Sept. 2, 1941. R. A. BUTLAND 2,254,994

TRANSFUSION APPARATUS

Filed Nov. 6, 1939 2 Sheets-Sheet 1

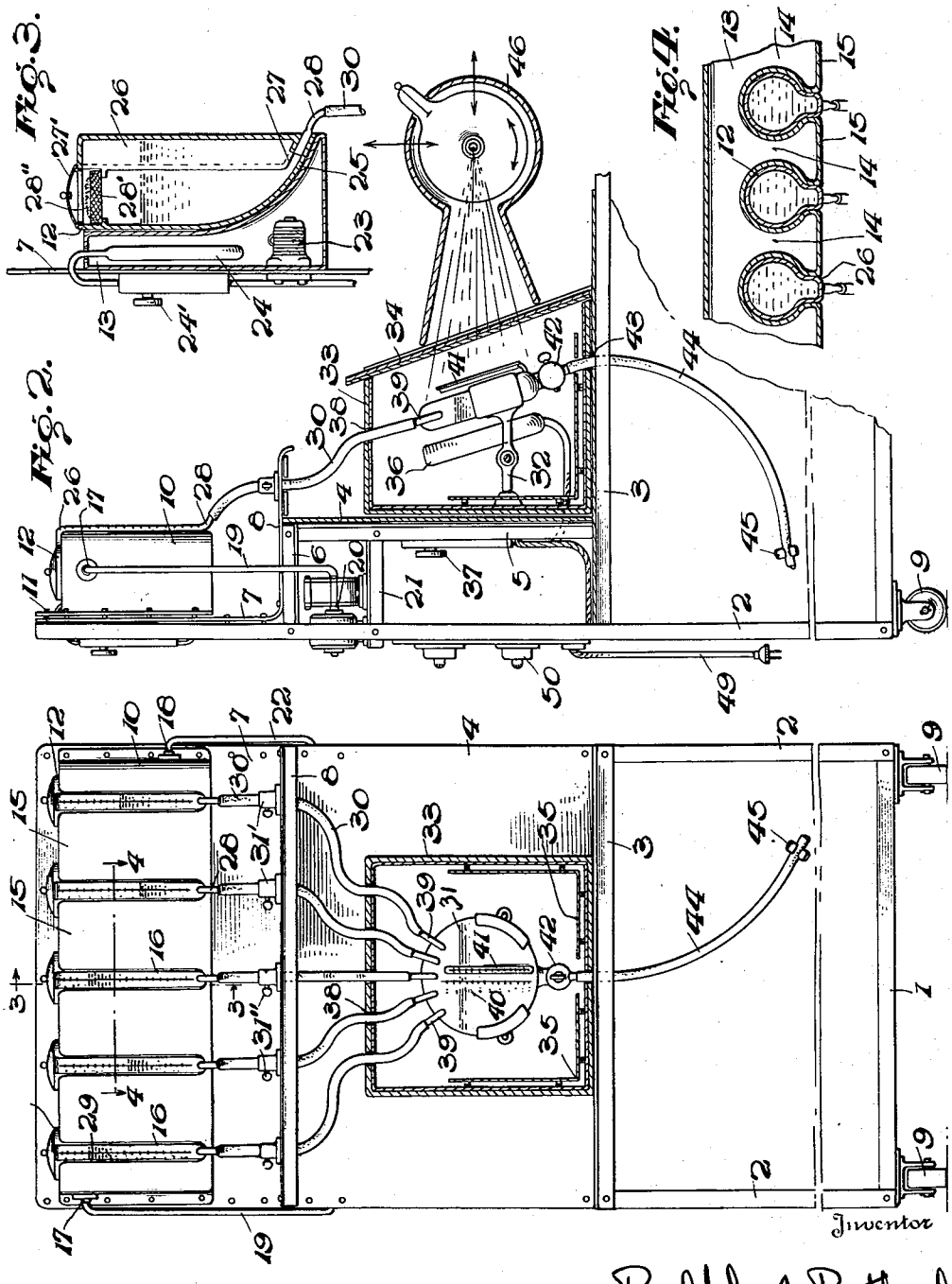

Fig. 1.

