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APPARATUS FOR SURGICAL USES

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Fig. 1.

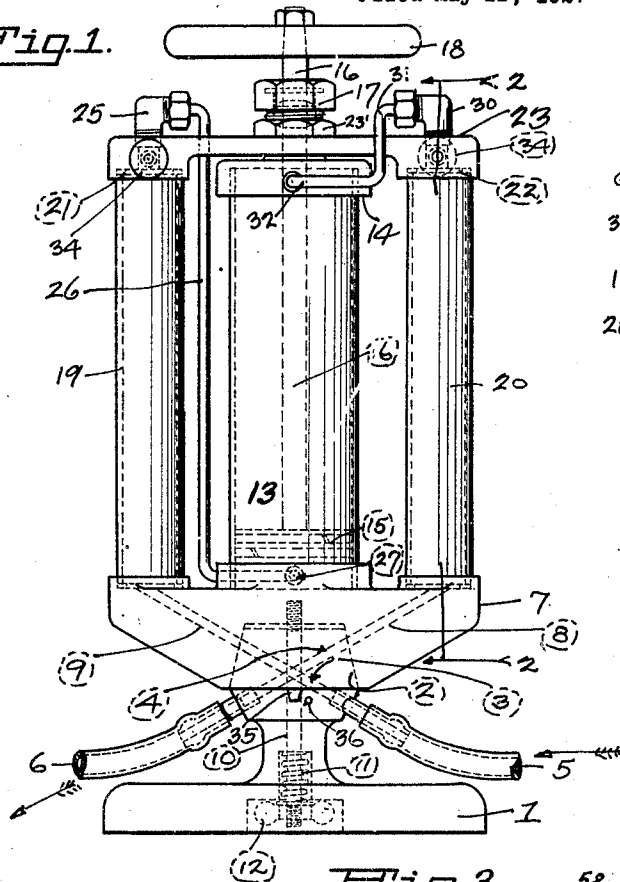


Fig. 2.

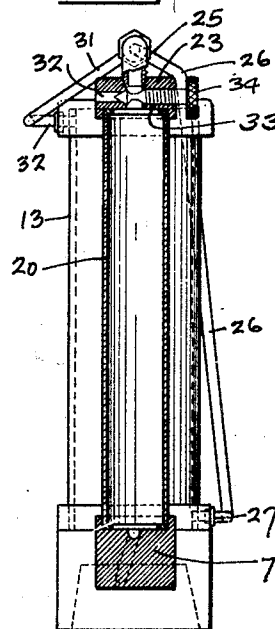
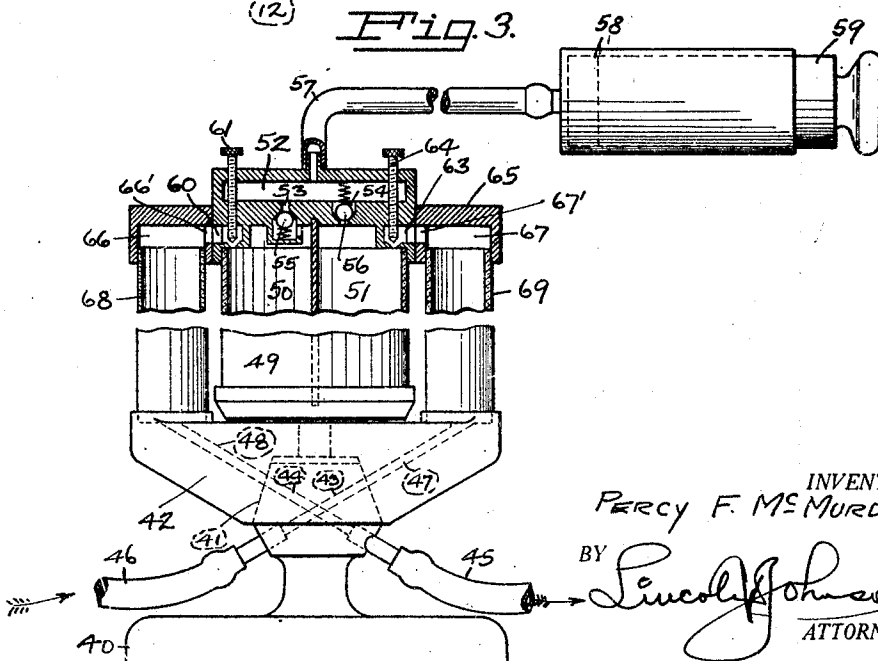


Fig. 3.



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APPARATUS FOR SURGICAL USES.

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This invention relates particularly to an apparatus for surgical uses, particularly adapted for blood transfusion.

