This invention relates to the hydrotherapy art and has as its general object to improve and simplify the treatment of ailments of the human body by the application thereto of moist heat. The commonly accepted method in general use today is to apply, to the body of a patient, usually in a reclining position on a cot or hospital bed, towels that have been saturated in hot water and partially wrung out. This practice requires the frequent changing of the towels as the heat of the residual moisture therein is dissipated.

An object of the invention is to provide an improved method of therapeutically treating the human body, wherein heated vapors are applied to the body of a patient lying directly upon a pad which serves as a distributing outlet for the vapors. The invention contemplates particularly the application of heated water vapor or steam, either plain or medicated. A particular object of the present invention is to provide a method and apparatus whereby moist heat can be continuously applied to a body at a uniform rate. More specifically, the invention contemplates the continuous application of heated water vapor or steam to the body of a patient at a rate that is regulated to maintain a selected treatment temperature throughout the period of treatment. To this end, the invention contemplates the use of apparatus including a steam generator having means to regulate the delivery of heated vapor therefrom, a vapor delivery pad adapted to distribute the hot water vapors coming from the generator to a selected area of the patient's body while the patient is lying directly upon the pad, and a connection between the generator and the pad for carrying the hot vapors from the generator to the pad. A specific object of the invention is to provide a delivery pad so constructed as to be capable of supporting the body of the patient while freely delivering the heated vapors thereto. Another object is to provide a delivery pad that will distribute the vapors quite evenly throughout its area. A further object is to provide a pad which, together with the foregoing characteristics, is flexible and adapted to conform itself to the curvature of the patient's body and to the contours of a yielding supporting mattress, as deformed by the body of the patient pressing downwardly thereagainst.

A further object is to provide a pad including an inlet, a plenum chamber for distributing vapors from the inlet, and a plurality of elongated distributing ducts extending from the plenum chamber, each having a series of progressively arranged vapor outlets in its side walls, the ducts and outlets being so constructed and arranged as to distribute the vapor uniformly throughout their length, and being arranged to collectively provide a support for a patient's body, adapted to support the body without having its vapor distributing function impaired. Furthermore, the invention contemplates a pad which, though adapted to flex in order to conform to body curvature, will not lose any of its uniform distributing efficiency as the result of such flexing.

A further object of the invention in one of its aspects is to provide a distributing pad having the characteristics set forth above and, in addition, being preformed in a spirally rolled shape such as to receive a limb and having means for adjustably securing the same around limbs of varying diameters.

A further object is to provide an improved steam generator suitable for the generation of steam at a relatively slow rate, for use in the practice of the therapeutic treatment outlined above. Another object is to provide such a steam generator which is of relatively simple and inexpensive construction yet thoroughly dependable in operation. A particular object is to provide such a steam generator which may utilize a conventional one gallon glass jar as a water reservoir for supplying water continuously to the generator. A further object is to provide a generator having a novel and improved temperature control means through which the temperature of the vapor delivered from the generator may be adjusted without varying the rate of generation of steam. To this end, the invention contemplates the use of valve means for mixing air with the steam coming from the generator, at a rate that is adjustable to bring the temperature of the delivered vapor to any selected level.

Other objects will become apparent in the ensuing specification and appended drawings in which:

Fig. 1 is a perspective view showing my improved therapeutic treatment apparatus in position for use in connection with a treatment cot;

Fig. 2 is a perspective view of the vapor delivery pad;

Fig. 3 is a transverse cross sectional view of a portion of the pad;

Fig. 4 is a sectional view of a portion of the pad taken in a plane parallel to the general plane of the pad;
Fig. 5 is a partial plan and partial sectional view of the pad;
Fig. 6 is a plan sectional view of a modified form of the pad;
Fig. 7 is a plan sectional view of another modified form of the pad;
Fig. 8 is an end view of another modified form of the pad;
Fig. 9 is a vertical sectional view of the steam generator;
Fig. 10 is a plan view of the steam generator, pads being broken away;
Fig. 11 is a vertical sectional view of the steam generator with thermostatic control;
Fig. 12 is a face view of the temperature regulator;
Fig. 13 is a diagram of the temperature control circuit; and
Fig. 14 is a sectional view of the inlet of another modified form of the pad.

