

Nov. 11, 1969

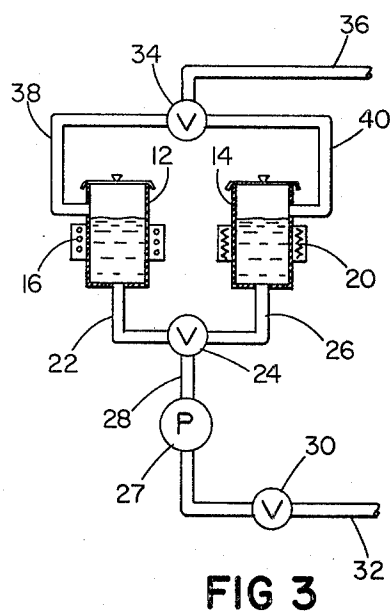
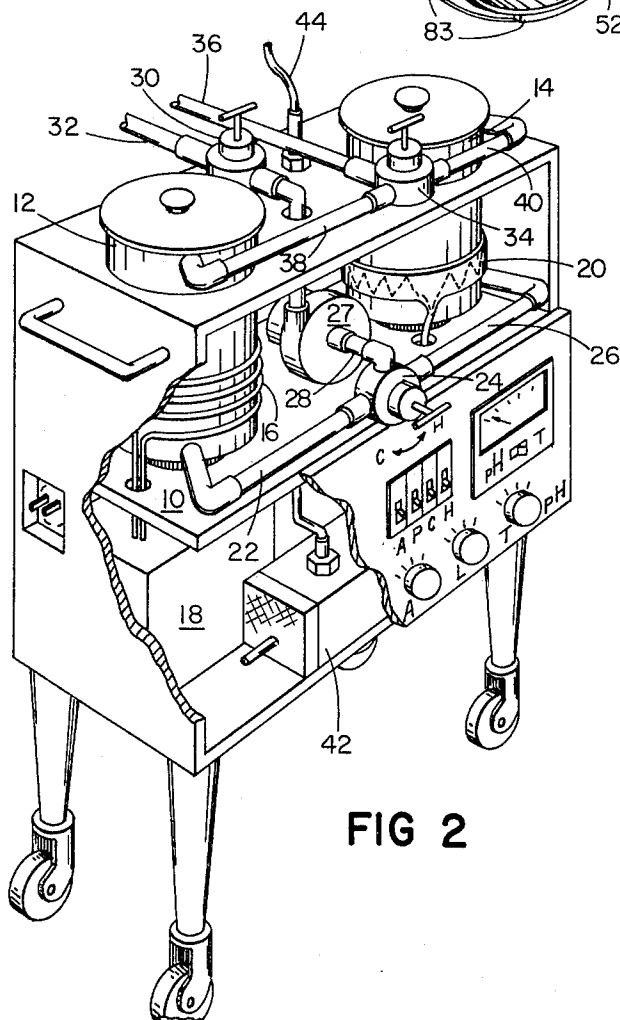
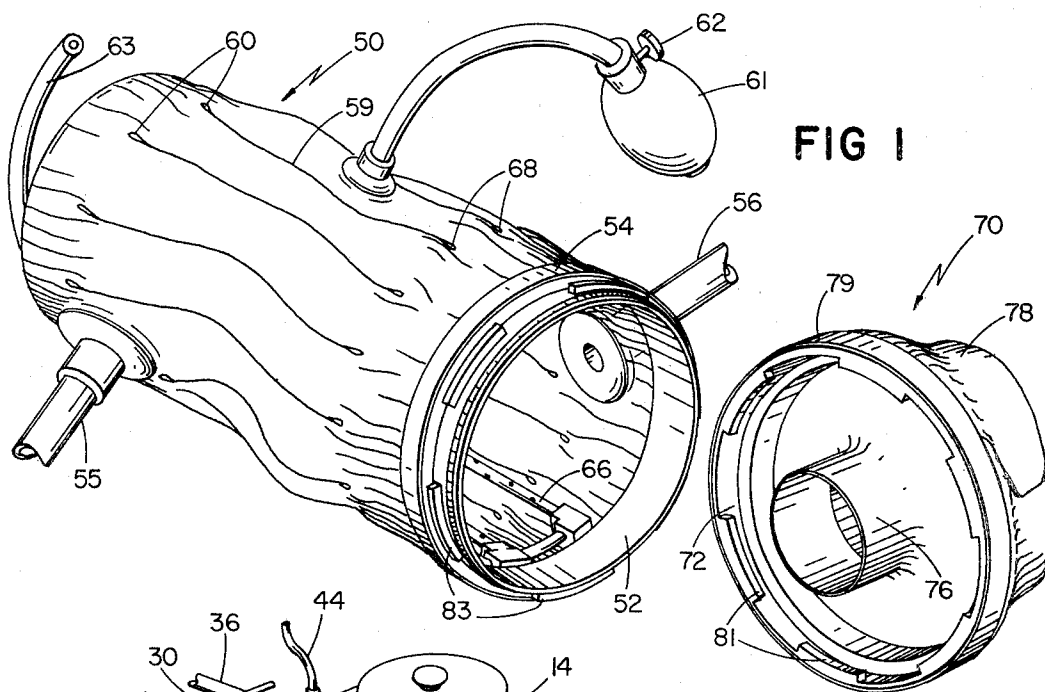
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3,477,424