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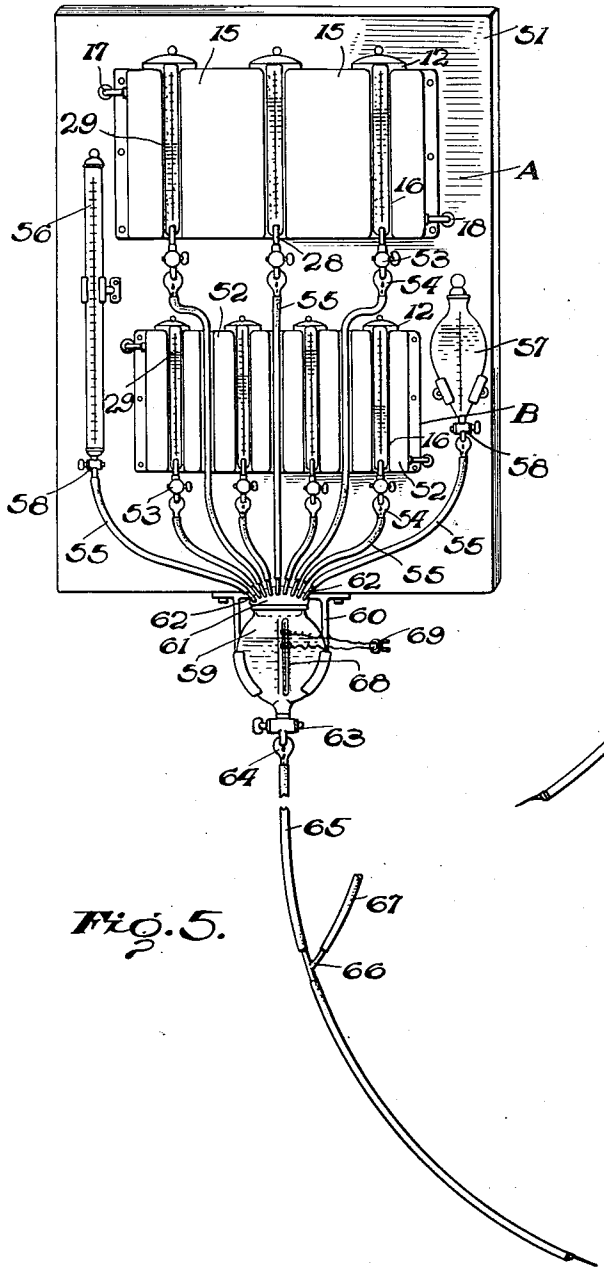


Fig. 5.

Fig. 6.

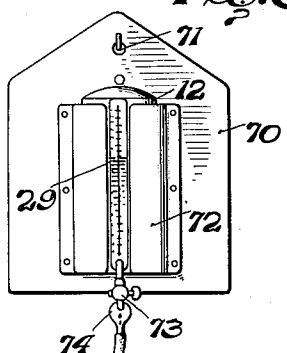
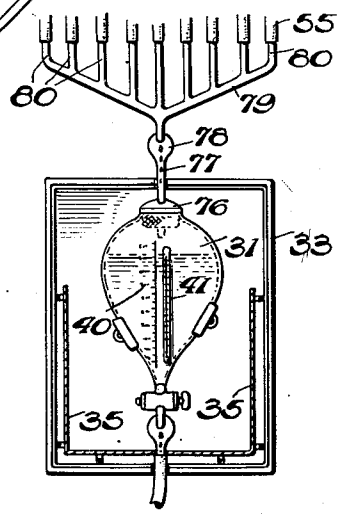


Fig. 7.



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UNITED STATES PATENT OFFICE

2,254,994

TRANSFUSION APPARATUS

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Application November 6, 1939, Serial No. 303,159

3 Claims. (Cl. 128—214)

This invention relates to methods and apparatus for the administration of fluids into the blood stream and for treatment of the fluids while in transit through the apparatus.

In the administration of any fluid into the blood stream, whether the fluid be blood or any other therapeutic addition, it is necessary that the fluid be kept at the proper temperature, and that it flow into the blood stream of the recipient at an accurately controlled rate, and that the desired amount of fluid be introduced. The infusion of fluid into a recipient in too great amounts, at improper temperatures, or at an improper rate will result in serious shock and injury to the patient. It is, therefore, a fundamental object and purpose of my invention to provide in a practical apparatus an arrangement whereby the administration of fluids into the blood stream may be controlled in a relatively simple and efficient manner.

It is becoming increasingly evident in the practice of therapy that diverse malignancies and diseases may be treated with salutary effect by the infusion of therapeutic additions into the blood stream. Such additions may simply consist of citrated blood, or of citrated blood combined with therapeutic additions of various kinds which may be found advantageous, or solely of a therapeutic addition. As the practice of infusing compositions into the blood stream becomes more common in the treatment of a great many malignancies and diseases, it is apparent that the need for practical apparatus affording the attending surgeon complete operative control of the various phases of the administration is pressing.

I am aware that there are now in use various apparatus and methods whereby transfusions of the general type referred to may be administered. However, in many such apparatus pressure means are utilized to urge the fluid into the blood stream of the recipient so that, in a blood transfusion, for instance, the corpuscles of the blood are injured by the pinching action of the compressor. Also, in the apparatus now known to me efficient and automatic means for controlling the temperature of the fluid at all stages of its course through the apparatus are lacking, and even in the simplest transfusion the process of infusion must often be halted to test and ascertain the temperature of the fluid. Furthermore, means are not always provided to permit the attending surgeon to effectively measure and control the quantity of the addition being infused into the blood stream of the recipient. As all such phases of a transfusion require the greatest degree of accuracy if the administration is to be a success, it is, therefore, highly advantageous and desirable to have each of them regulated in a single compact unit for control by the practitioner. I have provided such an apparatus comprising either a mobile or stationary single compact unit where certain of the controls are preferably but not necessarily automatic in their operation and other controls are adapted for manual control and regulation by the attending surgeon, all of such controls being under the direction and inspection of the operator of the apparatus.