Referring now specifically to the drawings in detail, Fig. 1 illustrates the general arrangement of my hydrotherapy apparatus, ready for use. The vapor delivery pad, indicated generally at 10, is laid upon the supporting surface of a treatment cot or bed 11 in a position where the patient may lie upon the pad, with the pad directly beneath the area to be treated. A steam generator, indicated generally at 12, is positioned upon the floor beside the bed and is connected to the pad 10 by a flexible tube 13.

The pad 10 has a cover 14 in the form of an envelope of heavy terry cloth (such as is used in Turkish towels) or equivalent material, which aids in the distribution of the heated vapors to the body of the patient and provides a relatively soft surface for the patient to rest against, avoiding the harshness of direct contact with the pad itself. The envelope 14 has a mouth to receive the pad, and this mouth may be closed about the inlet neck 15 of the pad by means of a draw string 16.

In the practice of my improved therapeutic method, the patient lies upon the pad 10. Generator 12 is regulated to supply a constant stream of moist heated vapor or steam at a selected temperature which is deemed proper for the treatment of the particular patient, and the heated vapor is delivered from the pad 10, through cover 14, at a relatively uniform rate over a selected treatment period. The treatment is particularly useful in giving relief to sufferers from arthritis, polio and other ailments for which damp heat has been found beneficial.

The pad 10 is of a tough, highly flexible material such as soft rubber, resistant to the corrosive action of heated water vapor. Some of the flexible plastics of the thermoplastic type (e.g., the vinyl and acrylic resins) may also be suitable. To facilitate the construction of the pad, it may be formed in two sections, including a flat, imperforate bottom 17 and a formed or molded upper section 10. The upper section 10 has a series of parallel hollow ribs 18 each cooperating with bottom 17 to define a steam duct 20 extending longitudinally therethrough. The ribs 18 are spaced apart to define regularly spaced external grooves or channels 21, and are provided with a series of outlet apertures 22 which deliver the heated vapor from the ducts 20 into the channels 21. The channels 21, opening upwardly, deliver the heated vapor directly to the body of the patient lying upon the pad. Passing through the cover 14, the vapor spreads laterally from the channels 21 so as to be distributed fairly uniformly to the patient’s body.

The ribs 19 have walls of sufficient thickness so that they will support the patient’s body without collapsing to such an extent as would materially restrict the even distribution of vapor through the apertures 22. The heated water vapor enters the pad through the neck 15, which communicates with ducts 20 through a manifold 23 fanning outwardly from the neck 15. Manifold 23 defines a plenum chamber 24 which gradually diminishes in cross sectional area from inlet neck 15 to its respective extremities.

To avoid collapse of the plenum chamber 24 under the patient’s weight, it is provided with pillars 59 extending between and integrally united to its top and bottom walls.

To produce a uniform vapor distribution and temperature over the entire area of the pad, the outlet apertures 22 may be spaced gradually closer together toward the closed ends of the ducts, as shown in Fig. 6. Also, the ducts may be tapered in cross sectional area from maximum area adjacent manifold 23 to minimum area at the closed outer ends thereof as shown at 20 in Fig. 6. As an alternative to the close spacing of the holes, shown in Fig. 5, the diameters of the apertures may be graduated from one end of the other of the pad, as shown at 22 in Fig. 7. As a further means of attaining uniformity of delivery of the vapor over the entire area, the apertures 22 may be staggered on the respective sides of the ribs 13, as indicated in each of Figs. 5, 6 and 7.

The invention contemplates the possibility of supplying steam to the pad from a steam line of a steam heating system, in which case the safe operation of the pad could be insured by the utilization of pressure and temperature regulating valves in the line leading to the pad.

A temperature regulating valve that has been found to operate satisfactorily is shown in Fig. 14. The valve, indicated at 58, is simply a butterfly valve, pivotally mounted in the neck 15 and controlling the rate of flow of vapor into plenum chamber 24.

A preferred means of preparing heated vapors for the pad, I have shown in Figs. 9–10 of the drawings a steam generator which embodies a casing 25, an annular generating chamber 26 therein, a water distribution sump 27 disposed within the inner periphery of the generating chamber 26, a water reservoir 28 for supplying water to the sump 27, an annular heating element 62 for heating the water in the generating chamber 26, and an annular collector hood 29 for receiving the generated steam and directing it through an outlet connection 30, to the tube 13.

