June 13, 1933. W. J. KIRK 1,914,026

THERAPEUTIC APPARATUS

Filed Sept. 18, 1930 3 Sheets-Sheet 1

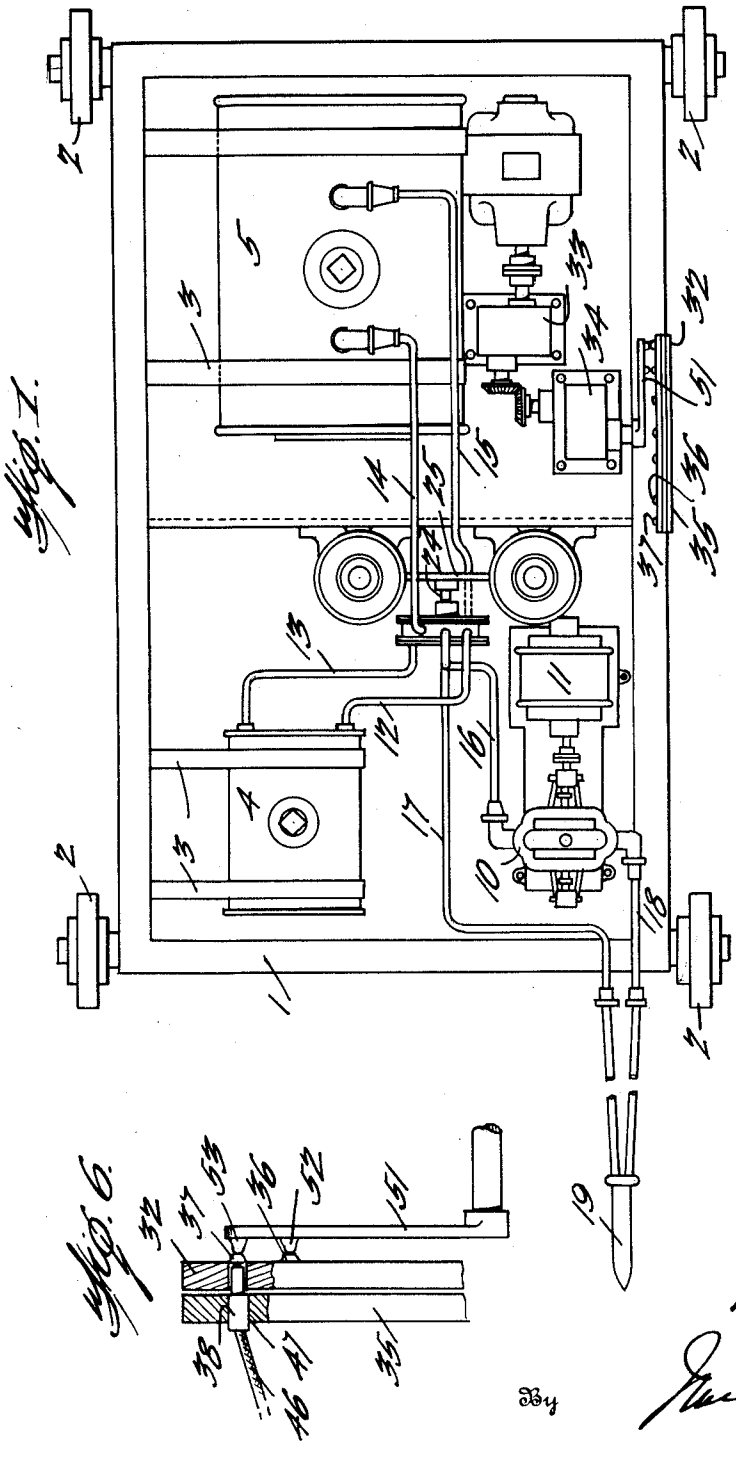


Fig. 1.

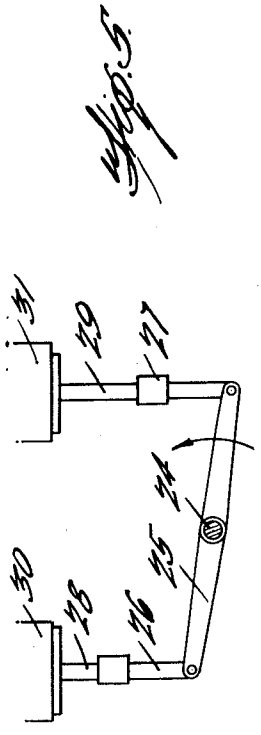


Fig. 5.