MOBILE HYDROTHERAPY EQUIPMENT

Filed Oct. 31, 1967

2 Sheets-Sheet 1



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MOBILE HYDROTHERAPY EQUIPMENT

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2 Sheets-Sheet 2

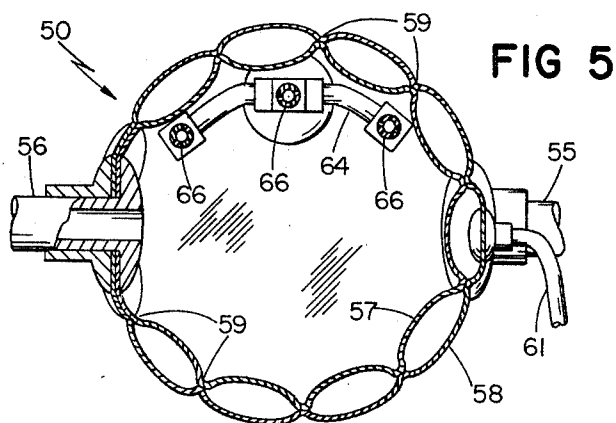


FIG 5

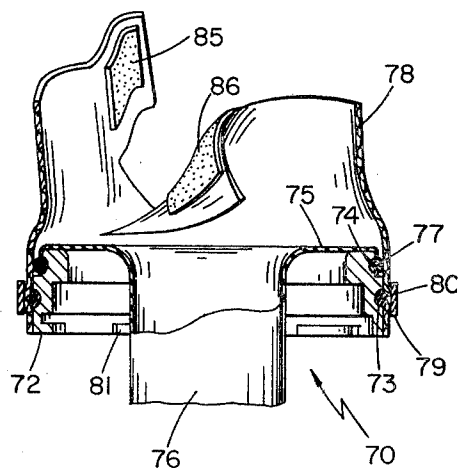


FIG 6

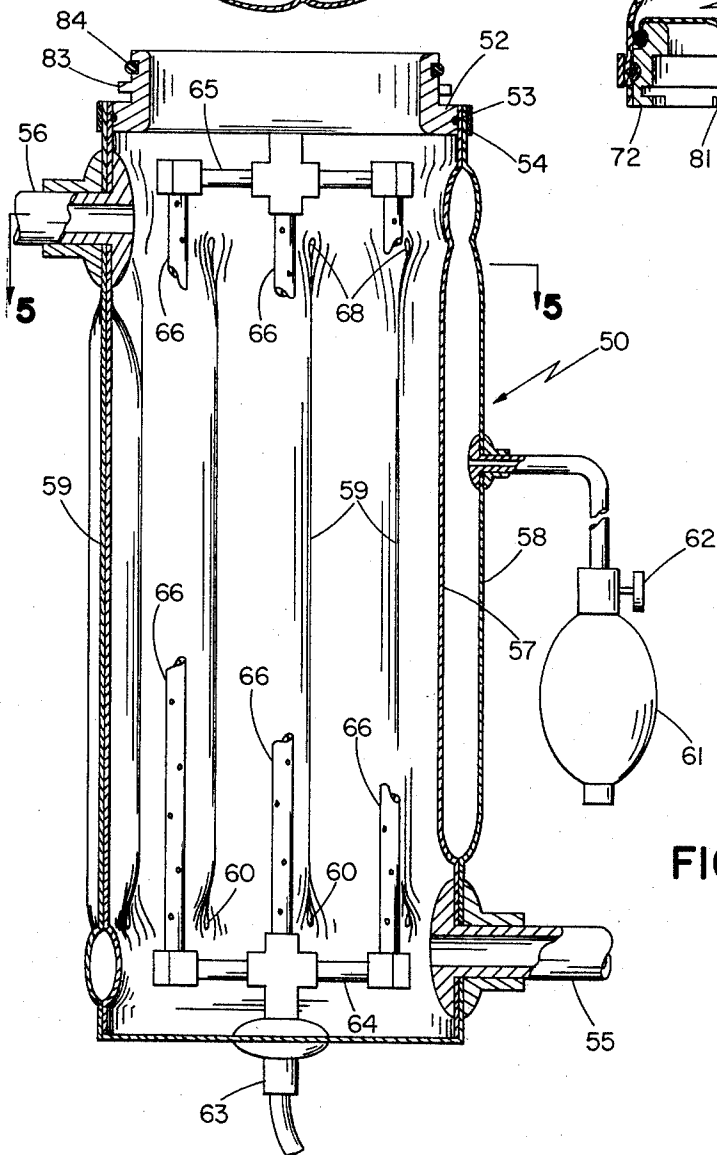


FIG 4

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MOBILE HYDROTHERAPY EQUIPMENT

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10 Claims

ABSTRACT OF THE DISCLOSURE

Bed-side hydrotherapy equipment includes a mobile cabinet having separate sources of cold and hot liquid, and a remote portable sleeve compartment having transparent flexible film walls and associated inflatable bladder means for expanding the compartment walls to maintain the internal volume of the compartment around a body member inserted and sealed water-tight in the compartment, together with connecting conduits with associated valves so that liquid may be circulated through the compartment selectively from and to either of the sources. Aeration is provided to the compartment in cross flow relation to the liquid flow through the compartment to provide whirlpool effects.

This invention relates to hydrotherapy equipment and more particularly to mobile equipment adapted for use at a patient's bedside as distinguished from immovable equipment permanently installed in hydrotherapy tub rooms to which a patient has to be moved and which is thus unavailable to an immobilized patient, for example, one in leg traction who otherwise would benefit by hydrotherapy as, for example, to an also injured arm.

More particularly, the invention provides in conjunction with a mobile cabinet a remote portable sleeve compartment in which a portion, such as the whole or distal part of a leg or an arm of a human body may be isolated by water seals, such compartment being removably connected to suitable flexible conduits forming a pair of closed liquid circulating systems which selectively include a source of warm liquid or a source of cold liquid, together with an associated pump and valve system such that an operator may cut in one circuit or the other alternatively at the control of the operator and at selected temperatures and flow rate.