5 An object of the invention is to provide an apparatus for blood transfusion in which the blood may be drawn from the source of supply and delivered to its destination in practically an uninterrupted stream.

10 A further object of the invention is to provide a blood transfusing apparatus in which the blood to be transfused is drawn into the apparatus by air suction and delivered from the apparatus by air pressure, to avoid breakage to or damage of the blood cells when delivered to the system of the recipi-

15 ent. Other objects of the invention are to provide a blood transfusing apparatus that may be readily sterilized; an apparatus in which the volume of fluid being delivered may be accurately measured and the rate of flow from the apparatus into the system of the recipient easily controlled; and an apparatus that will be superior in point of simplicity, inexpensiveness of construction, positiveness of operation, and facility and convenience in use and general efficiency.

20 In this specification and the annexed drawings, the invention is illustrated in the form considered to be the best, but it is to be understood that the invention is not limited to such form, because it may be embodied in other forms, and it is also to be understood that in and by the claims following the description, it is desired to cover the invention in whatsoever form it may be embodied.

25 In the accompanying one sheet of drawings

40 Fig. 1 represents a side elevation of a blood transfusing device constructed in accordance with my invention.

Figure 2 is a sectional view taken along the line 2—2 of Figure 1.

45 Fig. 3 is a side elevation, partly broken away, of a modified form of a blood transfusing device constructed in accordance with my invention.

50 In detail, the construction illustrated in the drawings comprises a base 1, on the upper surface of which a tapered bearing 2 is formed, on a substantially vertical axis. The bearing 2 is provided with a pair of independent intersecting passages 3 and 4 therethrough. A tube 5 registers with the

60 cates with the other passage 4. Each of the tubes 5 and 6 is flexible and on the end of the tube a needle (not shown) is attached. The needle on one tube is to be inserted into the system of the individual donating the blood, while the needle on the other tube is to be inserted into the system of the recipient of the blood. The particular form of the needle referred to is immaterial, and the construction thereof does not concern

65 hereinafter described. A table 7 is provided with a tapered recess on the bottom thereof, and said table is rotatably mounted on the tapered bearing 2. The table 7 is provided with a pair of independent passages 8 and 9 arranged therein, on opposite sides thereof, and each of the respective passages 8 and 9 connects one of the ends of the upper face of the table 7 with one or the other of the passages 3 and 4 in the base 2. A stud 10 is secured to the under face of the table 7, and extends through a central hole 4 in the base 2. A spring 11 and thumb nut 12 are provided around the end of the stud 10, within the base 1, to form a tight joint between the table 7 and the bearing 2 on the base 1. Both the base 1 and the table 7 are formed of material which will resist corrosion. The tapered joint between the base 1 and table 7 is tight to prevent the escape of fluid between the registering passages in the base and in the table 7 but free enough to permit the table 7 to be revolved about a vertical axis while the base remains stationary. In order to register the passages 8 and 9 extending through the table and the passages 3 and 4 on the base, I have provided a lug 7 and stationary pins 36 on diametrically opposite sides of the base 2. The pins 36 are so located on the base that when the table lug 35 is engaged with one pin, the passages 3—8 and 4—9 will be in alignment, and when the lug 27 engages the opposite pin the passages 3—9 and 4—8 will be in alignment.

80 A cylinder 13 is secured, centrally, on the upper face of the table 7 and the upper end of said cylinder 13 is closed by a cover 14. A piston 15 is reciprocatingly mounted within the cylinder 13 and a piston rod 16 is secured to the upper face of the piston 15 and extends out through a packing joint bearing 17 formed on the cover 14. A

handle 18 is secured to the end of the piston rod 16 to permit the piston 15 to be manually reciprocated within the cylinder 13.

A pair of glass receptacles 19 and 20 are arranged on each of the opposite ends of the table 7, diametrically opposite each other, and on opposite sides of the cylinder 13. The lower end of each of the tubes 19 and 20 rests on a resilient gasket fitted within each recess in which the tubes 19 and 20 are held, on the upper face of the table 7. The upper end of each of the tubes 19 and 20 is supported in recesses 21 and 22 formed in the opposite ends of a cross bar 23 which extends diametrically across the cover 14 on the cylinder 13, and is there so held in rotatable relation, by the nut 23' which is a part of the piston rod bearing assembly.

