

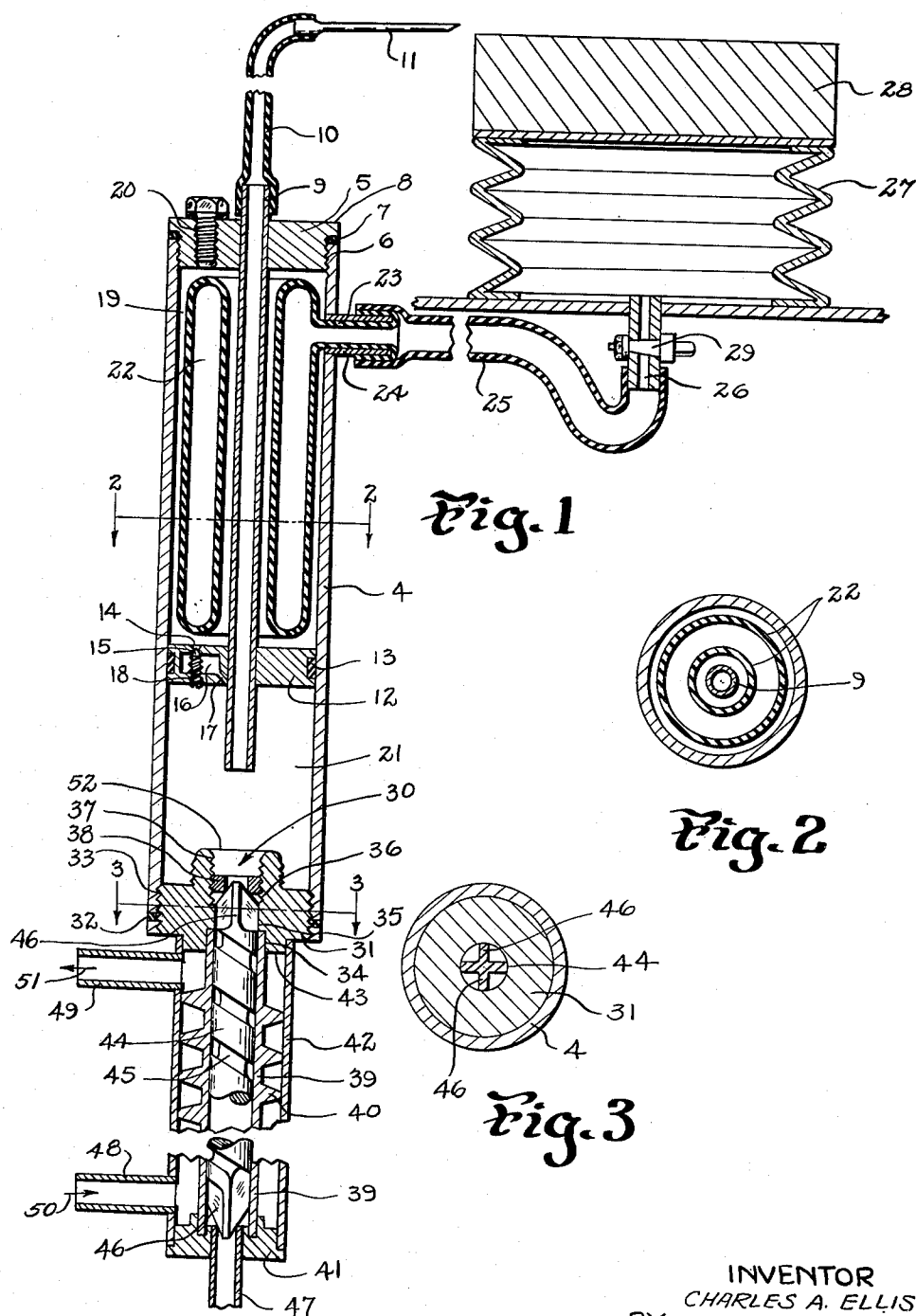
Aug. 4, 1953

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2,647,514

APPARATUS FOR COLLECTING AND PRESERVING BLOOD

Filed June 29, 1951



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UNITED STATES PATENT OFFICE

2,647,514

APPARATUS FOR COLLECTING AND PRESERVING BLOOD

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Application June 29, 1951, Serial No. 234,239

8 Claims. (Cl. 128—275)

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This invention relates to an improved apparatus for collecting and preserving blood and has as a principal object the provision of an apparatus for mixing a controlled amount of ACD (acid, citrate, dextrose) solution with the blood at the time that the blood is taken from the donor. Blood, as taken from a donor, has a tendency to coagulate unless steps are taken for preventing such coagulation. The present apparatus is designed to mix the ACD solution with the blood at the time of extraction from the donor to prevent such coagulation and to then chill the blood and ACD mixture prior to directing it into a suitable container for preservation in blood banks or for other uses.

