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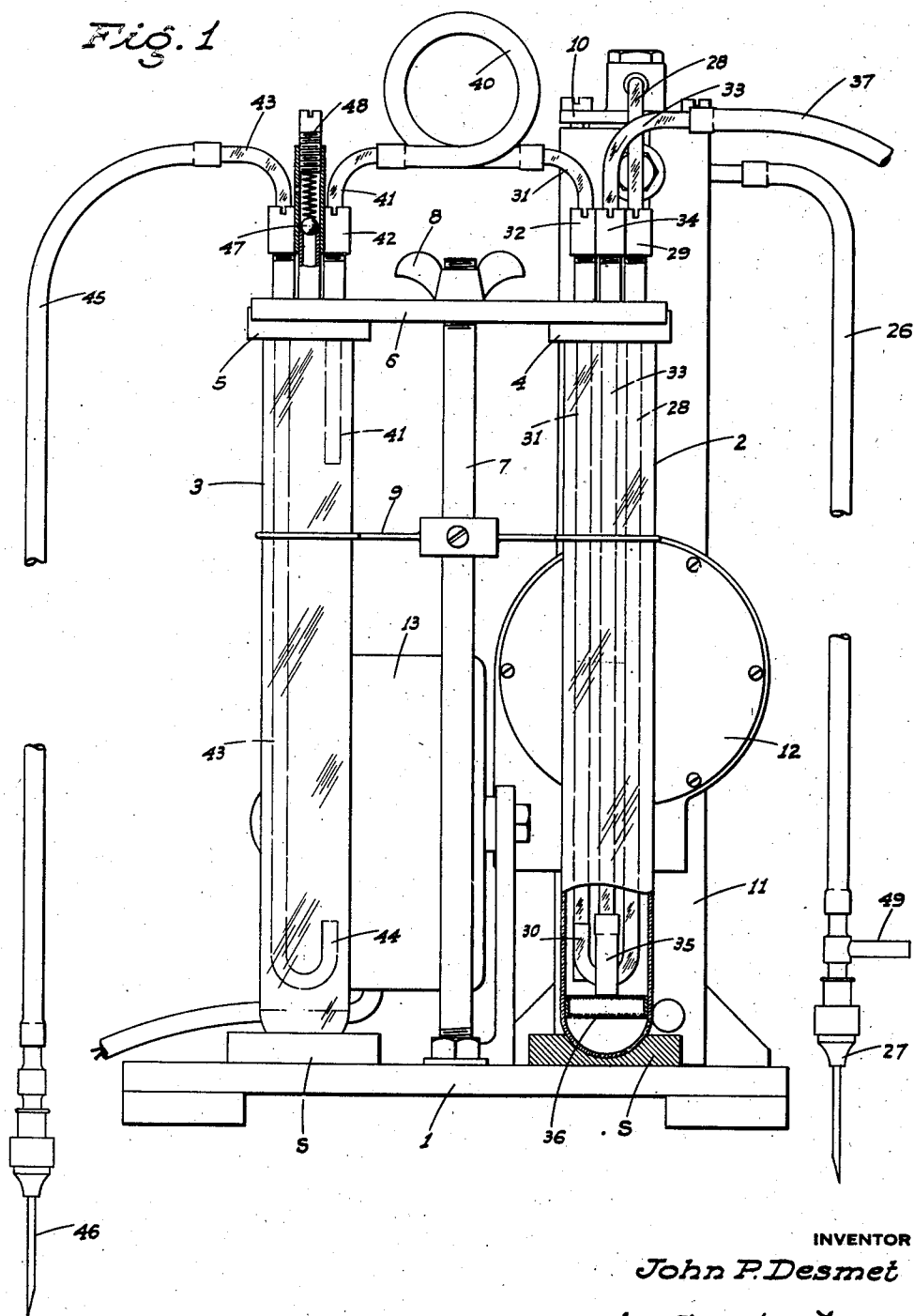
2,406,207

