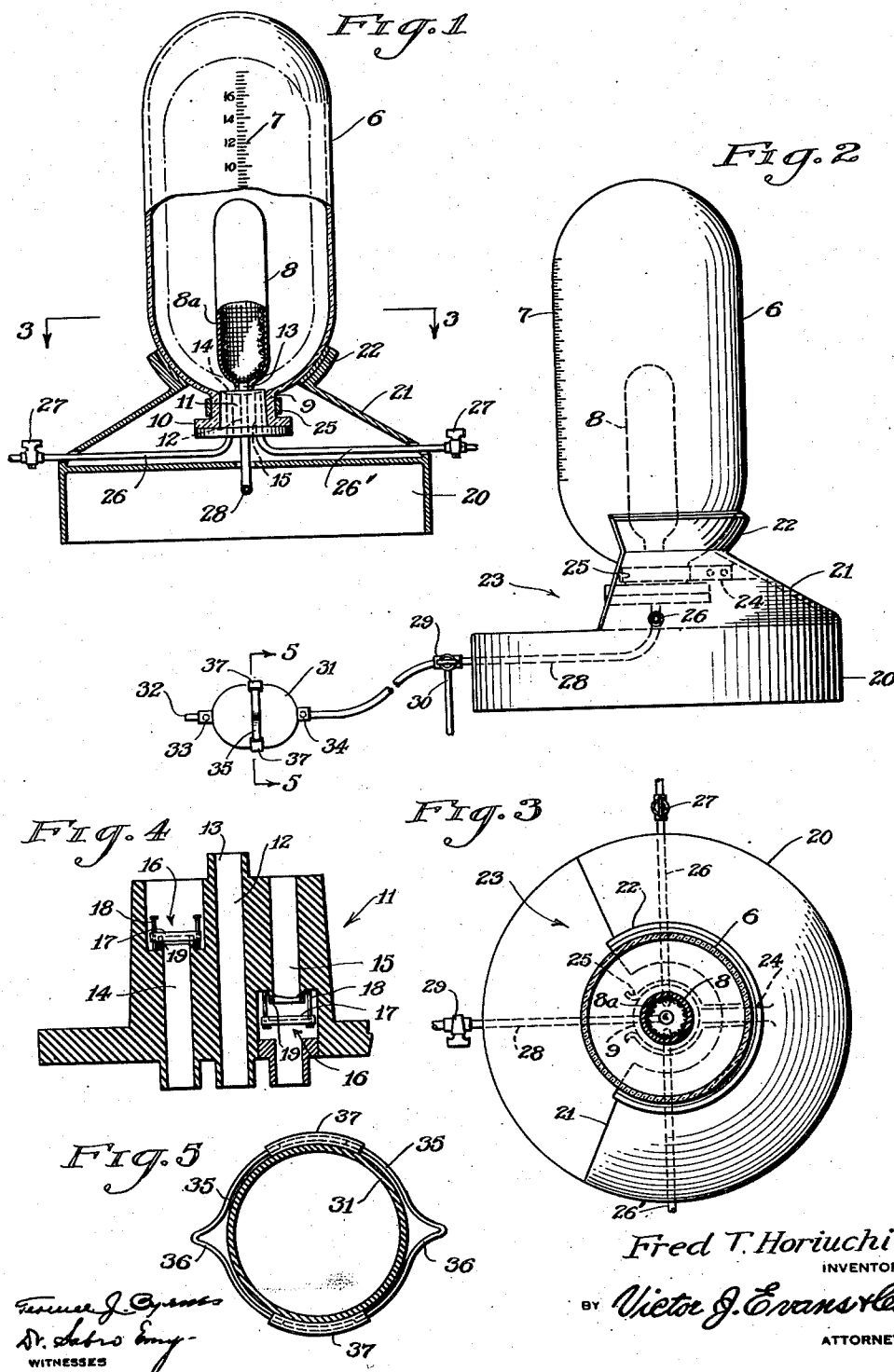


March 16, 1937.

F. T. HORIUCHI
BLOOD TRANSFUSION APPARATUS
Filed Nov. 5, 1935

2,074,223



UNITED STATES PATENT OFFICE

2,074,223

BLOOD TRANSFUSION APPARATUS

Fred T. Horiuchi, New York, N. Y.

Application November 5, 1935, Serial No. 48,371

5 Claims. (Cl. 128—214)

This invention relates to surgical or laboratory apparatus and more particularly to apparatus of this character used during blood transfusion operations.

One of the objects of my invention is to provide an apparatus particularly adapted for blood transfusion operations in which a receiver vessel is employed for the storage of the blood between stages of the operation, the receiver vessel being provided with novel means for inducing a readily controllable vacuum within the vessel whereby to effect the drawing in or suction of the blood to within the vessel.