Fig. 6.

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Fig. 2.

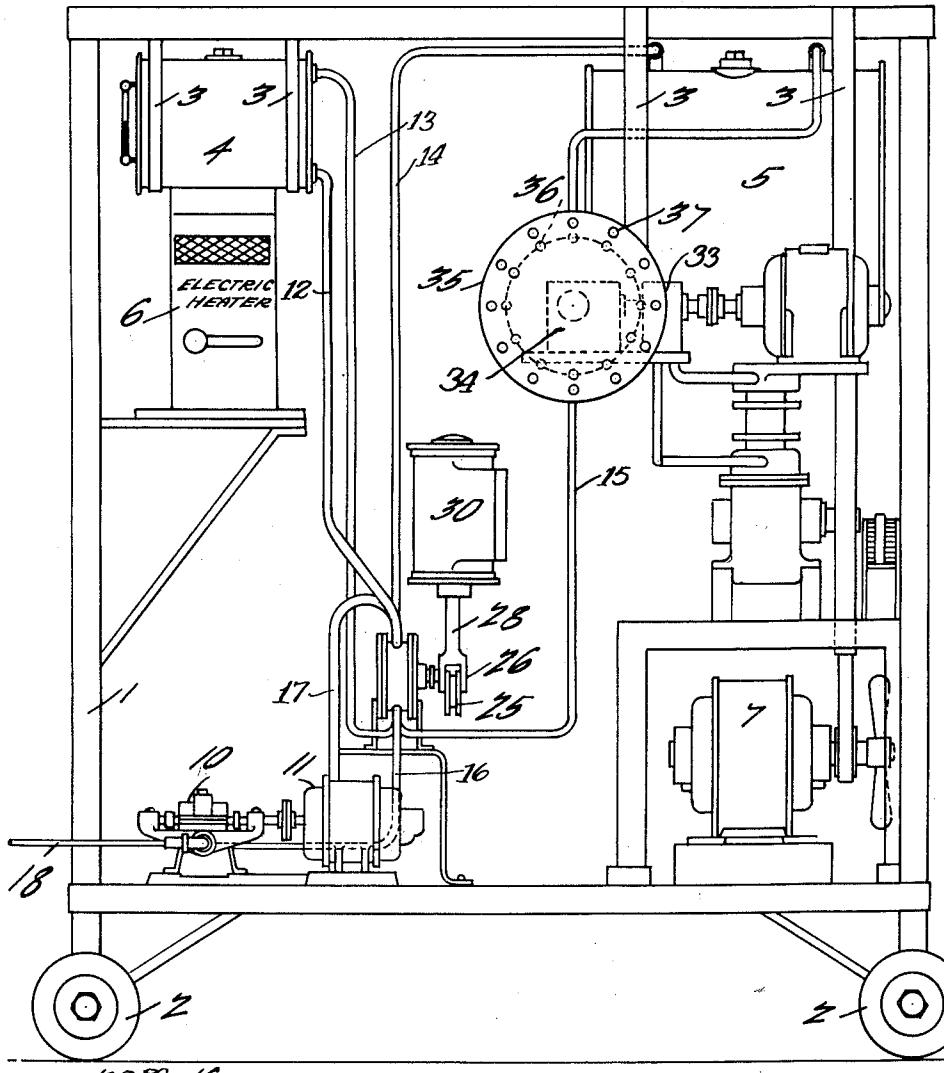
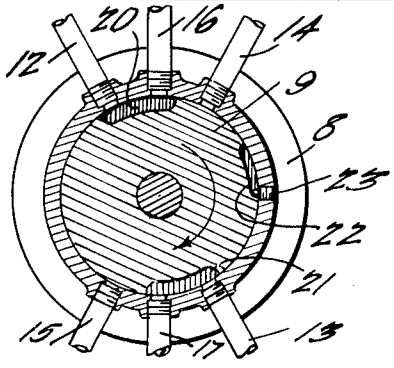


Fig. 4.