Another object is to provide an apparatus of the above character whereby the flow of the ACD solution during said mixing with the blood may be forcefully controlled.

Another object is to provide a cooling system in combination with an apparatus of the above character for cooling the mixture prior to its being deposited in a container for preservation.

Another object is to provide air pressure means for controlling the rate of flow of the ACD solution for mixture with the blood wherein the air is isolated from said solution to prevent the accidental forcing of air into the donor's blood stream.

Another object is to provide apparatus of the above character wherein the various parts may be readily disassembled for cleansing.

Other objects and advantages of the invention will become apparent from the following description taken in connection with the accompanying drawings and it will be apparent that many changes may be made in the details of construction and arrangement of parts shown and described without departing from the spirit of the invention as expressed in the accompanying claims. I, therefore, do not wish to be limited to the exact details of construction and arrangement of parts shown and described as the preferred form only is given by way of illustration.

Referring to the drawings:

Fig. 1 is a longitudinal sectional view of the apparatus embodying the invention;

Fig. 2 is a sectional view taken as on line 2—2 of Fig. 1; and

Fig. 3 is a sectional view taken as on line 3—3 of Fig. 1.

In the drawings wherein like characters of reference designate like parts throughout the several views, the apparatus embodying the invention comprises an outer cylindrically shaped cas-

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ing 4 having a cap 5 threadedly connected, as illustrated at 6, to said casing and having a resilient washer 7 between the adjacent end of said casing and a flange 8 formed throughout the periphery of said cap 5. The cap 5 has a central opening in which a tubular member 9 is secured by solder or the like. The said tubular member extends in a direction longitudinally of said casing to a location spaced from the opposed end thereof. The tubular member 9 extends outwardly of the upper end of said cap 5 to receive a resilient hose line 10 to which a suitable hollow needle 11 is attached.

The tubular member 9 is held in spaced relation with the inner walls of the casing 4 adjacent the lower end thereof by a disk-shaped member 12 having a central opening therein and in which the said tubular member 9 is secured by solder or the like. The disk is sealed throughout its contour with the inner wall of the casing 4 by a suitable gasket 13 of rubber, synthetic rubber or other desirable material. The disk 12 is provided with a tapered opening 14 in which the tapered end 15 of an adjustable screw is extended to form a needle valve communicating with an open chamber 16 formed internally of said disk 12 and which, in turn, communicates with a restricted opening 17 angled so as to communicate with the adjacent outer side wall of the tubular member 9. The tapered end 15 is formed integral with the screw member 18 which is threadedly connected with the disk and by which the position of the tapered end 15 may be controlled with respect to the tapered opening 14 formed in said disk 12. The said disk member 12 and cap 5 form a sealed chamber 19 internally of the casing 4 in which is placed the ACD solution. The said solution is inserted through a suitable opening in the cap 5 sealed by the stopper 20.

The ACD solution is adapted to flow through the needle valve into the chamber 16 and thence outwardly of the restricted angled opening 17, downwardly of the adjacent outer side wall of the tubular member 9, and is adapted to intermingle with blood drawn from the patient through the tube 9, hose line 10 and needle 11 whereby the said blood and intermingling ACD solution will flow into a lower chamber 21 internally of said casing 4.

To vary and control the speed of flow of the ACD solution through the needle valve into the chamber 16, there is positioned internally of the chamber 19 and, in surrounding relation with the tubular member 9, a sealed cylindrically shaped hollow sack of resilient material 22 such

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as rubber, synthetic rubber, plastic or the like having an integral stem 23 extending outwardly of a relatively short tubular member 24 secured within an opening formed in the side wall of the casing 4. The resilient stem 23 is reversely folded over the outer end of the tubular member 24 and has a resilient tubular member 25 in secured overlying relation with the reversely folded end of the stem 23. The resilient tubular member or hose line 25 is secured to a hollow stem 26 communicating with suitable bellows 27 or other means for forcing a liquid such as air into the sack 22. In order to automatically cause the bellows 27 to collapse and force air outwardly thereof into the sack 22, there is provided a suitable weight 28 or the like. The flow of the liquid into the sack 22 from the bellows is controlled by a suitable valve 29 mounted in the stem 26.