The apparatus which I have devised may be used with efficiency and accuracy either in direct or indirect transfusions, and in transfusions of various kinds which are continuous during one or more days' period and which must be controlled with a great degree of accuracy. My apparatus is also adapted for use in the most complex transfusions where any number of therapeutic agents are being infused into the recipient, all of them being under the control and observation of the attending surgeon. The apparatus may, of course, be used in the laboratory for experimental purposes as well as in routine or complex therapy, and presents a new avenue of approach to the solution of many unsolved pathological problems.

The present day external treatment of malignancies by X-ray has produced excellent results, however, it is now believed that such may be successfully treated by and through the infusion of therapeutics into the blood stream of a patient. It is within the scope of my invention to treat such malignancies by the infusion of specially treated therapeutic agents into the blood stream of the recipient. I have combined in my apparatus for cooperation therewith means to treat the blood or other therapeutic agents or radioactive substances, or any combinations thereof which may at the particular time be disposed in my apparatus, with a stream of cathode or other rays in the presence of, near or before electric discharge tubes, high frequency power or high tension discharge tubes, Coolidge tubes, Penetrans tubes, water-cooled tubes, split cathode tubes, X-ray therapeutic tubes, ultra-violet rays, and any and all kinds of rays, ray emanations and the like. It will be clear from the specific description of my invention to follow that the apparatus may be used in such manner as to bombard the fluids contained therein with any of the various types of rays mentioned, or with other desirable rays, or to use my apparatus in the administration of transfusions without the

ray treatment, all being under the control and specific wishes of the attending surgeon. It will be evident that the apparatus of this invention is of such flexible nature that a great diversity of combinations of therapeutic agents may be used, or such different agents may be infused singly, alternately, and in various combinations, the temperature, quantity, relative proportions, rate of infusion, and the control for all such aspects disposed within access for facile regulation by the attending surgeon. The infusion of therapeutic assistants into the blood stream of a patient by such means as I have invented presents a wide field for experimentation in the treatment of a diversity of diseases and malignancies, and it is, therefore, a fundamental object of my invention to provide a compact apparatus for a controlled therapy of this broad type.

It is my purpose to provide an apparatus which may be used in the simplest routine therapy as well as in the most complex therapy. The routine direct blood transfusion, for instance, may be administered by the adaptation of my apparatus to receive the donor's blood and for the addition thereto of an anticoagulant. The apparatus may likewise be adapted with the greatest facility to administer a complex infusion of a variety of therapeutic agents over a relatively long period of time, each and all of which are under the positive control of the attending surgeon.

With the foregoing general objects, features, and results in view, as well as certain others which will be apparent from the following explanation, the invention consists in certain novel features and design, construction, mounting and combination of elements, as will be more fully and particularly referred to and specified hereinafter.

Referring to the accompanying drawings in which similar reference characters refer to corresponding parts throughout the several figures thereof:

Fig. 1 is a front elevation of the preferred form of my invention with a portion thereof shown in section.

Fig. 2 is an end elevation of the preferred form of my invention with a portion thereof shown in section.

Fig. 3 is a section taken on line 3—3 of Fig. 1.

Fig. 4 is a section taken on line 4—4 of Fig. 1.

Fig. 5 is a front elevation of a modified form of my invention.

Fig. 6 is a front elevation of a further embodiment of my invention.

Fig. 7 is a detailed view of a modification of my invention.

In Figs. 1 and 2 of the drawings I have disclosed by way of example and not as a limitation one form of my invention in which the apparatus is shown as a single compact unit mounted upon a mobile stand or framework which comprises a base or platform 1 having vertical supporting legs 2 of any desired number, and a forwardly projecting horizontal shelf 3 mounted on the legs 2 a substantial distance from the lower end thereof. A vertical panel 4 is mounted on vertical supporting members 5 spaced forwardly from the legs 2 and extending upwardly from the shelf 3. Horizontal supports 6 are provided connecting the upper ends of the supporting members 5 with the legs 2. A panel 7 is mounted on the legs 2 and extends therebetween and is formed with an apron portion forming a horizontal shelf 8 mounted on the supports 6. In order to provide a mobile unit the legs 2 may be mounted on casters 9. The framework, panels, and shelves are preferably made of stainless steel or the like metal so that the various parts thereof may be easily cleaned and will stand severe usage. It is to be understood that while I have disclosed the framework upon which the apparatus is supported as being mobile that it may well consist of a stationary framework which may be mounted by various means upon a wall or the like, or in any desired position, and furthermore the arrangement of shelves, panels and the like which I have shown are not to be considered as of a limiting nature, as it is within the scope of my invention to provide various arrangements of shelves, panels, supports and the like adapted to provide the most useful and convenient disposition thereof to suit the particular installation.