BLOOD TREATING DEVICE

Filed Oct. 4, 1944

2 Sheets-Sheet 1

Fig. 1



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Fig. 2

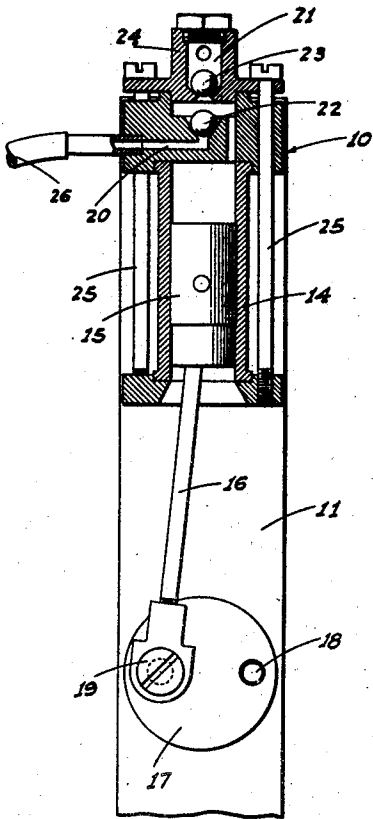
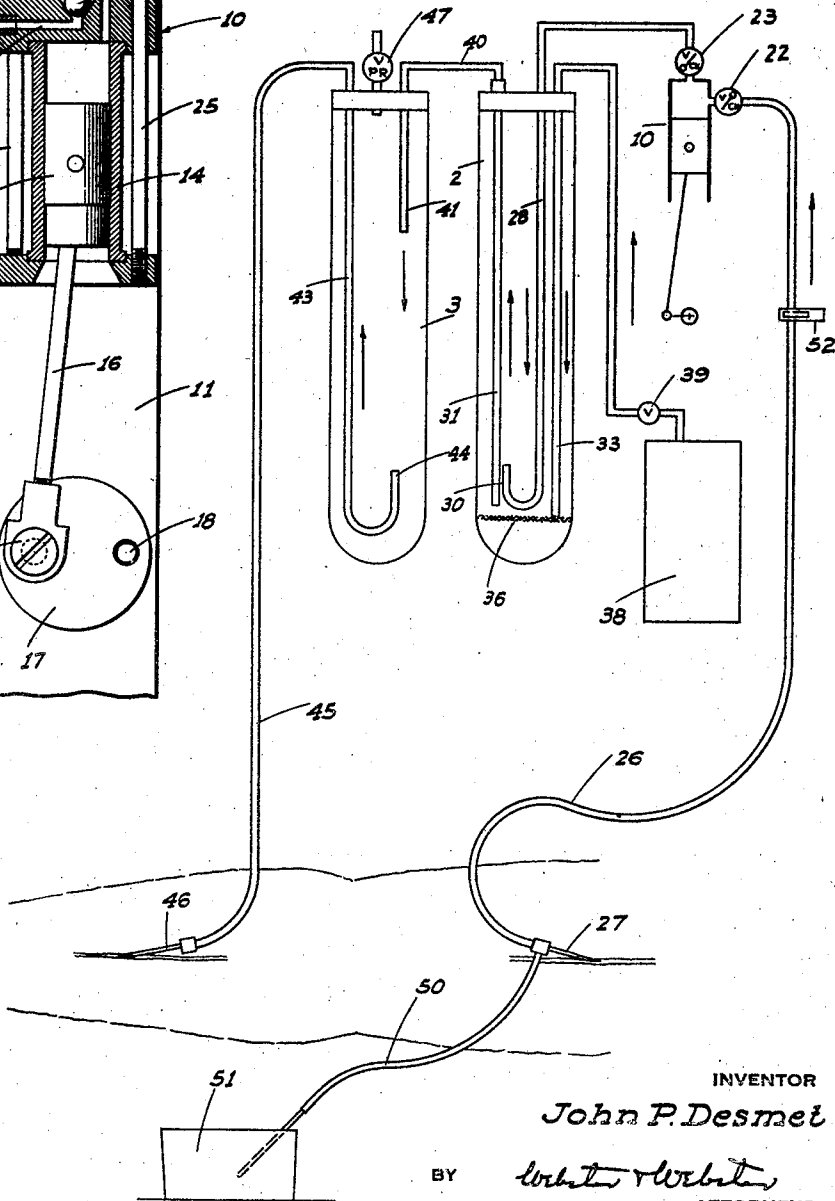


Fig. 3



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BLOOD-TREATING DEVICE

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8 Claims. (Cl. 128-214)

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This invention relates to, and it is an object to provide, a novel method of blood treatment and a unique device for practicing such method; such method contemplating the withdrawal of blood from a patient, treating such blood while withdrawn, for the purpose of revitalizing the same, and then returning the treated blood to the circulatory system of the patient. The blood revitalizing treatment preferably comprises the oxygenation of the blood by the introduction of oxygen thereinto, although other treatments may be used, as for example the use of ozone as the treating medium.