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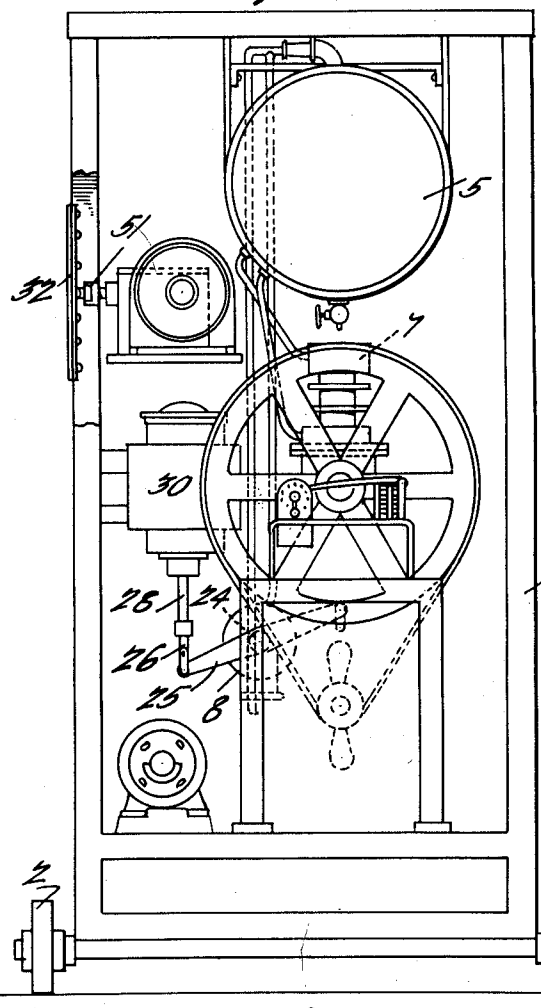
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THERAPEUTIC APPARATUS

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Fig. 5.



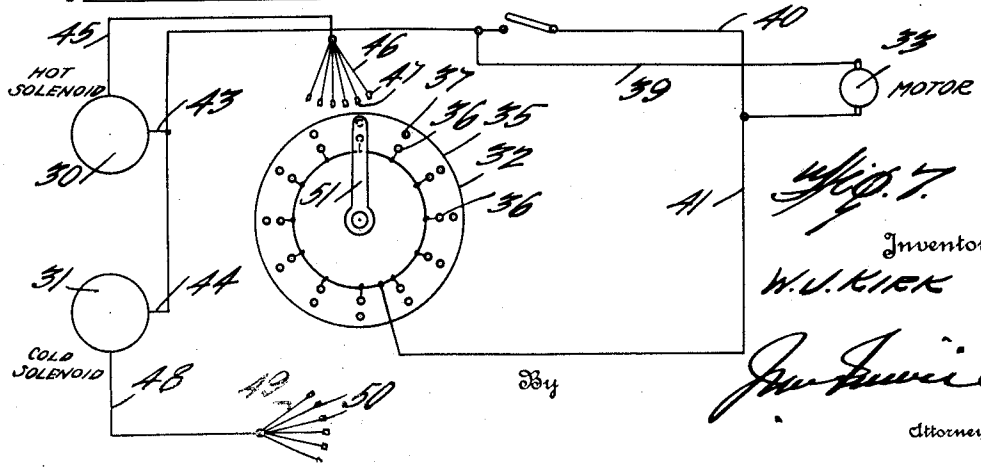


Fig. 7.

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UNITED STATES PATENT OFFICE

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THERAPEUTIC APPARATUS

Application filed September 18, 1930. Serial No. 482,829.

This invention relates to therapeutic apparatus wherein provision is made for treatment, more particularly in the application of heat and cold to a patient, and the apparatus designed for the selective periodic automatic control of the heating and cooling mediums, while maintaining a constant temperature of such mediums throughout any period of use.

In the treatment of the human body for many subnormal conditions, the application of heat or cold or both is universally practiced, and naturally in such treatment the various requirements necessitate different degrees of heat or cold in the particular cases. The ideal condition for such treatment is, of course, that which will permit the selective degree of heat or cold to be constantly maintained without substantial variation during the desired period of treatment; and not infrequently a particular condition requires successive heat and cold treatments.

Heretofore, except possibly in the case of the electric pad or blanket involving the use of heat alone, it has been practically impossible to maintain a heat or cold treatment for a desired period without variation in the treating medium, that is, it has been practically impossible to maintain the treating medium at an exact desired temperature without change throughout the full period of treatment. Even in the use of the electric pad or blanket it is not always possible to subject the part being treated to an exact temperature for such heating pads or blankets are generally regulatable only to a low, medium or high heat. Ordinarily, in both hot and cold applications, the initial application is at the desired temperature but the treating medium gradually and more or less quickly changes its temperature approaching that of the atmosphere or the body and thus if, as is usually the case, a particular degree of heat or cold is highly important, this particular degree of heat or cold under ordinary applicators is only maintained for a very short time and constant renewal of the treating medium is necessary to even approach an ideal condition of a constant temperature treatment.