A combined container rack and tank unit 10 is disposed transversely of the panel 7 adjacent the top thereof and above the shelf 8, which rack and tank is secured to the panel by any suitable means, such as rivets 11 or the like. The container rack is formed of metal, such as "Monel" metal, and is preferably though not necessarily lined with copper, and is designed to constitute a leakproof casing or tank adapted to receive a heating medium therein, as well as to constitute a rack for receiving one or more containers 12, the temperature of the contents of which is to be controlled. While I have disclosed the combined container rack and tank as receiving a straight row of containers 12 it is within the scope and conception of my invention to provide such a unit which is of circular, semicircular, or of any other advantageous formation. It is to be understood, of course, as hereinbefore pointed out that if a differently shaped container rack and tank is used the panel and framework construction upon which the rack and tank is supported could likewise be altered if necessary to properly support the combined rack and tank. The combined container rack and tank 10 is adapted to receive therein a heating medium which may be either liquid or gaseous and is so constructed as to substantially envelop each of the containers supported therein for transferring heat from the heating medium thereto. The container rack and tank which may be designed to support any number of containers is formed to provide various compartments or portions through which the heating medium is adapted to circulate for transferring heat by convection to the containers and hence to the contents thereof. The container rack and tank 10 comprises a rear transversely disposed compartment 13, the front wall of which is formed to provide transversely spaced curved container receiving and surrounding sections, each of which is curved downwardly and forwardly to provide a larger lower portion which is particularly disclosed in Fig. 3 of the drawings. Between each container receiving section is a channel 14 formed by the walls of the container receiving section and adapted to receive a heating medium to be circulated therethrough. The channels 14 are formed at their forward portions to provide vertically disposed compartments 15 spaced one from the other to provide longitudinal slot-like openings or recesses 16 extending between the vertical walls of the compartments 15. As will be apparent by this particular construction of combined rack and tank I have provided a container supporting and heating arrangement having recesses

therein for receiving the containers whereby each container is substantially encircled by members through which a heating medium flows to insure efficient transfer of heat from the heating medium into the container to accomplish the desired result. As the channels are open to the rear transverse compartment for communication therewith and the vertical forward compartments are open with respect to the channels, it is, therefore, clear that the heating medium disposed within the tank will circulate freely through and into each of the various compartments which constitute the tank structure.

The combined container rack and tank unit 10 which is adapted to receive for circulation therethrough any desired type of heating medium such as oil, is provided with an oil or other heating medium outlet 17 disposed at the upper portion of one end of the tank, and is also provided with an oil inlet 18 disposed at the lower portion of the opposite end of the tank from the aforementioned oil outlet. For removal of warmer oil or heating medium from the upper portion of the tank I provide a pipe 19 opening into the tank at the outlet 17 and secured therein by any suitable means, which pipe 19 extends from the said oil outlet to a motor driven pump unit 20 which is disposed on a shelf 21 mounted on and extending between the legs 2 and the supporting members 5 of the framework. An oil inlet pipe 22 extends from the pump unit to the oil inlet opening in the tank 10 in which it is secured by any suitable means. One or more electric heating elements 23 of any desired type are disposed within the tank 10, preferably adjacent the bottom thereof for immersion within the oil or other heating medium and are connected into any desirable electric circuit for automatic operation through the medium of a bulb type thermostat 24 or any desired type of thermostat, the thermostat disposed to extend into the oil or other heating medium which is within the tank 10. Thermostat setting or adjusting means 24' are disposed on the rear side of the panel 7 for actuation by the operator of the apparatus. It will, therefore, be evident that upon the proper setting of the thermostat the temperature of the oil or other heating medium with which the tank 10 is filled will at all times be automatically controlled by the action of the thermostat which will operate to open or close the electric circuit to the heating elements 23, depending upon the temperature of the hetaing medium within the tank. In order to assure the proper circulation of the heating medium throughout the various compartments which constitute the combined container rack and tank so as to evenly distribute the heating medium relative to the containers 12 supported therein, the motor driven pump unit is operated at any desired periods to withdraw warm oil which has risen to the top of the tank by convection from the upper outlet 17 through the pipe 19 to the pump 20 and through the return line 22 to the lower portion of the tank, thus substituting the cooler oil in the bottom of the tank for warmer oil. While I have disclosed this particular method of controlling, heating, and circulating the oil or other heating medium within the tank it is apparent that any desired method and apparatus may be utilized for this purpose, for instance, if air is being used as the heating medium it may be circulated through the tank 10 and the various compartments thereof by means of a fan or blower, or a liquid heating medium may be agitated to circulate through the tank by means of an impeller or the like, and, it is, therefore, to be understood that I do not intend to limit my invention by the disclosure in the drawings of this particular apparatus for heating, controlling, and circulating the heating medium disposed within the combined container rack and tank.

