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2,730,104

HYDROTHERAPY TANK WITH INFLATABLE LIMB RECEIVING CUFF

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FIG. 1

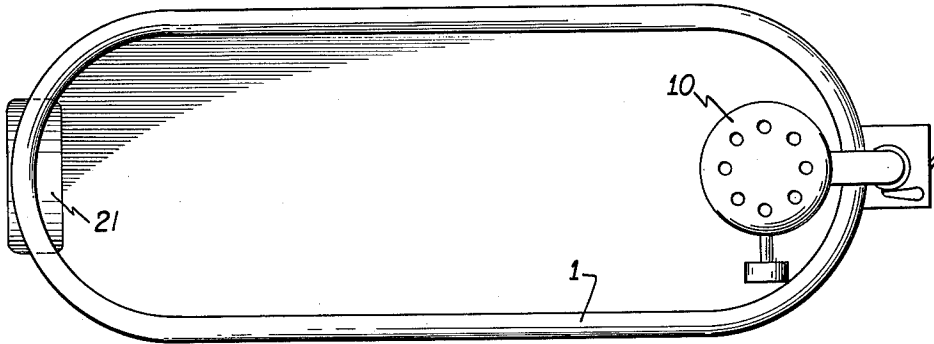


FIG. 2

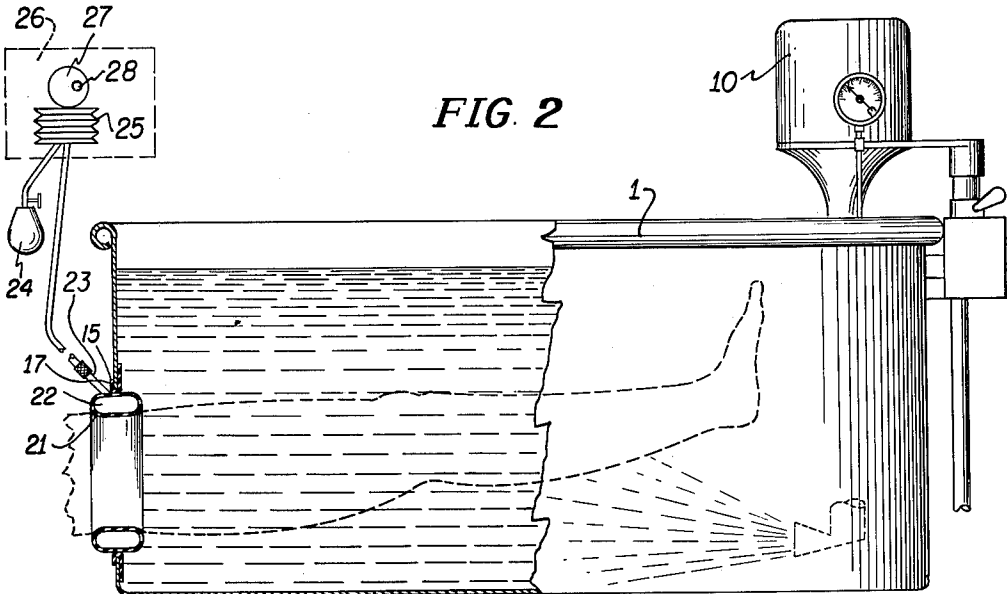
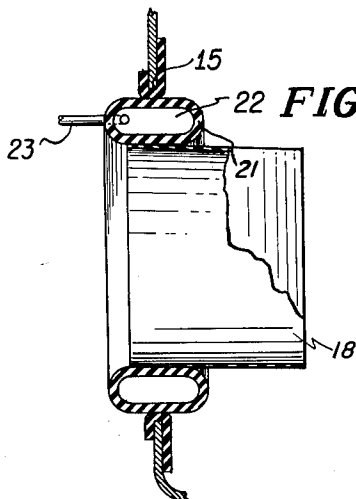


FIG. 3



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2,730,104

HYDROTHERAPY TANK WITH INFLATABLE LIMB-RECEIVING CUFF

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7 Claims. (Cl. 128—370)

This application is a continuation-in-part of my co-pending application Serial No. 680,682, filed July 1, 1946, that issued March 4, 1952 as Patent No. 2,587,644.