Furthermore, it has been heretofore practically impossible to apply the heat and cold treatment to the orifices of the human body and maintain the temperature of the treating medium at a desirable constant. There have been a variety of instruments provided and used for this particular type of treatment, but the ideal temperature condition is only maintained for a very short time and the constant renewal of the treating medium is absolutely essential to even approach an ideal temperature condition for a substantial period.

Again, in ordinary hospital treatment where hot and cold applications are necessary, the treating mediums must be first separately provided, generally in the form of hot water and cold water or ice, thus necessitating a considerable degree of preparation and an adequate supply of the respective treating mediums for each particular case. Thus the usual hot and cold treatments of a patient, where a particular temperature for a considerable period is important, requires not only considerable time and labor in preparing the respective mediums in sufficient quantity, but the more or less constant attendance of the physician or nurse and the periodic renewal of the treating mediums in order to even approach a constant temperature treatment.

The primary object of the present invention is to provide an apparatus designed to overcome all the objections noted, and primarily constructed to provide at the will of the user a treating medium which can be maintained at a desired constant temperature and which will be caused to circulate with respect to the particular applicator so that during the entire period of use of the applicator the temperature of the treating medium will be maintained at the desired constant with respect to temperature.

A further object of the present invention is the provision of an apparatus constructed with a view to placing at the service of the user both a heated medium and a cold medium and providing for the selective circulation of either of these mediums into and through the applicator for constant temperature treatment.

A further object of the invention is the

provision of an apparatus in which the heated and cold mediums, constantly maintained at a selected temperature, may be successively circulated through the same applicator to provide successive hot and cold treatments, with each at a constant predetermined temperature, and with the period of treatment of either medium completely selective in order to permit the respective treatments to be maintained for any regular or irregular interval.

A further object of the invention is the provision of an apparatus wherein the respective treating mediums are arranged for successive and constant circulations with respect to an applicator, with the alternating periods regular for any desired period or irregular with respect to periods, as may be determined by the user, with the control of the alternate circulation of the mediums at the predetermined regular or irregular periods entirely automatic.

A further and important object of the present invention is the provision of such an apparatus in an entirely and conventional portable form, permitting its convenient use at different places in the hospital, for example, through the simple transportation of the apparatus, with a view to not only avoiding the time and labor of preparing for such treatments but also insuring the constant availability incident to the mere moving of the apparatus at any place or places.

The invention is illustrated in the accompanying drawings, wherein:—

Figure 1 is a plan view of the apparatus, the cover plate being removed.

Figure 2 is a side elevation of the same, the side wall being removed.

Figure 3 is an end view of the apparatus, the end wall being removed.

Figure 4 is a vertical section through the controlling valve.

Figure 5 is a plan view of the automatic switch for the controlling valve.

Figure 6 is an edge view of the same.

Figure 7 is a wiring diagram for the operation of the control valve through the automatic switch.

The improved apparatus in the preferred form of details includes a cabinet 1 of appropriate size, which may be either of skeleton formation or substantially enclosed, as may be preferred. The cabinet is mounted upon wheels or rollers 2 so that it is completely portable and readily movable from place to place, as may be desired.

Supported in the cabinet, preferably near the upper portion, as by appropriate hanger straps 3, are tanks 4 and 5, the former being, for example, a tank for the reception of a heating medium, as hot water, while the latter is designed for the reception of a cooling medium, as cold water. The tanks are preferably supported adjacent the respective ends of the cabinet, and means are provided by which the medium in the hot water tank 4 may be heated and the medium in the cold water tank 5 cooled. The present invention is not particularly concerned with the heating means or cooling means, though it may be stated for a more comprehensive understanding of the invention, that an electric heater 6 may be placed within or below the hot water tank to be heated by the current, with a conventional control for the heating agent, so that the water in the tank 4 may be held at any desired temperature degree. A cooling unit 7 of any conventional or preferred type may be arranged in the lower portion of the tank so as to maintain the medium in the tank 5 at any desired temperature below that of the atmosphere.

