapted to be removably mounted on said last named nipple and containing a valve operative to block leakage of the liquid contents of the container through the cap when the container and cap are inverted and to later admit air to the container to replace liquid drawn off from the latter, said check valve element comprising a tubular rubber body telescopically engaged with said last named nipple and having a rubber slit diaphragm valve extending across its bore, said valve opening inwardly under air pressure and closing outwardly under pressure of the liquid in the container.

2. In an apparatus for indirect transfusion and venoclysis, the combination with a container cap comprising a body having a lower open end internally threaded to screw onto the threaded neck of a bottle container, said body 55 formed with a generally N-shaped duct, and having a nipple communicating with one end of said duct adapted to receive a tube leading from a blood donor in the upright position of said cap and container and a tube leading to a donee or patient in the inverted position of said cap and container, and having another nipple communicating with the other end of said duct adapted to receive a suction member in the upright position of said cap and container, of a 65 check valve element adapted to be removably mounted on said last named nipple and containing a valve operative to block leakage of the liquid contents of the container through the cap when the container and cap are inverted and to later admit air to the container to replace liquid drawn off from the latter, said check valve element comprising a tubular body telescopically engaged with said last named nipple and having a bridge extending across its bore, said bridge 75

having an air duct extending therethrough and a tapered valve on its inner side adapted to plug the nipple passageway when said body is pushed inwardly over the nipple far enough to bring said valve into contact with the free end of the nipple.

3. A container cap of the type described adapted for use in indirect transfusion and venoclysis, comprising a one-piece body of molded resinous material, comprising limbs relatively offset both lengthwise and sidewise and having a common partition wall, the upper of said limbs having a chamber with an open upper end normally closed by a cover and an inclined nipple communicating with the lower portion of said chamber, and the lower of said limbs having a chamber with an open lower end opening into an internally threaded socket adapted to engage with the threaded neck of the container and an oppositely directed inclined nipple communicating with the upper portion of said last named chamber, and said partition wall having a duct connecting said chambers, and a removable extension tube communicating at its upper end with said last named chamber and of sufficient length to depend through the neck of the container; said first named nipple being adapted to receive a suction bulb in the upright position of said cap and container and a check valve to admit air to the container but block leakage of liquid from the container in the inverted position of said cap and container, and said last named nipple being adapted to receive a tube leading from a blood donor in the upright position of said cap and container and a tube leading to a donee or patient in the inverted position of said cap and container.

4. A container cap of the type described adapted for use in indirect transfusion and venoclysis, comprising a body having limbs relatively offset both lengthwise and sidewise and having a common partition wall, the upper of said limbs having a chamber with an open upper end normally closed by a cover and a downwardly inclined nipple communicating with and extending beyond the lower portion of said chamber, and the lower of said limbs having a chamber with an open lower end opening into an internally threaded socket adapted to engage with the threaded neck of the container and an upwardly inclined nipple communicating with the upper portion of said last named chamber, and said partition wall having a duct connecting said chambers; said first named nipple being adapted to receive a suction bulb in the upright position of said cap and container and serving to admit air to the container in the inverted position of said cap and container, and said last named nipple being adapted to receive a tube leading from a source of liquid in the upright position of said cap and container and a tube leading to a patient in the inverted position of said cap and container; said first named chamber being of substantial size and adapted to be filled with liquid before any liquid can pass out through its nipple, whereby the cap may function satisfactorily for the administration of liquid to the patient without any check valve applied to said first named nipple after a partial vacuum is initially established in the container.

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