As hereinbefore explained and pointed out it is essential for the proper and successful administration of blood or of any therapeutic agent into the blood stream that the temperature of the addition or additions thereto be properly and accurately controlled. A further requisite for the proper administration of fluids and combinations of fluids into the blood stream is that the proper amount and proportions of each be infused and that they be transferred at the proper rate. If these requirements are not followed carefully serious consequences to the recipient of the fluid will likely occur. For receiving and storing for indefinite periods blood or therapeutic agents or the like, and for controlling the temperature thereof and the proportions thereof which are being dispensed, I provide a container 12 which may be made of glass or may be constructed of any other desirable material. This container is disclosed in the drawings as constituting a member formed of glass and having a rear wall 25 curving downwardly and forwardly, and the front vertical wall of which is provided with a longitudinally extending forwardly projecting hollow rib 26 extending from the top of the container to a point spaced from the bottom thereof, where the said front wall is bent forwardly at an angle to provide a forwardly projecting lip 27 which is complementary to the rear wall 25 at its lower portion, both of these walls being drawn to provide a forwardly projecting downwardly curved drainage nipple 28 for the dispensing of fluid from the container. While the nipple 28 is not shown as having a stopcock associated therewith it is within the scope of my invention to provide one if desired. Such a stopcock would prevent drainage from the container to allow it with the contents thereof to be portable. Each container 12 is provided with a removable top 27' having a screen 28' seated on shoulders within the container 12 in which gauze or the like material 28'' rests. If necessary the top may have minute openings therein.

The containers 12 are adapted to receive the blood or therapeutic agent therein for retaining at the proper temperature by means of the heating medium which is disposed within the tank 10 for circulation about the containers. The containers have been designed to present a structure aiding in the transfer of heat from the heating medium to the contents thereof. The downwardly and forwardly curved rear wall of the containers produce a narrow or relatively reduced portion to render the transfer of heat to the contents of the container more effective.

The hollow forwardly projecting longitudinally disposed rib 26 is provided with metric calibrations 29 extending from the top to the bottom thereof and adapted for observation and reading by the attending surgeon for determining the amount of fluid being dispensed from within each individual container. Reference particularly to Fig. 1 of the drawings discloses the disposition of a plurality of containers within the combined container rack and tank unit for the measured dispensing and heating of the contents of the

containers. The projecting hollow ribs of each container are adapted to slide into the longitudinal slot-like openings 16 between the compartments 15 of the tank and to lie flush with the front faces of each of these compartments so that the attending surgeon may with the aid of the calibrations on the ribs measure the quantity of fluid removed from each container. It is clear that the containers are so designed that the fluid will, of course, be within the hollow rib as well as within the container bodies themselves. The containers are supported within the combined container rack and tank in engagement with and between the rear transverse compartment 13 and the compartments 15 which retain them against forward movement. Lateral movement is prevented by means of the connecting fins or channels 14. Because of the particular construction it is to be noted that the containers seat on the curved wall of the rear compartment. Thus, I have provided a combined rack and tank which so supports each container that it is substantially enveloped and surrounded by the various compartments through which the heating medium is circulated for heat transfer therefrom to the contents of the containers.

While in the particular embodiment of my invention which I have disclosed in Figs. 1 and 2 of the drawings I have shown a combined rack and tank for holding five containers it is within my conception and clearly within the scope of my invention to provide such a rack and tank which will accommodate any desired number of containers, and, furthermore, while I have disclosed a container of a particular configuration it is to be understood that containers of various shapes and sizes may be utilized, and when such variably shaped containers are used the combined container rack and tank will be shaped to conform thereto.

For dispensing the fluids within the containers I provide rubber tubing 30 which is connected to the nipples 28 and extends downwardly to and through sleeves 31' which are mounted on the shelf 8 which is apertured beneath each sleeve for the passage of the rubber tubing therethrough. The sleeves 31', one of which is provided for each container, have threaded holes therein for receiving screws 31'' having plates or disks on the inner ends thereof for compressing or pinching engagement with the tubing when the screws are turned to thereby pinch the tubing to cut off or retard the flow of fluid from the container 12 and through the tubing. The tubing 30 may consist of double walled rubber hose or of lengths of rubber tubing combined with glass tubing in order to retain the heat of the fluid from the container as it passes therethrough to an element of the apparatus which is about to be described.