The salient feature of the present invention is the selective circulation for predetermined periods of the respective mediums from the tanks 4 and 5 to and through an applicator and, as the invention contemplates this circulation to be either constant with respect to one medium or alternate with respect to both mediums, there is provided to effect this result what is termed a control valve for the governing of the circulation of the respective mediums. This control valve, illustrated more particularly in Figure 4, includes a fixed casing 8 within which is arranged a valve body 9 mounted for limited rotative movement with respect to the casing. Appropriate circulating pipes connect the respective hot and cold water tanks 4 and 5 with the valve and also connect the valve with the applicator, and as the respective mediums are to be maintained in constant circulation, each system must include means for maintaining a constant pressure on the treating medium in the direction of circulation, and this circulating of pressure element must, of course, operate through the valve.

For the purposes of this invention, this circulating element is shown as a pump 10 of conventional type operated by a motor 11, preferably electric, the details of either of which elements may be entirely conventional or in any preferred or adaptable form. In providing for the circulation of the respective mediums through the control valve, a pipe 12 leads from the hot water tank 4 to and through the casing 8 of the valve. A return pipe 13 leads from the valve casing 8 at a point diametrically opposite the inlet pipe 12 to the hot water tank. The cold water tank is correspondingly connected to and through the valve casing 8 by inlet pipe 14 leading from the cold water tank to the valve casing and opening within the latter in spaced relation to the inlet from the hot water tank, a return pipe 15 for the cold water leading from the valve casing at a point diametrically opposite the inlet pipe 14. At a point intermediate the inlet pipes

12 and 14 from the hot and cold water tanks, there is connected to and opening through the casing 8 of the valve a circulating pipe 16 which leads to the suction or inlet of the pump 10, a return circulating pipe 17 leading into the valve casing at a point diametrically opposite the pipe 16, that is, said pipe 17 is between the return pipes to the cold and hot water tanks. The outlet pipe 18 from the pump 10 leads to an applicator 19, here shown as of a form for use in an orifice of the human body, though obviously to be constructed of any desired form or shape. The return pipe from the applicator is a continuation of the circulating pipe 17 leading through the valve casing.

The valve body 9 is formed in its periphery with diametrically opposed channels 20 and 21, these channels having such a circumferential length as to place in communication the ends of two adjacent pipes in any one position of the valve body. The valve body is limited to two positions through the provision of a recess 22 therein, the end walls of which cooperate with a stop 23 carried by the casing, thus providing two extreme positions of the valve body.

As the respective circulating pipes, that is, the inlet and return pipes to the hot and cold water tanks are located diametrically opposite with respect to the valve casing, and as the channels 20 and 21 are diametrically opposed with respect to the valve body, it is apparent that in any one position of the valve, both the inlet and return pipes from either the hot or cold water tanks must be simultaneously in communication with these channels. As the channels have a circumferential length to include but two adjacent pipes in either position, and as the circulating pipes to the pump and from the applicator are arranged intermediate the circulating pipes from the respective tanks, it is apparent that the suction pipe to the pump and the return pipe from the applicator are always in open communication with the respective channels 20 and 21 and that according to the position of the valve, these circulating pipes 16 and 17 leading to the pump and from the applicator may be placed in communication with the inlet and return pipes of either the hot water tank or the cold water tank.

Thus in the position of the valve shown in Figure 4, the water will flow from the hot water tank through pipe 12, through the channel 20, to the pump through pipe 16, to and through the applicator 19, from the applicator through pipe 17, through the channel 21 and to the hot water tank through the pipe 13 to thus maintain the constant and continuous circulation of the hot water. If the valve body is shifted to the opposite position as limited by the stop 23, the cold water tank is placed in circulatory communication with the applicator, the cold water flowing through the inlet pipe 14, channel 20 in the valve body, pipe 16 leading to the pump through the applicator 19, pipe 17 leading from the applicator through the channel 22 and through the return cold water pipe 15.

Thus in either of the two positions of the valve, provision is made for a constant circulation of the treating medium from one of the tanks and this circulation remains constant as long as the valve remains in that position, the opposite position of the valve compelling a like constant circulation from the other tank. It is, of course, to be understood that the valve body is designed to be manually operated and to be moved to either limit position at the will of the user to thereby maintain the applicator under the constant temperature of the circulating medium from either the hot or cold water tanks, as may be desired in the particular instance. As the valve is conveniently accessible, any desired form of handle may be provided for manually operating the valve body, though, as will later appear, this manual operation may be carried out by moving the valve lever, which is designed more particularly for electrical control but which in the absence of that control may be readily operated manually.