An end 25, of a pipe 26, communicates with the recess 21 of the cross bar 23 and hence communicates with the interior of the receptacle 19. The opposite end 27 of said pipe 26 communicates with the bottom of the cylinder 13. One end 30 of a tube 31 communicates with the recess 22 adjacent the upper end of the opposite glass receptacle 20, while the other end 32 of said pipe communicates with the upper end of the cylinder 13. Each of the opposite ends of the cross member 23 are drilled with horizontal holes 33 therethrough, which holes intersect the ports communicating the respective pipes 26 and 31 with the interior of the respective receptacles 19 and 20. A manually operable needle valve 34 is threaded into each of the transverse holes 33, to close off communication between the interior of the receptacles 19 and 20 with the atmosphere.

The apparatus is operated in the following manner. In the position shown in Fig. 1, an upward movement of the piston 15 creates a suction, or less than atmospheric pressure, between the under face of the piston and bottom of the cylinder 13 and a greater than atmospheric pressure between the upper face of the piston and top of the cylinder. The suction below the lower face of the piston causes the air within the receptacle 19 to be evacuated therefrom through the pipe 26, and liquid, or blood from the system of the donor, is drawn through the tube 5 and into the glass receptacle 19, in a selected amount. The liquid is drawn into the glass receptacle 19 as the upward motion of the piston continues. Obviously, when the proper amount of fluid has been drawn into the receptacle 19, the movement of the piston is stopped. During the operation heretofore described, it will have to be assumed that the opposite receptacle 20 has been previously filled with the proper amount of fluid. Hence, the upward movement of the piston creates a pressure

of the air above the piston, and forces said air under pressure through the pipe 31 into the upper part of the fluid receptacle 20 and into contact with the fluid contained therein. The fluid contained in said receptacle 20 is thus forced therefrom outwardly and into the system of the recipient. After the initial operation of the apparatus, the piston is at the upper end of the cylinder 13 and a volume of fluid will have been discharged from the receptacle 20 and a fresh charge of fluid drawn into the receptacle 19. The table 7 would then be rotated about the stationary base to place the receptacle 19, full of fluid, in registry with the passage leading to the system of the recipient, and the receptacle 20, empty of fluid, in registry with the conduit leading to the system of the fluid donor. The piston is then forced downwardly, creating a suction above the piston and in the receptacle 20, thereby drawing a charge of fluid into said receptacle 20 and at the same time the fluid in the receptacle 19 is discharged therefrom into the system of the donor. On the upstroke of the piston, a suction is created below the bottom face thereof and a pressure above the upper face thereof, while on the down stroke of the piston a suction is created above the upper face of the piston and a pressure below the lower face of the piston.

The fluid receptacles 19 and 20 are so connected to the air suction or air pressure generating means that either a suction or pressure may be generated in each of the respective fluid receptacles. In the event that one fluid receptacle is being emptied faster than the other receptacle is being filled, the needle valve 34 on the receptacle that is being emptied the faster would be opened to allow the air pressure to escape to the atmosphere. If the fluid is being drawn into one tube faster than the other tube is being emptied, the needle valve 34 on the tube that is being filled the faster would be opened to allow atmospheric pressure to diminish the partial suction. Thus, where the apparatus is used for blood transfusion purposes, it is possible to simultaneously fill one receptacle of the apparatus with blood and discharge a charge of blood from the other receptacle to the system of the recipient. By alternately rotating the blood containers on the base throughout an arc of 180 degrees, the charging and emptying operation is continued until the desired amount of blood has been drawn from the system of the donor and transmitted to the system of the recipient.

In the modified form of the apparatus shown in Fig. 3, I provide a base 40 having a tapered bearing end 41. A table 42 is rotatably mounted on the bearing end 41 of the base. The base 41 is drilled with trans-

verse passages 43 and 44 therethrough and flexible conduits 45 and 46, each with a needle on the end thereof, are connected to each of the respective passages 43 and 44.

5 The table 42 is provided with passages 47 and 48 therein, each of which may be interchangeably connected with either of the base passages 43 and 44. A casing 49 is fixedly mounted on the base 41 and said casing is
10 divided into an air pressure compartment 50 and a suction compartment 51.

A passage 52 is provided above the respective compartments 50 and 51 and communicates through the respective ports 53
15 and 54 to each of said compartments. An inlet ball check valve 55 is provided in the port 53 to permit a charge of air to be forced into the compartment 50 while an outlet ball
20 check valve 56 is provided in the port 54 to permit air to be sucked from the suction compartment 51. A tube 57 communicates the passage 52 to a cylinder 58 within which a plunger 59 is reciprocatingly mounted.
25 By reciprocating the plunger 59 back and forth within the cylinder 58, the air within the cylinder 58, the tube 57, the passage 52 and the respective compartments 50 and 51 is so displaced that an air pressure is built up in the compartment 50 while the
30 pressure within the compartment 51 is reduced below that of atmospheric air pressure. The pump 59 is not used while blood is being given to or taken from a person but merely between such operations. The air pressure
35 compartment 50 is provided with an outlet 60 thereon and the discharge of air through said outlet is regulated and controlled by a needle valve 61. Similarly, the suction compartment 51 is provided with an inlet 63
40 thereon and the flow of air into the compartment 51 through the inlet is regulated by a needle valve 64.