A collecting cell or multi-fuser 31 is mounted preferably at an angle on an adjustable bracket 32 which is secured within a suitably lined box-like casing 33 which is mounted upon the horizontal shelf 3. The multi-fuser casing 33 is provided with a series of any desirable number and type of removable filter panels 34 set at an angle and forming the front side of the multi-fuser casing. Suitable means are employed for mounting the panels 34 on the casing. Any desirable number of electrical heating elements 35 are disposed within the multi-fuser casing, the heating elements being automatically energized and de-energized through the action of a thermostat 36 which is shown as one of the capillary bulb type but which may be of any known or desirable form. This thermostat is mounted within and adjacent to the multi-fuser 31 and is connected to a control box 37 which is mounted on the rear side of the panel 4 externally of the casing for control by the attending surgeon. The casing 33 which is mounted upon the shelf 3 at a position forwardly of and disposed below the combined container rack and tank 10, is provided with a plurality of apertures 38 for receiving therethrough the tubing 30 extending from the nipples of the containers. It is to be understood that any number of apertures may be provided, the number depending upon the number of containers which are being used. The rubber tubing extends into the casing 33 for connection with nipples 39 which are formed upon the collecting cell or multi-fuser 31 which is preferably formed of glass, and is preferably, though not necessarily, of heart shape. The number of nipples 39 extending from the multi-fuser is dependent upon the number of tubes 30 extending into the casing 33 for connection with the multi-fuser. It is apparent that the apparatus is endowed with great flexibility as the number of containers may be varied and the number of connections into the multi-fuser may, of course, likewise be varied. Metric calibrations 40 corresponding to those provided on the containers 12 are formed on the front face of the multi-fuser for visibility from an external position with relation to the casing 33. A thermometer 41 is mounted adjacent to the front face of the multi-fuser for visibility from outside the casing. A ground glass nipple providing a stopcock 42 is provided at the lower portion of the multi-fuser for drainage of the contents thereof and an aperture 43 is formed in the casing directly below the outlet 42 for the passage therethrough of rubber tubing 44 which is secured to the nipple 42. A clamp 45 of any desired type may be associated with the rubber tubing 44 at any advantageous position therealong, to control the flow of fluid from the multi-fuser instead of the stopcock 42.

With one or more containers 12 in position within the combined container rack and tank 10 and with the screws or compressors 31'' in released open position to allow the gravity flow of fluid from the containers through the tubing 30 into the collecting cell, and with the stopcock 42 and clamp 45 open it will be apparent that the fluid within the containers 12 will flow therefrom through the multi-fuser and into the tubing 44 for infusion into the blood stream of a patient through a needle which may be attached to the free end of the tubing 44.

In order to retain and control the heat of the fluid within the multi-fuser 31 the thermometer 41 associated therewith permits the attending surgeon to know what the temperature is within the casing 33, and due to the automatic control by means of the thermostat 36 the heating elements 35 will be turned on and off to control the temperature within the container 33 to thereby regulate and retain at the proper temperature the fluid within the multi-fuser 31.

By means of the calibrations which are externally visible on the containers 12 and on the multi-fuser 31 the attending surgeon may by means of the individual compressors 31'' regulate the rate of flow and the proportionate quantity of fluid dispensed from each of the containers 12 into the multi-fuser, and may regulate by means of the stopcock control 42 and clamp 45 and ac-

cording to the calibrations 40 on the multi-fuser the amount and rate of flow of the fluid from within the multi-fuser which flows therefrom to the patient through the tubing 44.

It is often desirable in the treatment of certain malignancies and diseases to combine with the fluids which are being infused into the patient radio-active agents and various other agents which are sensitive to treatment by a stream of rays of various types applied thereto. Means are combined with my apparatus for treatment by electrotherapeutics, employing electrotherapy, radiotherapy or other electrical or ray phenomena variable with the pathological condition of the patient. Reference particularly to Fig. 2 of the drawings discloses one form of such means wherein the numeral 46 designates an adjustable X-ray tube disposed in any suitable manner to project a cathode stream into the casing 33 through the filter panels 34 to thereby bombard and effectively treat the fluid contents of the collecting cell or multi-fuser 31.

As examples of some from among several combinations of irradiable materials and activating rays which may be used in a manner as above described, I present the following—Salvarsan of proper strength and the required milliliters added to a suitable measurement of human blood which has been previously treated with sodium citrate and this treated with a cathode stream from a hard X-ray tube. The stream of cathode rays may be filtered through requisite millimeters of copper, aluminum, or other filter substances. As a further example—to a suitable measurement of sodium chloride and citrated blood may be added the required milliliters of iron and ammonium citrate, and sodium phosphate, and this treated with any of the visible or invisible rays of the spectrum, ranging from the long infra-red rays to the short ultra violet rays.

For connecting the entire apparatus into an electric circuit I provide a plug and electric cable 49 entering the apparatus at any convenient point, and an electrical control board 50 is disclosed mounted on the rear side thereof.