In therapeutic treatments, for which the present apparatus is more particularly designed, it is often of great importance to subject the patient to alternate applications of heat and cold, and further of importance at times that one or the other of such applications should be maintained for a comparatively greater length of time. While such a result is readily perfected through the manual control of the valve, as through such manual control the valve may be readily shifted to alternate the treatments, with any desired period for each whether regular or irregular, nevertheless such manual control involves at least the constant attendance of the operator for shifting the valve at the proper time and further, as may be highly important in serious cases, there is no assurance in this manual control that the periodic treatment will be accurately regulated or alternated.

Therefore, the present invention contemplates a means for automatically operating the control valve, with the time period of either treatment entirely selective, so that the user may set the apparatus for alternate hot or cold treatments, with either treatment maintained for any desired length of time within the limits of the apparatus, and thus insure that the hot and cold treatments will not only be properly alternated but each will be maintained for the prescribed length of time entirely regardless of any manual control and eliminating entirely the possibility of human error either as to alternation or as to periods of treatment.

To provide for this result, the apparatus

includes an electric switch combined with an electrically governed valve operating mechanism, the effective switch contacts for the control of such mechanism being designed for selective arrangement in order that alternation of the treatments for the same or varying periods may be carried out in an entirely automatic manner. The body of the valve has a fixed shaft extension 24 connected beyond the valve to a rocker arm 25, the terminals of which are connected by links 26 and 27 to the cores 28 and 29 of solenoids 30 and 31. Obviously, as the respective solenoids are energized, the rocker arm is moved and the body 9 of the valve rotated in one direction or the other to the limit permitted by the cooperation of the stop 23 of the valve casing with the end walls of the recess 22 in the valve body.

For the automatic control of the valve through the solenoid, there is provided an automatic switch, indicated generally at 32, and designed to be operated by a motor 33 through a reduction gear 34 of any conventional type so that the movable element of the switch may be operated comparatively slowly. The switch includes an insulating body 35 having an inner circumferential row of contacts 36 which are regularly spaced and concentric with the axis of the switch. An outer row of contacts 37 is arranged in radial alignment respectively with the inner contacts, and these outer contacts are aligned with openings 38 extending through the body of the switch and to or through said outer contacts 37.

The wiring diagram may be in any desired arrangement, a simple form showing a lead 39 from one of the service mains 40 which extends to and through the switch motor 33 for energizing the latter, and beyond the motor is in the form of a lead 41 which is in electrical contact with each of the inner contacts 36 of the switch. The other service main 42 is connected in parallel at 43 and 44 to the respective solenoids 30 and 31. The other side of solenoid 30 is in the form of a lead 45 which terminates in a series of branches 46 having terminal plugs 47 adapted to snugly fit and frictionally engage in the openings 38 cooperating with the outer contacts of the switch. The other solenoid 31 has a similar lead 48 terminating in branches 49 with terminal plugs 50 to engage the openings 38.

If the outer series of contacts 37 are, for example, twelve in number, the plugs 47 and 50 for the respective solenoids need only be six in number in order to provide periodic alternations within the limits of the particular switch. However, it is to be understood that no limitation is intended in this respect and that the switch contacts may be in any number and the terminal plugs of the respective solenoids in any number.

The rotating element of the switch is in the form of a switch arm 51 operated by the reduction gear 34 and having points 52 and 53 to ride over and engage the respective inner and outer contacts as the switch arm is moved over the face of the switch, it being understood that in any one live position of the switch arm, the points 52 and 53 simultaneously engage a radially aligned inner and outer contact 36 and 37.

It is, of course, apparent that if a plug 47 of the circuit including solenoid 30 is passed through the switch body to cooperate with a particular outer contact, that particular solenoid circuit is energized when the switch arm engages that particular contact and through this energization of the solenoid 30 the valve body 9 is moved to one limit position and either the hot or cold water circuit is in operation. If one of the plugs 50 is introduced into the switch body to cooperate with one of the outer contacts 37, the solenoid 31 is energized and the valve body correspondingly operated. This construction places at the disposal of the operator a means for not only controlling automatically the alternate applications of the heating and cooling mediums but to control these applications either regularly or irregularly. Thus if the plugs 47 and 50 are alternately connected with the successive outer contacts 37, it will be apparent that in the rotation of the switch arm 51 the valve is operated at each successive switch interval so that at such interval the valve is reversed and the particular treating medium controlled by the energizing plug at that particular contact is placed in circulation through the applicator. In the alternate arrangement described, the heating medium will be maintained in circulation during the time required for the switch arm to move from the particular energizing plug 47, for example, to the next energizing plug 50, and when the switch arm reaches the latter plug, the valve will be reversed and the cooling medium caused to circulate through the applicator.