An annular housing 65 is rotatably mounted around the upper end of the casing
45 49, and said housing is provided with a pair of recesses 66 and 67 therein on diametrically opposite sides thereof which communicate through ports 66' and 67' with the respective outlet and inlet ports 60 and 63, respectively.
50 A fluid receptacle 68, open at its opposite ends, is confined between the recess 66 on one side of the housing 65 and the passage 43 on the rotatable support 42. A similar fluid receptacle 69 is interposed between the recess 67 on the opposite side of the housing
55 65 and the passage 47 in the rotatable member 42. In using the form of apparatus shown in Fig. 3 for blood transfusion purposes, the needle on the end of the tube 46 is inserted into the system of the blood donor, and the less than atmospheric pressure in the compartment 51, as well as in the contiguous blood receptacle, causes
60 blood from the system of the donor to be sucked into the receptacle 69. The speed at

which the blood is drawn into the tube 69 is regulated by adjusting the valve 64 in the compartment 51, whereby it is possible to have the blood drawn into the suction side of the system at the same rate of speed that
70 the blood is discharged from the discharge side of the apparatus. On the initial filling of the receptacle 69, the valve 61 on the discharge side of the system would either be closed or else the needle would not be injected into the system of the blood recipient.
75 As soon as the first receptacle is filled with the desired amount of blood from the donor's system, the filled receptacle on the support 42 is rotated throughout an arc of
80 180 degrees to register the filled receptacle with the discharge outlet on the air pressure side of the apparatus. This rotating movement also registers the empty receptacle with the suction side of the apparatus. Immediately after each of the receptacle are placed
85 in proper registry, the control valves 61 and 64 are opened and discharge of blood from the filled receptacle into the system of the recipient, as well as suction of blood from the system of the donor into the empty receptacle, is simultaneously commenced.
90 The filling and discharging of each blood receptacle is continued until such time as the required amount of blood has been drawn from the donor's system and transmitted to the recipient's system.

In either the preferred or modified form of the invention, shown in Figs. 1 and 3, the blood that is drawn into the receptacle
100 or the blood that is discharged from the receptacle is handled in a delicate and careful manner so that the blood cells are not broken or bruised. The movement of the blood by less than atmospheric, or greater
105 than, atmospheric, air pressure, has no tendency to bruise the blood cells, and at all times in either the filling or discharging operation, the blood travels in a relatively smooth, straight path. In my apparatus I
110 have done away with ball check valves and other contrivances through which blood must pass, and have minimized the possibility of the blood cells being broken up or otherwise disrupted. I have found that
115 blood transfusing apparatuses that move the blood stream by the mechanical force of a piston, or causes the blood stream to move past check valves and the like, the blood cells are broken and damaged. In my apparatus
120 the blood is subjected only to the moving force of air, either greater or less than atmospheric pressure, and the only time that the stream of blood is broken is when the empty and full receptacles are changed
125 in location.

Having thus described this invention, what I claim and desire to secure by Letters Patent is:

1. An apparatus for surgical uses com- 120

prised of a base having a pair of independent passages therethrough; an intake member and a discharge member connected to each of said passages; a pair of independent fluid receptacles rotatably mounted on said base, each fluid receptacle being open to communication with either of the passages in the base; and means to create a less than atmospheric pressure of air in one receptacle to draw a charge of fluid through the intake member into the receptacle and to create an air pressure in the other receptacle to discharge fluid from said receptacle through the discharge member.

2. An apparatus for surgical uses comprised of a base having a pair of independent passages therethrough; an intake member and a discharge member connected to each of said passages; a table rotatably mounted on the base having a pair of independent passages therein each being open to selective communication with either of the passages in the base; a pair of independent fluid receptacles arranged on the table in communication with each of the respective passages therein; and means to create a less than atmospheric pressure of air in one receptacle to draw a charge of fluid through the intake member into the receptacle and to create an air pressure in the other receptacle to discharge fluid from said receptacle through the discharge member.

3. An apparatus for surgical uses comprised of a base having a pair of independent passages therethrough; an intake member and a discharge member connected to each of said passages; a pair of independent fluid receptacles rotatably mounted on said base, each fluid receptacle being open to communication with either of the passages in the base and a pump reciprocatingly mounted adjacent said receptacles to create a less than atmospheric pressure of air in one receptacle to draw a charge of fluid through the intake member into the receptacle and to create an air pressure in the other receptacle to discharge fluid from said receptacle through the discharge member.