Another object of my invention is to provide a receiver vessel including means for creating a vacuum within the vessel, the same means being adapted to generate a pressure within the vessel so as to cause the contents of same to be forced out of the vessel into suitable piping provided for the purpose.

Briefly stated, my invention resides in the provision of expansible and contractible means, such, for example, as a rubber globular member within a vessel, which means, being subjected to a supply of air under pressure, will be caused to expand or inflate in the vessel and thereby displace the air or other matter in the vessel, and inversely as the air within the bulb is discharged the same will contract or deflate of its own elasticity thus to effect the induction of a vacuum within the vessel.

One of the features of my invention resides in the high sensitivity with which my device may function in drawing in the blood or ejecting same so as to facilitate the control of the vacuum or pressure within the vessel to an exact degree, thereby rendering the device particularly adapted for the purposes indicated.

The invention will be fully and comprehensively understood from a consideration of the following detailed description when read in connection with the accompanying drawing which forms part of the application, with the understanding, however, that the improvement is capable of extended application and is not confined to the exact showing of the drawing nor to the precise construction described and, therefore, such changes and modifications may be made therein as do not affect the spirit of the invention nor exceed the scope thereof as expressed in the appended claims.

In the drawing:

Fig. 1 is a front elevational view of my apparatus partly broken away in central section.

Fig. 2 is a side elevational view of same.

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

Fig. 4 is an enlarged central vertical section of the vessel stopper shown in Fig. 1, showing my novel check valve arrangement; and

Fig. 5 is a transverse sectional view of the inflator bulb taken on line 5—5 of Fig. 2.

Reference is now had to the accompanying drawing for a more detailed description thereof, in which the numeral 6 indicates the receiver vessel of my blood transfusion apparatus constructed of transparent material, preferably cylindrical in shape, and having hemispherical ends. The vessel 6 is suitably calibrated, as indicated at 7, to indicate the contents of same.

Within the vessel 6 is disposed a closed resilient tube 8 preferably formed of a high elastic rubber, shaped and proportioned in conformity with the interior of the vessel 6. The tube 8 in normal uninflated condition, as shown in full lines in Fig. 1, is of a minimum size appreciably smaller than the interior of the vessel 6 but amply elastic so that upon inflation of the tube 8 same will assume the size and approximate proportion of the vessel 6. In order to fix the minimum size of the tube 8 so that the same may not contract beyond a certain limit during its deflation a reticular structure or suitable framework 8a is provided. In its preferred form the structure 8a embodies a tubular form of woven wire material in conformity to the interior of the tube 8 when the latter is slightly inflated. The member 8a is held in vertical position by having its lower end attached to the nipple 13. The provision of the member 8a will thus limit the contraction of the tube 8 during the deflation of the latter to a definite degree, so that the tube 8 will always have the same minimum displacement and therefore the vessel 6 will always have the same maximum capacity.

The lower end of the vessel 6 is constricted to form a neck 9 turned outwardly at its free end to form a flange 10. Into the neck 9 is suitably secured a flanged stopper 11, in the center of which is formed an air inlet 12 which terminates at its inner end in a nipple 13 to which the lower end of the tube 8 is securely attached. The stopper 11 is also provided with an inlet port 14 thru which blood or other liquid may pass to the interior of the vessel 6. The stopper 11 is also provided with an outlet port 15 thru which the blood or other contents of the vessel 6 may be passed.

The inlet port 14 and the outlet port 15 are each provided with a novel form of check valve 16 suitably arranged to check the flow of the liquid in the opposite direction by closing the port, see Fig. 4. Each of the check valves 16 comprises a slidable disc 17 guided for axial sliding movement on a series of guide rods 18, the ends of which are headed over, which rods pass thru suitable apertures in the periphery of the disc 17. The respective ports 14 and 15 are each extended axially into the corresponding check valve chamber to form a valve seat 19, against

which the valve disc 17 may rest to close the port.

The vessel 6 of my apparatus is suitably supported on a base 20 preferably of hollow circular form, from which extends upwardly a hollow conical structure 21 terminating in a circular flange 22 adapted to snugly receive the lower hemispherical end of the vessel 6. The conical structure 21 surrounds the vessel 6 slightly more than half its periphery so as to provide an opening 23, see Fig. 3, at the front of the apparatus thru which the condition of the stopper 11 and the associated apparatus may be readily observed. The flange 22 is correspondingly interrupted at the front of the apparatus to form an opening thru which the neck 9 of the vessel 6 may be readily passed during the placement of the vessel 6 on the base 20. To assure rigid support for the vessel 6 a bracket 24 is provided, which bracket is supported on a suitable lug extending from the structure 21 and comprises a pair of semi-circular spring clips 25 adapted to surround and securely grip the neck 9.