Of course, the plugs 47 and 50 may be alternately arranged at regular intervals or such plugs may be arranged at irregular intervals, that is, assuming, for example, that a plug controlling the circuit of the solenoid 30, which we will assume moves the valve to circulate the heating medium, may be arranged in the uppermost outer contact 37 and a plug 50 for controlling the circuit of the solenoid 31 which governs the valve for the circulation of the cooling medium, may be placed at the third outer contact beyond the uppermost plug, and a plug 47 for controlling the circuit of the solenoid which positions the valve for the circulation of the heating medium may then be placed in immediate successive outer contact 37. If we assume, for example, that the switch arm

makes a complete circuit of the switch in sixty minutes and that the outer contact 37 are regularly spaced or at five-minute intervals, the arrangement described will result in causing the circulation of the heating medium for a period of fifteen minutes, following which the cooling medium will circulate for a period of five minutes and the valve will then be shifted to again provide for the circulation of the heating medium.

Thus, in the arrangement described it is apparent that the heating and cooling mediums may be circulated alternately at regular intervals or alternately at any irregular intervals within the particular arrangement of the switch, and as the invention contemplates the arrangement of the switch in this particular to provide any desired or appfopriate intervals, it is apparent that the apparatus readily lends itself to the control of the circulation of the respective heating and cooling mediums for any regular irregular intervals in any desired alternation to thus permit the therapeutic use of the appliance practically without limit in accordance with the particular service which may be required of the applicator.

In connection with the applicator, it is to be understood that the same may assume any form either for external use with the surface of the body or for use in any orifice of the body, and that the applicator will be conventionally formed for the particular use. The sole requirement in this particular is that the applicator must be arranged for the circulation of the medium therein in order that the service of the applicator may readily respond to the temperature of the particular medium being used.

The apparatus as a whole thus provides a readily and conveniently portable structure requiring only, in the instance illustrated, the conventional plugs by which it may be connected to the ordinary house service so that no matter at what point or points in the hospital, for example, the use is required of the treating mediums, the apparatus may be readily moved to the bedside of the patient, connected to the wall sockets, and the treatment continued automatically, if desired, through the medium of the automatic switch or manually, if preferred, simply through avoiding the use of the plugs 47 and 50 and operating the valve body by hand, as indicated in the experience of the operator or the necessities of the particular use by moving the rocker arm 25 to shift the valve as the different mediums are required. This places within the control of the user a means by which any particular treating medium, whether hot or cold, may be selectively used for any desired length of time or the particular mediums may be alternated selectively by direct manual control of the operator, or if the case being treated permits and requires regular or irregular applications of the respective treating mediums throughout a considerable period of time, the automatic switch, by proper application of the respective plugs 47 and 50, may be arranged to give the desired alternation and thereafter this particular selected alternation of the treating mediums will be automatically maintained as long as the apparatus is in use and without requiring any attention, manipulation or care on the part of the user or patient.

It is, of course, understood that while no particular reference is made herein to any means for heating or cooling the respective treating mediums, such means, while of an entirely conventional character, is necessarily designed so that any particular temperature of the respective mediums may be had. That is to say, the heating medium may be heated to any desired temperature and the cooling medium held at any desired temperature. Thus the physician or other operator can select not only the particular temperature of the respective mediums and compel its circulation through the applicator as desired, but can readily change or vary the treatment either with respect to the temperature of the treating mediums or to their degree or to their period of alternations or after alternate treatment can, by the removal of the plugs controlling one of the solenoids, maintain a continuous treatment of the other medium in a simple, expeditious manner.

While the apparatus as a whole is designed for therapeutic treatment, it is, of course, to be understood that its use is not limited to this particular field. In many of the arts and manufactures, it is important and desirable to have at control respective cooling and heating agents, and the apparatus lends itself readily to such uses. Therefore, it is to be understood that the apparatus as described is designed and intended for any and all purposes wherein there is required the use of a circulating medium of high or low temperature or both, and wherein the portability of an apparatus providing such medium is an essential and desirable characteristic.