The apparatus as disclosed in Figs. 1 and 2 of the drawings allows great latitude to the surgeon in the controlled and selective administration of fluids to a patient. Each container 12 may, in a relatively complex therapy, hold a different therapeutic composition which is to be infused after mixing in certain proportions and after treatment, into the patient's blood stream. Accurate control of the proportion of fluid drained from each container is accomplished by observation of the scale thereon and by operation of the compressors 31''. Alternate infusions of fluids from separate containers may be administered by controlled drainage from one container at a time. By gravity flow the relative quantities of fluid from each container drains into the multi-fuser for combination therein and treatment if desired by electrotherapy, as, for instance, by means of the X-ray tube 46. Drainage from the multi-fuser to the patient is by gravity and is controlled by the cock 42 and/or by the clamp 45. It is seen that the entire fluid flow is by gravity, which provides sufficient head due to the arrangement and design of the entire apparatus.

In certain cases it may be desirable not to make use of the multi-fuser. In such instances the rubber tubing 30 will not be run into the casing for connection to the multi-fuser but instead will be free to discharge the fluid from a container as and where desired.

With the transfusion apparatus as described the containers may be filled under sterile conditions and all of the connecting media properly attached, whereupon the apparatus may be moved direct to the patient for the infusion, the connecting plug 49 merely being connected into a convenient electric circuit. The infusion then continues under the observation and control of the attending surgeon who merely has to set the thermostatic controls, observe the calibrations and regulate the valves for controlling the rate of flow and the proportionate quantity of fluid draining by gravity from each container and from the multi-fuser.

Another form of my apparatus is disclosed particularly in Fig. 5 of the drawings. In the description of the modifications of my invention the same numerals will be used to designate similar elements of the apparatus to those which have heretofore been described in connection with the preferred embodiment of my invention as disclosed in Figs. 1 and 2 of the drawings. The apparatus as disclosed in Fig. 5 of the drawings is mounted on any desirable stand or framework, such, for instance, as that disclosed in Figs. 1 and 2 of the drawings, and consists of a panel 51 mounted thereon which is adapted to receive the various units of the transfusion apparatus. In this form of my invention I disclose two combined container rack and tank units, namely, the upper unit A and the lower unit B. It is to be understood that a greater number of units of container racks and tanks may be employed if desired to hold any number of containers 12. The combined rack and tank of this embodiment of my invention consists of a rear transverse compartment 13 similar to that which has been described in connection with the preferred form of my invention. The container supporting and enveloping members which are associated, for heating medium transfer, with the rear transverse tank 13 comprise transversely spaced curved container receiving and enveloping sections, the front walls of which are formed as in Fig. 1 to provide vertically disposed compartments 15 spaced apart to provide longitudinal openings 16 for receiving the ribs 26 of the containers which have the usual calibrations 29 thereon. It is apparent, therefore, that the calibrations are visible for observation to indicate the amount of fluid being drained from each container. The containers 12 are preferably, though not necessarily, of the same type as those hereinbefore described, having at their outlet nipples 28 ground glass stopcocks 53 and enlarged glass portions 54 providing a visible area for observation of the passage of fluid therethrough. This arrangement is particularly advantageous in a prolonged transfusion in which the fluid is infused into the patient drop by drop. The dropping of the fluid being visible through the glass enlargement 54. It happens that I have chosen to show in Fig. 5 of the drawings the unit B as constituting the support for four containers while the unit A is only adapted to receive three containers. It is obvious that they may be enlarged to hold more containers or may be made smaller to hold fewer containers. The rack and tank units A and B are adapted to receive either a liquid or gaseous heating medium and to operate on the same principle and by the same apparatus as that which has been disclosed in connection with Figs. 1 and 2 of the drawings.

The lower unit B which is about to be described differs in certain features from the combined

rack and tank of the unit A. In this form of combined container rack and tank the usual rear transverse tank 13 is utilized with which are containers supporting and enveloping members which comprise pairs of oppositely disposed semi-circular arm members 52. Each pair of these members 52 is spaced one from the other to provide an open area or space therebetween. The opposed supporting and heating medium containing arms 52 are spaced apart to provide the usual opening for the longitudinal projecting ribs 26 of the containers which have the usual calibrations 29 thereon. The open areas between the pairs of container enveloping arm elements 52 of the rack and tank provide a space for the passage of rubber or like tubing 55 to extend from the upper unit A through and between the lower unit B. An advantageous characteristic of this construction is provided by this arrangement whereby the tubes 55 carrying the heated fluid from the heated upper containers will pass between the heated pairs of arms 52 in the lower unit B to thereby aid in retaining the proper temperature in the fluid flowing from the containers supported in the unit A. The containers 12 which are supported in the unit B are of similar construction to those hereinbefore described, each having the ground glass stopcock 53 and preferably provided with the enlarged glass portions 54 to which tubing 55 is connected.