The device thus lends itself to thermal contrast bath as well as hypothermia and a variety of other treatments.

Provision is also made for agitating the liquid circulating through the compartment so as to provide desired whirlpool effects. Suitable disconnects are included to permit sterilization. Preferably, the compartment is constituted in part of transparent film for observation purposes and has inflatable bladder means for distending the compartment to maintain a proper internal volume in the perfusion chamber for circulation of the liquid.

A typical embodiment of the invention is shown in the accompanying drawings wherein:

FIG. 1 is a perspective view of the portable sleeve compartment before its attachment to a body seal cap, also shown in angular relation to the compartment for purposes of clarity in FIG. 1;

FIG. 2 is a view of the mobile cabinet, broken away to show internal parts;

FIG. 3 is a schematic diagram of the flow system provided by the cabinet parts;

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FIG. 4 is a cross-sectional view taken longitudinally through the portable sleeve;

FIG. 5 is a cross-sectional view taken along the line 5—5 of FIG. 4; and

FIG. 6 is a sectional view of the compartment cap shown at the right in FIG. 1.

Turning first to the mobile cabinet shown in FIG. 2, it comprises a wheeled carriage having a shelf 10 on which rest two covered tanks 12 and 14.

Tank 12 is surrounded with cooling coils 16 connected to a refrigerator unit 18.

Tank 14 is surrounded with an electric-resistance heater element 20.

The bottom of tank 12 communicates through a conduit 22 with a two-way valve 24. Tank 14 communicates with the same valve 24 through a conduit 26. The outlet from valve 24 leads to a pump 27 through conduit 28 and thence upwardly to a flow regulator 30 and a flexible out-flow tube 32.

Valve 34 on the front top side of the cabinet is a return directional valve for fluid returning through flexible tube 36 so as to lead the fluid either by way of line 38 to tank 12 or by way of line 40 to tank 14 according to the hand setting of the valve.

As shown schematically in FIG. 3, by setting valves 24 and 34 either for left flow or right flow, pump 27 causes flow of fluid from 12 through 22, 24, 28, 27, 30, 32 and return through 36, 34, 38 to 12; or from 14 through 26, 24, 28, 27, 30, 32 and return through 36, 34, 40 to 14.