It is to be understood that although the weighted bellows 27 are illustrated as a means for forcing a liquid such as air into the sack 22, any other suitable means may be provided for inflating or deflating the sack as desired. The inflation of the sack which lies within the ACD solution internally of the chamber 19 will create a pressure on said ACD solution and cause the same to more speedily flow through the needle valve into the chamber 16 and through the restricted opening 17 onto the outer adjacent side wall of the tube 9. The speed of flow may also be controlled by the adjustment of the needle valve.

The sack, therefore, is intended purely for forcing the ACD solution outwardly of the chamber 19 under a variable control without permitting a mixture of air with said ACD solution. The mixture of ACD solution and blood, which, as stated above, is for the purpose of preventing coagulation and for enabling the blood to be preserved in suitable containers, flows from the chamber 21 through an opening 30 formed centrally of a cap member 31 secured in sealed relation with the lower end of the casing 4 as by a suitable resilient washer or the like 32. The cap member 31 is threadedly connected, as illustrated at 33, to the lower end of the casing whereby the said cap member as well as the upper cap member 5 and disk 12 carried by the tubular member 9 may be removed from the casing 4 for the purpose of cleansing and sterilization at different occasions. The lower cap member 31 has a counterbore 34 communicating with an intermediate smaller bore 35 which, in turn, communicates with the opening 30 which has a threaded inner wall 37 for receiving a threaded perforated nut 38. A tubular member 39 having a helical cooling fin 40 on the exterior and extending longitudinally thereof has its upper end fitted and secured within the counterbore 34 as by solder or other suitable means. The lower end of said tubular member 39 is fitted and secured within a cap 41 in sealed relation with the lower end of a cylindrical housing 42 which surrounds the outer edge of the helical cooling fin 40. The said cylindrical housing 42 is secured to a shouldered projection 43 formed on the lower cap member 31 as by soldering or other suitable means. Centrally of the tubular member 39 having the helical fin 40 thereon, there is provided a core 44 having a plurality of spiral grooves 45 extending longitudinally thereof and communicating with a plurality of diametrically opposed flutes 46 formed in the ends of said core 44. The said ends having the diametrically opposed flutes 46 therein are tapered

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to fit, at the upper end thereof, within the opening in the perforated nut 38 and to fit within the end of a stem 47 secured inwardly of the cap 41 by solder or other means. The said core 44 is held in position of use by means of the nut 38 whereby the mixture of blood and the ACD solution inwardly of the chamber 21 may flow through the opening 30, the perforation in the nut 38 about the fluted portions 46 and longitudinally of the spiral grooves 45 and thence outwardly about the flutes 46 in the lower tapered end of the core. The mixture of blood and the ACD solution then flows outwardly through the stem 47 wherein the said mixture may be directed into a suitable receptacle or container. The housing 42, adjacent its upper and lower ends, is provided with stem portions 48 and 49 through which a cooling liquid such as ice water may be caused to circulate inwardly of said housing about the inner tubular member 39 and cooling fin 40 with a continuous flow as indicated by the arrows 50 and 51. This arrangement chills the mixture of blood and the ACD solution so that the mixture may be more positively preserved in the receptacle or container in which it flows from said cooling system.

In operation, the apparatus functions substantially as follows:

The casing 4 having the expandable hollow sack 22 therein is filled with the ACD solution with the sack preferably in a substantially collapsed state. The solution is inserted in the casing 4 through the opening in the cap member 5 by removing the stopper 29. The stopper is then replaced and blood is drawn from the donor through the hollow needle 11, hose line 13 and internal tube 9. As the blood is drawn from the donor, the ACD solution is caused to flow through the needle valve into the chamber 16 and outwardly of the restricted opening 17 whereby its flow downwardly of the outer side wall of the tube 9 will cause it to intermingle and mix with said blood in the chamber 21. The speed of flow of the ACD solution may be increased by causing a liquid such as air to be forced through the hose line 25 into the sack 22 whereby the sack will expand and cause a pressure on the ACD solution and increase its speed of flow through the needle valve and the restricted opening 17. The speed of flow may also be regulated by the adjustment of said needle valve. When the mixture of blood and ACD solution rises to a level above the upper end 52 of the cap member 31, it will flow over said end downwardly through the opening 30 about the flutes 46 and downwardly of the spiral grooves of the inner core 44. During this latter flowing, a coolant such as ice water is circulated inwardly of the cylindrical housing 42 about the tubular member 39 and cooling fin 40 to chill the mixture prior to its flowing outwardly about the flutes 46 in the lower end of said core and outwardly through the tubular stem 47. The stem 47 directs the chilled mixture of blood and ACD solution into a suitable container whereby it may be preserved for use in blood banks and the like.

From the foregoing description, it will be seen that extremely simple, efficient and safe means have been provided for quickly and more positively mixing ACD solution with blood directly extracted from a donor whereby the flow of the ACD solution, during said mixing, is controlled by isolated air pressure to obviate all danger of having air accidentally directed to the donor and

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the chilling of said mixture may be more efficiently and expeditiously accomplished.

Having described my invention, I claim:

1. In an apparatus of the character described, the combination of a casing having two separate fluid chambers therein, a tubular member having a downwardly directed portion for directing the flow of a first fluid into one of said chambers, sealed expandable and collapsible means in the other of said chambers adapted to lie within a second fluid of different characteristics to be placed in said other chamber, and means intermediate said chambers having a passageway therein for directing the flow of said second fluid in said other chamber, as effected by the expansion or contraction of said expandable and collapsible means, to an outer side wall of said tubular member to cause the second fluid to flow downwardly of said outer side wall and intermingle and mix with the first-mentioned fluid as the first fluid flows outwardly of said tubular member and into the lower part of said one chamber.

2. In an apparatus of the character described, the combination of a casing having upper and lower end walls and an intermediate wall together forming upper and lower chambers in said casing, tubular means extending through the upper of said end walls, through the upper chamber, through the intermediate wall and into the lower chamber for directing the flow of a first fluid into said lower chamber, sealed expandable and collapsible means in said upper chamber adapted to lie within a second fluid of different characteristics to be placed in said upper chamber, said intermediate wall having a passageway therein for directing the flow of the second fluid from said upper chamber downwardly of an outer side wall of the portion of said tubular member in said lower chamber, whereby said first and second fluids will intermingle and mix with each other in said lower chamber.

3. In an apparatus of the character described, the combination of a casing having closed end portions with openings extending through each respective end, a cylindrical housing secured to one of said closed end portions in sealed relation therewith and having an opposed perforated end wall, said casing having an inner wall intermediate the ends thereof dividing said casing into an upper and lower chamber, a tubular member extending through the opening in the end wall opposite the cylindrical housing, through the upper chamber, through the intermediate wall and terminating in the lower chamber, a sealed inflatable member internally of the upper chamber having an integral stem extending through an opening in the side wall of said upper chamber and adapted to be connected in sealed relation with air pressure means, a cooling system internally of said cylindrical housing having its end portions respectively sealed with the lower end wall of the casing and with the perforated end wall of the cylindrical housing in aligned relation with the openings in said walls, said tubular member having means for connection with a hollow needle for extracting blood from a donor and for directing the flow of said blood through said tubular member into the lower chamber, said upper chamber being adapted to receive a liquid for mixture with said blood, said intermediate wall having a valve therein leading from said upper chamber and having a restricted opening communicating with said valve and with

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a side wall of the tubular member internally of said lower chamber, said liquid in said upper chamber being adapted to be forced by inflation of said inflatable means through said valve and restricted opening so as to flow downwardly of the side wall of the tubular member through which the blood is adapted to flow whereby the fluid will intermingle and mix with the blood as it flows outwardly of said tubular member into the lower chamber and said cooling system having means for directing the mixture of blood and said liquid from said upper chamber through said cooling system and means connected with the perforation in the lower wall of the cylindrical housing through which said cooled mixture of blood and liquid is adapted to be directed.