An additional object of this invention is to provide a blood treating device as above which comprises means including a pump to withdraw the blood from the circulatory system of the patient, a chamber into which the withdrawn blood is introduced, together with a quantity of pure oxygen or the like, another chamber into which the treated blood is fed for defoaming and pressure regulation, and means to reintroduce the treated blood from said other chamber into the patient's circulatory system.

A further object of the invention is to provide a device of the character described which is so constructed as to be very safe in operation, and to maintain the blood against contamination during the treating process.

An additional object of the invention is to construct the device so that it can be readily dismantled for cleaning and sterilization.

A further object of the invention is to produce a simple and inexpensive blood treating method and 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 drawings similar characters of reference indicate corresponding parts in the several views.

Figure 1 is an elevation of the blood withdrawing and treating device.

Figure 2 is a fragmentary elevation, mainly in section, of the pulsator.

Figure 3 is a diagrammatic view of the device as in use.

Referring now more particularly to the characters of reference on the drawings, the device, which is readily portable, comprises a horizontal base 1 on which a pair of vertically elongated, upstanding receptacles 2 and 3 are mounted; such receptacles being of glass and in generally the form of a test tube. The receptacles are closed at

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their lower end and such ends engage in seat blocks S mounted on the base 1. Although initially open at their upper ends the receptacles 2 and 3 are normally closed at said ends by means of heads 4 and 5, respectively, fixed in connection with a cross-bar 6. A post 7, threaded on its upper end, projects upwardly from the base and through the bar. A wing nut 8 on said threaded portion of the post 7 engages against cross bar 6 and maintains the heads 4 and 5 firmly against the upper ends of the receptacles 2 and 3; there being suitable gaskets (not shown) between the heads 4 and 5 and said receptacles. To prevent tipping of the receptacles 2 and 3 when the heads 4 and 5 are removed, I provide holders 9 which extend in opposite directions from the post 7 intermediate its ends.

The receptacle 2 forms a blood receiving and oxygenating chamber, while the receptacle 3 forms a defoaming and pressure stabilizing chamber, as will hereinafter appear.

A pump, indicated generally at 10, is mounted on a bracket 11 which upstands from the base 1 to one side of the receptacle 2; such pump being driven at relatively slow speed through the medium of a reduction gear box 12 driven from an electric motor 13 mounted on the base 1.

The pump 10 comprises, as is shown in detail in Fig. 2, a reciprocating type pump, which includes a cylinder 14, a piston 15, and a connecting rod 16 attached at its lower end to a crank disc 17 driven from the gear box 12. The connecting rod 16 is arranged for connection to the crank disc 17 at different distances from the axis of the latter whereby to vary the stroke and consequently the pumping volume of the pump. This is accomplished by providing a plurality of tapped bores 18 at different distances from the axis of the crank disc 17, and into which bores the securing screw 19 of the rod 16 may be selectively engaged.

The pump 10 includes, in addition, an intake passage 20 and an outlet passage 21; the passage 20 including a check valve 22 closing away from the pump, while the passage 21 includes a check valve 23 closing toward the pump.

A head assembly, indicated generally at 24, is removably mounted in connection with the cylinder 14 by means of tie bolts 25; such head assembly 24 carrying the passage and check valve arrangement and being readily removable from the pump, as is evident.

A flexible intake conduit 26 is fitted at one end with a transfusion type needle 27, and said flexible conduit connects, at its other end, with the passage 20.

The outlet passage 21 of the pump is connected with a relatively small diameter glass tube 28 which leads through a packing gland 29 on head 4 into the receptacle 2 as an inlet; such tube 28 extending downwardly in the receptacle to a point adjacent but short of the bottom of the latter and is there formed with an upturned discharge gooseneck 30. Another relatively small diameter glass tube 31 extends into the receptacle 2 from exteriorly thereof through a packing gland 32; said tube 31 being of substantial length and vertically adjustable through the gland 32. The tube 31 forms the outlet from the receptacle 2, and when in its lowermost position of adjustment terminates at its lower end adjacent but short of the bottom of said receptacle 2.