In FIG. 2 there is also shown on a lower shelf an air pump 42 having a line leading upwardly to an outgoing top rear air tube 44. Since as will hereinafter be described air pumped through line 44 is returned through conduit 36 along with the liquid flow, it should be noted that the return conduits 38 and 40, as indicated in FIG. 3, empty into tanks 12 and 14 at a level above the normal level of the liquid in the tanks.

Now referring to FIGS. 1 and 4—6, the portable sleeve comprises a double wall collapsible tube 50 of transparent film material such as a sterilizable vinyl co-polymer and which is closed at its bottom end as shown in FIG. 4 but is open at its top end. Its top end, however, is sealed to a rigid connector ring 52 between an O ring 53 and an external annular clamp member 54.

The tube 50 has an inlet 55 that can be connected to tube 32 and an outlet 56, leading through the double walls of the tube, that can be connected to tube 36. The inner wall 57 of the tube is heat-sealed to the outer wall 58 of the tube along longitudinal seams 59 spaced circumferentially around the tube and terminating, as shown in FIG. 4, short of the ends of the tube at point 60 to provide communication at the ends between the longitudinal cells formed between the walls.

A hand pressure bulb 61 with a releasable one-way valve 62 is attached through the outer wall 58 of the tube so that the bladder formed between the double walls can be inflated to rigidify the structure after it has been positioned on the part to be treated.

In addition, there is supported along the bottom of the tube from an air inlet 63 an internal rigid assembly comprising two opposite arcuate headers 64 and 65 connected by three spaced perforated rigid tubes 66.

When the air tube 44 from the cabinet is connected to inlet 63, a flow of air in cross-flow relation to the liquid

flowing from inlet 55 to outlet 56 is provided to give agitation to the liquid and provide whirlpool effects depending upon the relative rates of flow. The air exhausts with the outgoing liquid through outlet 56 and discharges as the liquid falls into the tank 12 or 14.

The bag 50 is inserted, as for instance over a human arm, after the seal cap shown in FIGS. 1 and 6 has been previously positioned as, for example, around the biceps.

Such cap 70 has a rigid annulus 72 provided with two external grooves 73 and 74. A rubber diaphragm 75 having a central aperture surrounded by a circular sleeve 76 is stretched drum-like over the ring 73 and secured thereby by an O-spring or ring 77. Fitted over the diaphragmed ring is a water-proofed cloth cuff 78 which is clamped against a resilient O-ring 79 by an external clamp 80.

As shown in FIG. 1, the ring 72 has pressure cooker type lugs 81 adapted to receive therebetween corresponding lugs 83 on connector ring 52 of the tube 50 and then tube 50 is twisted to provide a water-tight seal due to the presence of an intervening O-ring 84 as shown in FIG. 4.

The outer end of cloth cuff 78 is slit and provided with any suitable type of slit-closing fastening means such, for example, as two opposed patches 85 and 86 of interlocking disengageable stick cloth to strap the body member inserted through the sleeve 76. The cuff is important because it aids in preventing the rubber sleeve 76 from inverting itself if the pressure rises in the perfusion chamber of tube 50.

In operation, an arm, for example, is inserted through the cuff and sleeve 76 of the disconnected cap 70. The uninflated sleeve assembly is then passed over the arm and connected to the cap. Any further connections required are then made, the bladder inflated, the valves set and pump and air motor started. Upon completion of the treatment the bladder is deflated, the liquid drained, the parts disassembled and removed from the patient.

Various instruments and switches are shown on the cabinet which can be provided to give control and visual indication of temperature of the liquids in the tanks 12 and 14, the operation of the air blower 42, etc. For example, the liquid in tank 12 may be at 60° F. and that in tank 14 may be regulated to a temperature between 90° and 120° F.

It is contemplated that the cap member 70 can be duplicated at the other end of the sleeve so that the compartment will isolate only part of a human limb, for example, from above to below the knee or from above to below the elbow.

By providing screw-threaded or other water-tight couplings of a type known to the art, the parts of the cabinet may be disassembled for sterilization purposes as separate units; for example, the two tanks 12, 14, the assembly 22, 24, 26, 28, the assembly 34, 38, 40, and the regulator valve 30 with or without the attached conduits 32 and 36. The sleeve 50 and cuff 70 may also be sterilized as separate units as may be the air hose 44.