4. In an apparatus of the character described, the combination of a casing having an intermediate wall portion dividing it into an upper and lower chamber, a cooling system carried by said casing and operatively associated with the lower chamber, said upper chamber being adapted to receive a liquid and having inflatable and deflatable means internally thereof and to lie within said liquid, means for directing another liquid into said lower chamber, means in the intermediate wall portion for directing controlled amounts of fluid from said upper chamber into said lower chamber at a controlled rate of flow as effected by the expansion or contraction of said inflatable and deflatable means in said upper chamber to intermingle and mix with the other liquid directed into said lower chamber and means for permitting said mixture of fluids to flow through said cooling system.

5. In an apparatus of the character described, the combination of means for mixing an ACD solution with blood directly extracted from a donor and means for cooling said mixture to aid in the preservation of said blood, said means for mixing the ACD solution with the blood comprising a hollow casing having an intermediate inner wall portion dividing said casing into an upper and lower chamber, an upper perforated wall having a tubular member extending therethrough and in sealed relation therewith, said tubular member extending through said intermediate wall and having an end portion terminating in the lower chamber, said tubular member being adapted to be connected with a hose line carrying a hollow needle adapted to direct blood from a donor through said tubular member, an ACD solution in said upper chamber, valve means in said intermediate wall for permitting a controlled amount of said ACD solution to pass from said upper chamber into said lower chamber to intermingle and mix with the blood in said lower chamber as effected by varying the pressure on the ACD solution internally of said upper chamber for increasing or decreasing its flow through the valve means and cooling means having a passageway connected with the lower chamber through which said mixed blood and ACD solution may pass to be cooled by said cooling means.

6. In an apparatus of the character described, the combination of means for mixing an ACD solution with blood directly extracted from a donor and means for cooling said mixture to aid in the preservation of said blood, said means for mixing the ACD solution with the blood comprising a hollow casing having an intermediate inner wall portion dividing said casing into an upper and lower chamber, an upper perforated wall having a tubular member extending there-through and in sealed relation therewith, said

tubular member extending through said intermediate wall and having an end portion terminating in the lower chamber, said tubular member being adapted to be connected with a hose line carrying a hollow needle adapted to direct blood from a donor through said tubular member, an ACD solution in said upper chamber, valve means in said intermediate wall for permitting a controlled amount of said ACD solution to pass from said upper chamber into said lower chamber to intermingle and mix with the blood in said lower chamber as effected by varying the pressure on the ACD solution internally of said upper chamber for increasing or decreasing its flow through the valve means, and cooling means for receiving said mixed blood and ACD solution for cooling the same, said cooling means comprising a cylindrical housing secured in sealed relation with the lower end of the casing and having an inner tubular member of smaller diameter secured to the casing and having a passageway communicating with the lower chamber and through which the mixture of blood and ACD solution is free to flow, said inner tubular member having spiral cooling fins thereon intermediate said tubular member and the inner side wall of the cylindrical housing about which a cooling liquid is adapted to be flowed and means in the inner tubular member communicating with the passageway for increasing the path of flow of the mixed blood and ACD solution in a direction longitudinally of said inner tubular member to be chilled by said cooling liquid

7. In an apparatus of the character described, the combination of two separate chambers, tubular means for directing the flow of a first fluid into one of said chambers, said tubular means terminating in said one chamber above the bottom thereof, sealed expandable and collapsible means in the other of said chambers adapted to lie within a second fluid of different characteristics placed in said other chamber, and means separating said chambers and having a passage-

way therein for directing the flow of said second fluid from said chamber having the expandable and collapsible means therein to an outer side wall of said tubular member through which the first-mentioned fluid is directed into said one chamber, whereby said fluids will intermingle and mix with each other before reaching the bottom of said one chamber.

8. In an apparatus of the character described, the combination of a casing having an intermediate wall portion dividing it into an upper and lower chamber, a cooling system carried by said casing and operatively associated with the lower chamber, said upper chamber being adapted to receive a liquid and having inflatable and deflatable means internally thereof and to lie within said liquid, means for directing another liquid into said lower chamber, adjustable valve means in the intermediate wall portion for directing controlled amounts of fluid from said upper chamber into said lower chamber at a controlled rate of flow as effected by the expansion or contraction of said inflatable and deflatable means in said upper chamber and as controlled by the adjustment of said valve means to permit the liquid in the upper chamber to intermingle and mix with the other liquid directed into said lower chamber and means for permitting said mixture of fluids to flow through said cooling system and to be directed into a detachable container carried by said cooling system.

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