In connection with the therapeutic use of the apparatus, the characteristic and important function is the continuous circulation of the treating medium at a predetermined temperature. This highly important function is an obvious result of the apparatus and in that result enables the physician to subject the applicator to a selective temperature and to constantly maintain this temperature without change or variation as long as the particular treating medium is circulating through the applicator. Thus the undesirable result of previous methods of utilizing heat and cold in the treatment of the human body, namely the practical impossibility of maintaining the treating implement at a constant temperature, is entirely avoided, to say

nothing of the further disadvantage of the time and labor employed in the constant renewal of the treating medium of the usual agents. With the present apparatus, when the predetermined temperature of the treating medium is determined upon and the latter caused to circulate through the applicator, that temperature will be maintained at all times during the use of the applicator without attention on the part of the physician, nurse or patient and, therefore, the most effective results incident to the use of the treating medium will naturally result.

The apparatus described is of simple form and shown with respect to details as made up of conveniently obtainable and easily arranged parts, and while such showing is at present the preferred embodiment of the apparatus, it is to be understood that no limitation is intended by such illustration or description and that the parts and their relative arrangements may be varied through the use of mechanical equivalents or changes so long as such mechanical equivalents or changes are within the scope of the appended claims.

I claim:—

1. A therapeutic apparatus for the control of mediums of different temperature or character, including a source of supply for one medium, a source of supply for the other medium, an applicator, a valve, pipes leading to and from the valve to the applicator to establish re-circulation in said applicator, an outlet pipe from each source of supply leading to the valve, an inlet pipe to each source of supply leading from the valve, the valve being movable to establish re-circulation between the re-circulating pipes leading to the applicator and the inlet and outlet pipes of either source of supply selectively whereby a closed circulation may be established between either source of supply and the applicator at will.

2. A therapeutic apparatus for the control of mediums of different temperature of character, including a source of supply for one medium, a source of supply for the other medium, an applicator, a valve, pipes leading to and from the valve to the applicator to establish re-circulation in said applicator, an output pipe from each source of supply leading to the valve, an inlet pipe to each source of supply leading from the valve, the valve being movable to establish re-circulation between the re-circulating pipes leading to the applicator and the inlet and outlet pipes of either source of supply selectively whereby a closed circulation may be established between either source of supply and the applicator at will, and fluid pressure means arranged in one of the pipes between the valve and applicator.

3. In a therapeutic apparatus for the control of the closed circulation of either of two mediums, including a source of supply for one medium, a source of supply for the other medium, a valve, a pipe leading from one source of supply to the valve, a pipe leading from the valve to said source of supply, a pipe leading from the second source of supply to the valve, a pipe leading from the said valve to said second source of supply, an applicator, a pipe leading from the valve to the applicator, a pipe leading from the applicator to the valve, the operation of the valve controlling communication between the applicator pipes and the pipes of either source of supply independently, and fluid pressure means arranged in the pipe leading from the valve to the applicator.

4. A therapeutic apparatus including independent tanks, an applicator, a valve, pipes leading from each tank to the valve, pipes leading from the valve to and from the applicator, the movement of the valve serving to place the applicator in closed circulatory communication with either tank at will, and selectively controlled electrically operated means for governing the movement of the valve.

5. A therapeutic apparatus including independent tanks, an applicator, a valve, pipes leading from each tank to the valve, pipes leading from the valve to and from the applicator, the movement of the valve serving to place the applicator in closed circulatory communication with either tank at will, and electrically operated means for actuating the valve, and manually selective means for timing the valve operation.

6. A therapeutic apparatus for the control of mediums of different character or temperature, including a tank for one medium, a second tank for the other medium, an applicator, pipes between the respective tanks and the applicator to compel a return circulation of the medium of each tank to and from the applicator, a valve for opening the applicator to closed circulation from either tank at will, and fluid pressure means for the circulating medium arranged between the valve and applicator.

7. A therapeutic apparatus for the control of mediums of different character or temperature, including a tank for one medium, a second tank for the other medium, an applicator, pipes between the respective tanks and the applicator to compel a return circulation of the medium of each tank to and from the applicator, a valve for opening the applicator to closed circulation from either tank at will, fluid pressure means for the circulating medium arranged between the valve and applicator, electric means for operating the valve, and a manually selective element for controlling the time period in which the valve may be held in either circulatory position.

8. A therapeutic apparatus for the control of mediums of different character or temperature, including a tank for one medium, a second tank for the other medium, an applicator,

pipes between the respective tanks and the applicator to compel a return circulation of the medium of each tank to and from the applicator, a valve for opening the applicator to closed circulation from either tank at will, fluid pressure means for the circulating medium arranged between the valve and applicator, and means for operating the valve and selectively controlling the time period for which the valve may remain in either circulatory position.

In testimony whereof I affix my signature.

WILLIAM J. KIRK. [L. S.]