This invention relates to hydrotherapy tanks and, more particularly, to the construction of the limb inlet for a hydrotherapy tank adapted to administer hydrotherapy to the arms or legs of a patient while the patient himself remains outside of the tank.

In the treatment of pathological conditions of the limbs by hydrotherapy it is desirable that the patient should be subjected to as little bodily exertion as possible. Heretofore hydrotherapy when applied to the leg necessitated either that the patient be placed bodily into the tank so that the leg can be held in a horizontal position, or it involved placing the patient in a sitting position outside and above the tank, with the patient's leg hanging into the tank. Both of these forms of treatment are objectionable in many instances. In accordance with the present invention the patient may remain seated or lying in a wheel chair or in a bed and the leg or legs, or arms, that are to receive hydrotherapy are extended horizontally into the tank in one or two limb-receiving openings in a vertical wall of the tank. A suitable water seal is provided between the tank wall and the limb extending therethrough. The seal is also so constructed as to permit movement of the leg or arm within the tank either by the patient himself or by the person administering the treatment.

In accordance with the principles of the present invention a vertical wall of the tank is provided with a limb-receiving opening below what will be the level of the top of the water in the tank. The arm or leg is introduced into the tank through that opening and suitable means is provided for sealing against leakage of water from the tank at the opening through which the limb enters the tank. This leakage preventing means consists of an inflatable cuff which is inflated by air into contact with the limb and thus seal against the outward leakage of water.

Certain circulatory afflictions that are benefitted by hydrotherapy are also benefitted by periodic increase and decrease of pressure around the afflicted arm or leg. Such therapy generally consists of placing around an arm or leg an inflatable collar or cuff which is periodically inflated and deflated so that during the inflated interval it partially restricts the return venous circulation of blood through the afflicted parts. It is one of the objects of the present invention to provide a hydrotherapy tank which is so arranged that the afflicted parts can receive pressure treatment of the above mentioned nature at the same time.

The attainment of the above and further objects of the present invention will be apparent from the following specification taken in conjunction with the accompanying drawing forming a part thereof.

In the drawing:

Figure 1 is a top view of a hydrotherapy tank embodying the present invention;

Figure 2 is a side view of the tank of Figure 1 with certain parts shown in section; and

Figure 3 is an enlarged sectional view of the inflation cuff of Figure 2 with the sealing sleeve attached thereto.

Reference may now be had more particularly to the drawing wherein like reference numerals designate like parts throughout.

In the drawing, 1 indicates a metal hydrotherapy tank embodying the present invention. The tank may be of any desired shape and is here shown, by way of illustra-

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tion, as being of a conventional oval shape adapted for treatment of an arm or a leg. The tank is closed at the bottom and open at the top. A hydromassage apparatus, indicated at 10, is mounted on the tank. The apparatus 10 consists essentially of an electric motor driven turbine ejector that blow a mixture of air and water in a generally horizontal direction through the water in the tank 1. For that purpose the hydromassage apparatus draws water from the tank 1 and ejects it back into the tank with the air mixture. The point of discharge of the apparatus 10 is preferably adjacent the bottom of the tank and the direction of discharge is generally horizontal, so that the air ejected from the hydromassage apparatus below the surface of the water moves upwardly and horizontally, all in a manner well known in the art. The hydromassage apparatus 10 may be of any preferred construction such as, for instance, that shown in United States Patent No. 2,237,436, to which reference may be had.