There is thus provided a versatile device which can be used in the treatment of burns, contaminated wounds, open fractures, chronic osteomyelitis, stasis ulcers and dermatoses, since various medications may be included in the circulating liquid. Among its assets are repeated ready alternation of warm and cool liquid and sterile environment for treatment all at bedside and without carrying the patient to stationary therapy equipment.

What is claimed is:

1. Portable hydrotherapy apparatus comprising:
 - a pair of tanks for liquid,
 - means for cooling liquid contained in one of said tanks,
 - means for heating liquid contained in the other of said tanks,
 - a hollow, elongated, water-tight perfusion compartment adapted to surround a portion of a human body inserted into said compartment,
 - a liquid inlet to said compartment,
 - a liquid outlet from said compartment,

flexible conduits and valve means contained in said conduits for connecting said inlet and outlet selectively to each of said tanks to establish separate circuits for the circulation of liquid from each of said tanks through said compartment and returning to the same tank, and

a pump in the conduit leading to said inlet for circulating liquid through said compartment successively from and to each of said tanks depending upon the setting of said valve means.

2. Apparatus as claimed in claim 1 wherein the liquid inlet is at one end of said compartment and the liquid outlet is at the other end of said compartment.

3. Apparatus as claimed in claim 1 having in addition means for pumping air into said compartment in cross flow relation to the flow of liquid through said compartment and thence exhausting from said compartment with said liquid into the tank then included in the circuit.

4. Apparatus as claimed in claim 3, wherein the means for pumping air into said compartment includes a perforated rigid tube extending longitudinally within said compartment.

5. Portable hydrotherapy apparatus comprising:

- a tank for liquid,
- means for heating liquid contained in said tank,
- a hollow, elongated water-tight perfusion compartment adapted to surround a portion of a human body inserted into said compartment,
- a liquid inlet to said compartment,
- a liquid outlet from said compartment,
- flexible conduits and valve means contained in said conduits for placing said inlet and outlet in communication with said tank for circulation of liquid from said tank through said compartment and returning to said tank,
- a pump in the conduit leading to said inlet, and
- means for pumping air into said compartment in cross-flow relation to the flow of liquid through said compartment and thence exhausting from said compartment with said liquid into said tank.

6. Portable hydrotherapy equipment comprising:

- an elongated sleeve having a collapsible outer tubular wall made of flexible, transparent material,
- a liquid inlet and a liquid outlet adjacent opposite ends of said sleeve,
- means for sealing said sleeve around and in water-tight relation to a human body portion inserted into said sleeve,
- inflatable bladder means attached to the inside of the outer wall of said tubular sleeve for moving the outer wall of the sleeve when the bladder means is inflated to radially expanded position to maintain the volume of the chamber in which said body portion has been inserted at its maximum for circulation of liquid flowing through said sleeve from said inlet to said outlet, and

means for inflating and deflating said bladder means.

7. Equipment as claimed in claim 6 having, in addition, a perforated tube extending longitudinally within said sleeve, and

a second inlet connected to said perforated tube for blowing air through perforations in said perforated tube into said sleeve for exhaustion with a liquid flowing out through said outlet.

8. Equipment as claimed in claim 6 in which the bladder means is formed by an inner tubular member of flexible material sealed at its ends and along parallel spaced longitudinal lines to the inside of the outer wall of said tubular sleeve, leaving unsealed portions along said lines to provide communication between the resulting circumferentially adjacent longitudinally extending bladder cells.

9. Portable hydrotherapy equipment comprising,

- an elongated sleeve having a tubular wall made of transparent material,

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a liquid inlet and a liquid outlet to and from said sleeve,

means for sealing said sleeve around and in water-tight relation to a human body portion inserted into said sleeve,

a perforated tube extending longitudinally within said sleeve, and

a second inlet connected to said perforated tube for flowing air through perforations in said perforated tube into said sleeve for exhaustion with the liquid flowing out through said outlet.

10. Equipment as claimed in claim 6 wherein the sealing means includes a tubular flanged circular rubber diaphragm adapted to snugly grip the inserted body mem-

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ber and means external to said diaphragm for strapping the sleeve to the body portion.

References Cited

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L. W. TRAPP, Primary Examiner

U.S. Cl. X.R.

128—375

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,477,424

Dated November 11, 1969

Inventor(s) Thomas H. Tracy

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 5, line 11, change "6" to --9--.

SIGNED AND
SEALED
MAR 24 1970

(SEAL)

Attest:

Edward M. Fletcher, Jr.
Attesting Officer

WILLIAM E. SCHUYLER, JR.
Commissioner of Patents

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