I have disclosed various unheated containers attached to the panel 51 such as the burette 56 and the vacuum type thermos bottle 57, each of which is provided with any desirable outlet control means 58 connected with the tubing 55. It is within the scope of my invention to use any number of heated and unheated containers upon the panel 51, the types and number thereof being within the regulation of the attending surgeon.

It is understood, of course, that thermostatic controls and the like are utilized in connection with the units A and B, all as hereinbefore pointed out in connection with the apparatus as disclosed in Figs. 1 and 2.

In this form of my invention I provide a multi-fuser or collecting cell 59 which is preferably of the double walled thermos bottle type and is suspended from the panel 51 by means of a bracket 60 and is provided with a removable ground glass cover 61 having a plurality of nipples or glass entrances 62 extending therefrom for attachment to the rubber tubing 55 which extends from the various containers 12 supported in the units A and B. While I have disclosed a glass stopper or manifold member 61, a rubber stopper or one of any other suitable material may be used. At the lower end of the collecting cell 59 I provide an outlet controlled by a stopcock 63 opening into an enlarged glass portion 64 constituting a portion whereby the dripping of fluid may be visible. Tubing 65 is connected to the enlarged portion 64 and is adapted to extend to a needle or the like implement for infusing the fluid into the recipient. A glass Y fitting 66 may be incorporated in the tube 65 for receiving a further tube 67 which may be connected with a container disposed in any convenient position having therein a saline solution or the like which may be used for flushing out the needle.

In the event a single walled glass collecting cell is used instead of the preferred thermos bottle type cell I provide different means for controlling the temperature of the fluid within the collecting cell 59. In this instance I employ an electronic thermoregulator 68 which is installed in any convenient manner within the collecting cell and is provided with electric connection 69 to a relay.

In this form of my invention a greater gravity head may be attained by raising or lowering the panel 51. Any suitable means may be employed for influencing the gravity flow of the fluid.

In Fig. 6 of the drawings I have disclosed an apparatus particularly designed for use in a simple blood transfusion. This apparatus consists of a panel 70 having at its upper end an aperture 71. A single heated container rack and heating tank 72 is mounted in any suitable way upon the panel 70. The container rack and tank 72 contains a heating medium of a similar nature to that already described. A valve control outlet 73 is provided at the bottom of the container to drain the contents thereof through an enlarged visible drip portion 74 which is connected with the tubing 75 which carries the fluid to the patient. It is evident that such a simple unit as this may be suspended by means of the aperture 71 on the wall or other convenient place adjacent the bedside of the patient, and presents a simple apparatus which will control the temperature and rate of flow of the fluid from the container 12.

In Fig. 7 of the drawings I have disclosed a collecting cell which is mounted within a casing 33 and which at its upper end is provided with a stopper 76 to which is connected through an aperture in the casing a tube of double glass tubing 77 having an enlarged visible drip portion 78 to which is connected for fluid flow a manifold member 79 formed of single or double glass walls and having a plurality of tubes 80 projecting therefrom for connection with rubber tubing from the containers 12 which are mounted thereabove within the combined container rack and tank. Such an arrangement as that disclosed in Fig. 7 of the drawings is advantageous in instances where it is extremely critical that the temperature within the multi-fuser casing 33 be retained at an even level and by this arrangement the casing need not be opened to attach and detach tubing to the manifold member 79 to allow the fluid to flow into the multi-fuser. It is also to be noted that this arrangement has further advantages in presenting the tubing for facile and efficient cleaning thereof.

What I claim is:

1. In a transfusion apparatus, container racks and heating units spaced apart one above the other, a plurality of fluid containers mounted in said units for controlling the temperature of the fluids within the containers, valve controlled fluid outlets associated with each of said containers, a collecting cell mounted below said units and provided with inlets provided by means of tubing with said valve controlled fluid outlets for the controlled selective flow of fluid from said containers into said collecting cell, and said tubing connecting the containers in said uppermost heating unit with said collecting cell passing within the heating range of the heating unit below said uppermost heating unit and a valve controlled heating inlet in said collecting cell.

2. In a transfusion apparatus, a container provided with a projecting rib and adapted to contain and dispense a therapeutic agent, and a supporting and heating unit for said container and the contents thereof, embodying a tank for receiving therein a heating medium for circulation

therethrough and the walls of said tank arranged to support and substantially envelop said container, the tank walls being further formed to provide an opening for receiving and exteriorly exposing the projecting rib on the container, and a valve controlled drainage outlet in said container for dispensing the contents thereof.

3. A transfusion apparatus including a container adapted to dispense a fluid, a support and heating unit for said container and the contents thereof, embodying a tank for receiving therein a heating medium for circulation therethrough and the walls of said tank arranged to support and substantially envelop said container, the tank walls being further formed to provide an opening to exteriorly expose a particular portion of the container when the latter is in dispensing position supported by the tank, and means on said container for engagement with the walls of said tank to retain the container in position supported by the tank exposing the particular portion thereof, and a fluid outlet in said container.

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