From each of the ports 14 and 15 of the stopper 11 extend suitable pipes 26, 26' which pass thru apertures in the conical structure 21 and are provided with valves 27. To the air inlet 12 is connected an air pipe 28 into which is fitted a vent valve 29 provided with a vent nozzle 30. The valve 29 is adapted to open or close the pipe line 28 and further to be set so that the pipe line 28 may be closed and vented into the nozzle 30. The pipe 28 proceeds outwardly beyond the vent valve 29, to the end of which pipe is connected suitable air supply means such as the bulb 31. The bulb 31 is provided with an inlet 32 equipped with a check valve 33, the outlet of the bulb 31 also to be equipped with a check valve 34 so that upon contraction of the bulb 31 the air in same will be forced into the pipe 28 and upon subsequent expansion of same air will be drawn into the inlet 32, the check valves 33 and 34 operating accordingly.

To assure the rapid and complete expansion of the bulb 32 I have provided a novel spring means illustrated in detail in Fig. 5. The mentioned spring means comprises a pair of arcuate springs 35, each of which is bent at its middle to a V form 36 to present a more resilient structure at this portion. The respective free ends of the springs 35 are slidably disposed interiorly of a pair of guide tubes 37, which tubes are diametrically opposed and secured to the girth of the bulb 31.

During contraction of the bulb 31 the pressure of the hand is brought to bear on both of the tubes 37 against the force of the springs 35, which springs are thereby caused to flex at their centers 36 while the ends of the springs are caused to slide further into the guide tubes 37 to permit the easy contraction of the bulb 31. Upon release of the latter the springs 35 are permitted to expand to their normal position, thereby urging the guide tubes 37 outwardly, thus to assist the expansion of the bulb 31 to its normal form.

Preparatory to employing my apparatus during a blood transfusion operation the bulb 8 is completely inflated within the vessel 6, thereby displacing the entire air contents within same thru the outlet port 15. The tube 8 is inflated by

supplying air under pressure to the pipe 28 as by operating bulb 31, after which the vent valve 29 is closed. The supply of blood is connected to the inlet pipe 26 and the valve 29 is opened slightly to gradually vent the air within the tube 8 thru the nozzle 30. The contraction of the tube 8 effects the creation of a vacuum within the vessel 6, thus causing the drawing in of the blood, the amount of which is readily determined on the scale 7.

When it is desired to release the blood from the vessel 6 the tube 8 is inflated the desired amount so as to create the required pressure within the vessel 6, thereby forcing the blood contents thru the outlet 15 and its associated pipe 26'.

In cases where the blood is to remain in the vessel 6 an appreciable length of time it is desirable to employ a cooling agent, such as ice water. In such instances the bulb 8 instead of being inflated by air is inflated by the injection of the cooling liquid, which may be introduced by immersing the inlet 32 of the bulb 31 in the liquid, which liquid may be readily decanted thru the vent nozzle 30.

What is claimed as new is:

1. Blood transfusion apparatus comprising a substantially rigid vessel adapted to receive and hold blood and having an opening, a member within said vessel adapted to be inflated and deflated, an inlet and an outlet tube connected into said vessel, a tube connected into said member, a bulb for inflating said member, a pair of guides oppositely connected onto said bulb, and a pair of opposed springs, the ends of which are slidably retained in said guide.

2. Blood transfusion apparatus comprising a substantially rigid vessel adapted to receive and hold blood and having an opening, a member within said vessel adapted to be inflated and deflated, and means for limiting the contraction of said member, said means comprising a reticular structure within said member.

3. Blood transfusion apparatus comprising an hermetically sealed vessel having a constricted neck, an elastic imperforate member within said vessel adapted to be inflated and deflated, and a stopper in said vessel neck having a first port therethru connected into said elastic member and a second port connected into said vessel.

4. Blood transfusion apparatus comprising an hermetically sealed vessel having a constricted neck, an elastic imperforate member within said vessel adapted to be inflated and deflated, a stopper in said vessel neck having a first port therethru connected into said elastic member and a second port connected into said vessel, and a check valve in said second port adapted to be closed by passage of fluid thru said port.

5. Blood transfusion apparatus comprising an hermetically sealed vessel having a constricted neck, an elastic imperforate member within said vessel adapted to be inflated and deflated, a stopper in said vessel neck having a first port therethru connected into said elastic member and a second port connected into said vessel, and a check valve in said second port adapted to be closed by passage of fluid thru said port, said second port having an annular shoulder formed therein, said check valve comprising a slidable disc adapted to seat on said annular shoulder.

FRED T. HORIUCHI.