A third glass tube 33 leads into the receptacle 2 through a packing gland 34, and said tube 33 extends downwardly in receptacle 2 through a packing gland 34 to adjacent the gooseneck 30 and is there fitted with a rubber nipple or sleeve 35 which seats against a filter screen 36 frictionally engaged in receptacle 2 adjacent the bottom thereof but below the lower end portions of tubes 28 and 31. Above the packing gland 34 the tube 32 is connected with a flexible conduit 37 which leads to an oxygen tank or the like, indicated diagrammatically at 38; there being a control valve 39 in the conduit 37 at a convenient point.

Above the packing gland 32 the outlet tube 31 is connected to a flexible conduit 40 which is of sufficient length to permit of vertical adjustment of said tube 31; the flexible conduit 40 connecting at its other end with the upper end of a relatively small diameter glass inlet tube 41 which leads through a packing gland 42 into the upper end portion of the receptacle 3. A still further, relatively small-diameter, glass tube 43 extends into the receptacle 3 to a point adjacent but short of the lower end thereof, where said tube 43 is formed with an upwardly opening gooseneck 44. The tube 43 is the final outlet from the device and is connected with a flexible conduit 45, on the outer end of which is fitted a transfusion type needle 46.

An adjustable check valve 47 is mounted on the head 5 and is in communication with the interior of the receptacle 3, such check valve opening away from said receptacle and including an adjustment screw 48 whereby the pressure in said receptacle may be regulated as desired.

In use of the above described device, the needle 27 is introduced into the artery of the patient and the pump 10 is started. This withdraws blood from such artery through the flexible conduit 26 to the pump 10 and thence into the inlet tube 28. In order to prevent coagulation of the blood the needle 27 is of the type which includes a lateral fitting 49 adapted to be connected with a feed conduit 50 whose outer end is disposed in a receptacle 51 filled with a saline solution. It will thus be evident that as suction occurs in the flexible conduit 26 a certain amount of the saline solution will be drawn through conduit 50 into the blood flowing in said conduit 26. A clamp 52 on conduit 26 is employed to shut off the flow therein when necessary.

As the blood is pumped by the pump 10 into the inlet tube 28 such blood discharges from the gooseneck 30 into the interior of said receptacle; such interior being the blood receiving and oxygenating chamber, as previously stated.

As the blood flows into the receiving and oxy-

genating chamber, oxygen is fed from tank 38 through conduit 37 and tube 33 into the receptacle 2; the screen 36 assuring against the introduction of any foreign matter. This oxygen bubbles upwardly through the blood in the receptacle 2, effectively oxygenating said blood and revitalizing the same.

From the receptacle 2 the oxygenated blood, which tends to be in a somewhat foamy condition, flows upwardly through conduit 40 and is discharged into the receptacle 3 through the inlet tube 41. The position of vertical adjustment of the outlet 31 will control the amount of blood held in the receptacle 2, and consequently the amount of blood withdrawn at any one time from the patient's circulatory system.

As the blood discharges from inlet tube 42 into the receptacle 3 it tends to settle or defoam, and in addition the check valve 47 is set to regulate the pressure at which it is desired to return the oxygenated blood to the patient. As the blood defoams in the receptacle 3 it flows into the gooseneck 41 and out through the tube 43 to the flexible conduit 45 which feeds the needle 46 which has previously been introduced into a vein of the patient.

Operation of the device is continuous, and the blood oxygenating process is relatively rapid; the amount of blood withdrawn, its rate of flow, etc., being effectively regulated through the medium of adjustable elements of the device, as previously described.

With my improved system of blood treatment, the blood is purified and aerated, and the blood cells are materially revived by the introduction of oxygen or other similar gas into the blood. The method is especially beneficial in the treatment of blood diseases and for emergency use in shock and asphyxiation cases; the blood acting as a carrier of oxygen, and which oxygen produces the desired beneficial results.