The important feature of the hydrotherapy tank of the present invention lies in the provision of means whereby the arm or leg to be treated may be inserted into the tank below the top level of the water therein and extend in the tank in a generally horizontal direction or even upwardly by a slight or a great amount. To permit insertion of a limb into the tank and prevent leakage from the tank the tank wall has a generally circular opening 15 through which the limb is to be inserted. The opening is adjacent the bottom of the tank. Means is provided for sealing the space between the limb and the tank at the point of entrance of the limb into the tank to prevent escape of water therefrom. To that effect the tank opening 15 is provided with a hollow thin rubber tubular cuff 21. The rubber of the cuff is shown in exaggerated thickness for illustrative purposes. The limb is inserted through the tubular opening and then the space 22 of the cuff 21 is inflated by forcing air thereinto. This causes the cuff to embrace the leg or arm inserted therethrough with a greater or lesser amount of pressure, depending upon the pressure to which the space 22 is inflated, and thus to seal against the leakage of water between the limb and the cuff.

The space 22 may be inflated to the desired pressure by means of a tube 23 and a rubber bulb-like air pump 24 of the type commonly used in blood pressure measuring devices. The air pressure is built up in the cuff 21 and in a bellows 25 of a conventional rhythmic constrictor 26, which may be of a standard construction and includes a motor driven eccentric 27 which turns about a pivot axis 28 to effect a periodic increase and decrease of the pressure in the cuff 21. The amount of air introduced into the system is such that the pressure varies between upper and lower limits, both of which are above atmospheric pressure, so that the cuff 21 remains inflated at all times and maintains a water-tight seal between the limb of the person and the tank. When the pressure is at its maximum the pressure is effective to restrict the circulation of blood in the limb and when the pressure is at a minimum it permits the blood to flow in the limb. This is particularly important in the treatment of peripheral vascular diseases. The combination of vascular therapy and hydrotherapy produces beneficial results.

The tank of the present invention may contain a single opening for receiving one limb or may contain two openings, one for each arm or one for each leg.

When an arm or leg is treated while in a nearly horizontal position, or at times in an elevated position above the horizontal, many factors that aid in circulation are favorably influenced. In this position gravity definitely aids the return circulation in the extremity (the venous and lymphatic return), edema is reduced, and the healing process continues much more favorably. Having the limb in the best position of treatment in the arm or leg hydrotherapy tank is extremely important for best results.

During treatment the patient may be in a sitting position or in a reclining position, as in bed or on a stretcher or on a treatment table. Patients that are very ill and must remain in a reclining position are enabled to receive hydrotherapy treatment by a tank of the present invention. Another advantage of the tank of the present invention is that it makes it very easy for a technician to institute underwater hand massage and passive motion, which is quite difficult in the case of a leg hanging vertically in a whirlpool tank. The elastic sleeves or inflatable cuffs for sealing the space between the limb and the tank may be easily attached to or detached from the tank.

A suitable support for the arm or leg within the tank can be readily provided.

If desired the inflation cuff of Figure 2 may be provided with auxiliary sealing means adapted to embrace the inserted limb and seal against the leakage of water past the limb. When this is done the pressure on the cuff need not be maintained above atmospheric pressure and may vary between maximum and minimum values as above set forth, wherein the minimum value is atmospheric pressure. This result is obtained, in the embodiment illustrated in Fig. 3, by providing a sleeve 18 within the cuff 21 to which the entire periphery of one end of the sleeve is sealed. The sleeve projects into the tank 1 beyond the inner face of the cuff. The sleeve may be a membranous tubular sleeve in which the arm or leg is inserted and which is stretched by the arm or leg so that it closely embraces the same and prevents the leakage of water between the limb and the sleeve 18. The sleeve need be stretched only a slight amount on the limb and because it is of rubber and so exceedingly thin the water pressure on the outside of the sleeve causes the sleeve to seal around the limb.