4. An apparatus for surgical uses comprised of a base having a pair of independent passages therethrough; an intake member and a discharge member connected to each of said passages; a table rotatably mounted on the base having a pair of independent passages therein each being open to selective communication with either of the passages in the base; a pair of independent fluid receptacles arranged on the table in communication with each of the respective passages therein; and a pump reciprocatingly mounted adjacent said receptacles to create a less than atmospheric pressure of air in one receptacle to draw a charge of fluid through the intake member into the receptacle and to create an air pres-

sure in the other receptacle to discharge fluid from said receptacle through the discharge member.

5. An apparatus for surgical uses comprised of a base having a pair of independent passages therethrough; an intake member and a discharge member connected to each of said passages; a pair of independent fluid receptacles rotatably mounted on said base, each fluid receptacle being open to communication with either of the passages in the base; means to create a less than atmospheric pressure of air in one receptacle to draw a charge of fluid through the intake member into the receptacle and to create an air pressure in the other receptacle to discharge fluid from said receptacle through the discharge member; and means to control the flow of fluid into and from each of the receptacles.

6. An apparatus for surgical uses comprised of a base having a pair of independent passages therethrough; an intake member and a discharge member connected to each of said passages; a table rotatably mounted on the base having a pair of independent passages therein each being open to selective communication with either of the passages in the base; a pair of independent fluid receptacles arranged on the table in communication with each of the respective passages therein; means to create a less than atmospheric pressure of air in one receptacle to draw a charge of fluid through the intake member into the receptacle and to create an air pressure in the other receptacle to discharge fluid from said receptacle through the discharge member; and means to control the flow of fluid into and from each of the receptacles.

7. An apparatus for surgical uses comprised of a base having a pair of independent passages therethrough; an intake member and a discharge member connected to each of said passages; a pair of independent fluid receptacles rotatably mounted on said base, each fluid receptacle being open to communication with either of the passages in the base; a pump reciprocatingly mounted adjacent said receptacles to create a less than atmospheric pressure of air in one receptacle to draw a charge of fluid through the intake member into the receptacle and to create an air pressure in the other receptacle to discharge fluid from said receptacle through the discharge member; and means to control the flow of fluid into and from each of the receptacles.

8. An apparatus for surgical uses comprised of a base having a pair of independent passages therethrough; an intake member and a discharge member connected to each of said passages; a table rotatably mounted on the base having a pair of independent passages therein each being open

to selective communication with either of the passages in the base; a pair of independent fluid receptacles arranged on the table in communication with each of the respective passages therein; a pump reciprocatingly mounted adjacent said receptacles to create a less than atmospheric pressure of air in one receptacle to draw a charge of fluid through the intake member into the receptacle and to create an air pressure in the other receptacle to discharge fluid from said receptacle through the discharge member; and means to control the flow of fluid into and from each of the receptacles.

15 9. An apparatus for pumping fluids comprised of a base, having a pair of independent passages therein; inlet and outlet pipes connected to each of said passages; a pair of separate fluid receptacles rotatably mounted on the base adapted to be interchangeably connected with the pair of passages in the base; a reciprocating pump, and means to connect opposite ends of said pump to each of the fluid receptacles to create a less than atmospheric pressure in one receptacle and a greater than atmospheric pressure in the other receptacle, to suck fluid through the inlet pipe into the receptacle having the less than atmospheric air pressure and to discharge fluid through the outlet pipe from

the receptacle having the greater than atmospheric air pressure therein.

10. An apparatus for pumping fluids comprised of a base having a pair of independent passages therein; inlet and outlet pipes connected to each of said passages; a pair of separate fluid receptacles rotatably mounted on the base adapted to be interchangeably connected with the pair of passages in the base; a reciprocating pump; means to connect opposite ends of said pump to each of the fluid receptacles to create a less than atmospheric pressure in one receptacle and a greater than atmospheric pressure in the other receptacle, to suck fluid through the inlet pipe into the receptacle having the less than atmospheric air pressure and to discharge fluid through the outlet pipe from the receptacle having the greater than atmospheric air pressure therein; and means interposed between the respective receptacles and pump to control the greater or less than atmospheric air pressure in each of said receptacles to regulate the speed at which fluid will be drawn into or discharged from the respective receptacles.

In testimony whereof, have hereunto set hand at San Francisco, California, this 23 day of April, 1927.

PERCY F. McMURDO.