Since the oxygen first discharges through the screen 36 and then comes from the under side thereof back through the screen in diffused relation, it becomes thoroughly mixed with the blood.

When the oxygenization operation is concluded the valves in the pump line are closed. The pressure of the oxygen then continues to expel all the remaining blood from the apparatus and into the circulatory system of the patient.

My method and apparatus can also be effectively used in the liquification and oxygenization of dry blood for purposes of transfusion in cases of shock and the like, if plasma is not available, or in cases of anemia when deficiency of red blood corpuscles is involved.

From the foregoing description it will be readily seen that I have produced such a method and 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 method and 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. A blood treating device comprising a pump having an intake and an outlet, a flexible conduit connected at one end to the pump intake and having a transfusion needle on the other end, a receptacle forming an enclosed chamber, a conduit leading from the pump outlet to the chamber,

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means to introduce a gas into the chamber, another flexible conduit having a transfusion needle on its outer end, and means connecting said chamber and other conduit in communication; said last named means including another receptacle forming an enclosed blood-defoaming chamber, and a pressure regulating valve in communication with said other receptacle.

2. A device as in claim 1 in which both of said receptacles are of glass to permit visual determination of the quantity of blood therein.

3. A blood treating device comprising a pair of vertically elongated receptacles, three rigid tubes projecting into one of the receptacles from above, a pump having an intake and an outlet, a flexible conduit connected at one end to the pump intake and having a transfusion needle at the other end, means connecting one of said tubes in connection with the pump outlet, a source of gas under pressure, means connecting the second of said tubes in valved communication with said source, two rigid tubes projecting into the other receptacle from above, means connecting the third tube of said one receptacle in communication with one tube of said other receptacle, another flexible conduit connected at one end in communication with the second tube and said other receptacle, and a transfusion needle on the end of said other flexible conduit.

4. A device as in claim 3 in which said one receptacle includes a filter therein adjacent its lower end; said second tube of said one receptacle extending downward therein to adjacent the filter and having a resilient sleeve thereon projecting into contact with the filter.

5. A blood treating device comprising a pair of vertically elongated receptacles, three rigid tubes projecting into one of the receptacles from above, a pump having an intake and an outlet, a flexible conduit connected at one end to the pump intake and having a transfusion needle at the other end, means connecting one of said tubes in connection with the pump outlet, a source of gas under pressure, means connecting the second of said tubes in valved communication with said source, two rigid tubes projecting into the other receptacle from above, means connecting the third tube of said one receptacle in communication with one tube of said other receptacle, another flexible conduit connected at one end in communication with the second tube and said other re-

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ceptacle, and a transfusion needle on the end of said other flexible conduit; there being an adjustable pressure regulating valve in communication with said other receptacle.

6. A blood treating device comprising a pair of vertically elongated receptacles, three rigid tubes projecting into one of the receptacles from above, a pump having an intake and an outlet, a flexible conduit connected at one end to the pump intake and having a transfusion needle at the other end, means connecting one of said tubes in connection with the pump outlet, a source of gas under pressure, means connecting the second of said tubes in valved communication with said source, two rigid tubes projecting into the other receptacle from above, means connecting the third tube of said one receptacle in communication with one tube of said other receptacle, another flexible conduit connected at one end in communication with the second tube and said other receptacle, and a transfusion needle on the end of said other flexible conduit; said first and second tubes of said one receptacle terminating adjacent the lower end of the latter, and said third tube being vertically adjustable.

7. A device as in claim 3 including a base, said vertically elongated receptacles upstanding from the base and being initially open at the open end, a removable head closing the upper end of each receptacle, said heads being connected in rigid relation by a cross member, a post upstanding from the base between the receptacles, and securing means between said post and cross member urging the latter in a downward direction.

8. A blood treating device comprising a pump having an intake and an outlet, a conduit connected at one end to the pump intake, a transfusion needle at the other end of such conduit, a receptacle forming an enclosed chamber, a filter extending across the receptacle at a spaced distance from the lower end thereof, a conduit leading from the pump outlet into the receptacle, a source of gas under pressure, a conduit leading from such source into the receptacle and terminating immediately adjacent the filter whereby to discharge through the filter, a conduit leading from the receptacle, and a second transfusion needle in communication with said last named conduit.

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