In compliance with the requirements of the patent statutes I have here shown and described a preferred embodiment of my invention. It is, however, to be understood that the invention is not limited to the precise construction here shown, the same being merely illustrative of the principles of the invention. What I consider new and desire to secure by Letters Patent is:

1. Hydrotherapy apparatus comprising a receptacle adapted to hold water about a limb, said receptacle having an opening communicating with a water-receiving portion of the receptacle for receiving a limb to be extended through the opening in a generally horizontal direction, yielding means in the opening for sealing the space between the limb and the periphery of the opening against water leakage, said yielding means comprising an inflatable ring member adapted to encircle the limb, means connected to the ring for inflating the ring into pressure engagement with the limb, and means connected to the ring for cyclically varying the pressure in the ring between upper and lower limits both above a pressure which will maintain a seal between the ring and the limb inserted therethrough.

2. A container having an opening for receiving a limb to be extended through the opening into the container, yielding means for sealing the space between the limb and the periphery of the opening against leakage, said yielding means comprising an inflatable ring member secured to said container walls around the opening and adapted to encircle the limb, and means connected to the ring for inflating the ring member into pressure engagement with the limb, said last-mentioned means including means for cyclically varying the pressure in the ring member.

3. A hydrotherapy apparatus comprising an open top receptacle, said receptacle having an opening for receiving a limb to be extended through the opening into a water-receiving portion thereof, yielding means for sealing the space between the limb and the periphery of the opening against water leakage, said yielding means comprising an inflatable ring member connected to the receptacle walls around said opening and adapted to encircle

the limb, and means connected to the ring for inflating the ring member into pressure engagement with the limb, said last-named means including means for cyclically varying the pressure in the ring member between upper and lower limits, both above atmospheric pressure, to produce variations in the constriction of a limb extended through the ring member.

4. A hydrotherapy apparatus comprising a receptacle having an opening for receiving a limb to be extended through the opening in a generally horizontal direction, and yielding means for sealing the space between the limb and the periphery of the opening against water leakage, said yielding means comprising a leg-receiving water-proof flexible sleeve and an inflatable cuff around the flexible sleeve and received within said opening.

5. A therapy tank having an opening for receiving a limb to be extended into the tank through the opening in a generally horizontal direction, yielding means for sealing the space between the limb and the periphery of the opening against water leakage, said yielding means comprising a water-proof flexible sleeve open at both ends to permit insertion of a limb from the outside of the tank through the sleeve into contact with the ambient medium within the tank, and an inflatable ring-shaped cuff secured to said tank about said tank opening for applying pressure to a limb extending into said tank opening, said sleeve being connected to the inner circumference of the cuff.

6. A therapy tank having an opening for receiving a limb to be extended into the tank through the opening in a generally horizontal direction, yielding means for sealing the space between the limb and the periphery of the opening against water leakage, said yielding means comprising a water-proof flexible sleeve open at both ends to permit insertion of a limb from the outside of the tank through the sleeve into contact with the ambient medium within the tank, said sleeve extending from the opening in a direction inwardly of the tank so that the pressure of the water in the tank presses on the outside of the sleeve to press the sleeve into sealing relationship to a limb inserted therethrough, the sleeve having a single membranous wall the inner surface of which is pressed by the water in the tank towards the limb, and the sleeve being of a diameter substantially smaller than that of the opening in the receptacle, and an inflatable ring-shaped cuff secured in said opening, said sleeve being within said cuff and sealed thereto about its periphery.

7. A therapy tank having an opening for receiving a limb to be extended into the tank through the opening in a generally horizontal direction, yielding means for sealing the space between the limb and the periphery of the opening against water leakage from the tank, said yielding means comprising a waterproof tubular inflatable cuff secured in the limb-receiving opening and open at one end to the atmosphere outside of the tank and open at the opposite end to the interior of the tank and open between its two ends for receiving a limb that is to be inserted from the outside of the tank through the cuff into the tank, said cuff adapted to completely surround and closely embrace a portion of a limb inserted therethrough and being made of flexible membranous material so that it may be pressed around a limb, and a sleeve of membranous resilient waterproof material within the cuff and extending therefrom.

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