A feature of the generator is the compact coaxial arrangement of generating chamber 25, sump 27 and reservoir 25. Casing 25 may be of cylindrical shape, with a bottom 31 supported upon legs or a ring 32 of insulating material, and having a sheet of asbestos 33 insulating its inner surface against the too rapid dissipation of heat from the casing. The cylindrical wall of casing 25 is attached to bottom 31 and extends upwardly therefrom, its upper edge providing a support for the generating chamber 26.

Generating chamber 26 is of U-shaped cross section, including an annular flat bottom wall 34 and annular inner and outer walls 35 and 36 respectively to the body of the patient lying upon the pad. 37 has at its upper extremity an annular flange 37 joined thereto by an offset shoulder 38 which
rests upon the upper edge of casing 25. Inner wall 35 has a corresponding shoulder 39. Collector dome 29, which is of inverted U-shape in cross section, has its lower edges resting upon shoulders 38 and 39 respectively. Walls 35 and 36 are preferably slanted downwardly and inwardly so that the generating chamber may be separated from the wall of casing 25 by an air space to minimize heat losses through the side of the casing 25, which is of varying height, sloping from a minimum height at a point diametrically opposite connection 30 to maximum height at connection 30. This facilitates the thermo-convolutional flow of steam within collector dome 29 to outlet connections 30.

Sump 27 is connected to generating chamber 25 by one or more tubes 40 bridging the annular space between sump 27 and chamber 26. At its upper extremity, sump 27 is provided with an outwardly extending shoulder 41 upon which rests an annular, cushioning seat 42 for the shoulder 43 of reservoir 26. The seat 42 may be a length of tubing of soft rubber or the like, fixed into annular shape. Sump 27 has a rim portion 51 extending upwardly from shoulder 41 and is secured in any suitable manner, as by silver soldering, to the upper portion of inner wall 35 of the generating chamber. This provides the support for sump 27.

Attached to the mouth of reservoir 26 (which may be a conventional glass jar of gallon capacity) by means of a conventional cap 44, is a nozzle 45 through which water is delivered from the reservoir into the sump 27, maintaining a level determined by the lip of the nozzle. A corresponding level will automatically be maintained in generating chamber 26.

Heating unit 52 is of the electrical resistor type, in the form of a flat ring having a metal casing held in snug contact with the bottom wall 34 of generating chamber 25 by means of a bar or spider 45 pressing upwardly therewith. The center of bar 35 is attached to the bottom of sump 27 by means of a stud 46 the head of which is silver soldered or otherwise suitably secured to sump 27, and a nut 47 threaded onto stud 46. As shown, bar 45 is of channel section.

Control over the temperature of the vapor delivered from the generator may be effected either through the use of conventional thermostatic control mechanism, regulating the operation of heating element 52, or through the mixing valve shown in Fig. 11 which operates to admit a variable flow of air into collector dome 29 for mixture with the steam therein, to moderate the temperature thereof. In a side wall of dome 29, preferably the inner wall, is a series of air inlet apertures 48 adapted to register with corresponding apertures 49 of a valve member 50. Valve member 50 may be in the form of a valve member 50, a segment of a ring, engaged against the inner wall of collector dome 29 and resting upon the upper edge of inner wall 35 of collector chamber 26. By any suitable means, such as for example, handle 52, valve member 49 may be rotated to partially or fully close apertures 48. Within collector dome 29, a deflector baffle 53 is positioned in spaced relation to apertures 48, deflecting the steam currents rising from generator 29 so as to create suction in apertures 28, resulting in outside air being drawn through apertures 48 into the dome 29, as indicated by the arrows in Fig. 11.

Fig. 11 illustrates a thermostatic control embodying a thermostat 54 attached to the outer wall 38 of the generating chamber so as to respond directly to the temperatures in this chamber. Thermostat 54 operates to interrupt the circuit to the heating element 52 when the generating chamber reaches a selected maximum temperature, and to restore the circuit when the temperature in the generating chamber drops to a predetermined increment below such maximum temperature. To this end, the thermostat is arranged in series in the power supply circuit including conductors 55 and 56, between a connector 57 (for plugging into a conventional electric outlet) and the heating element 52. A conventional heat control adjuster including a knob 58 cooperating with an indicator dial 59 on casing 25, is utilized to set the thermostat 54 for operation at selected temperatures within a predetermined range.

One of the chief advantages of my invention is the concentration of treatment to the exact area of the body which requires the treatment. This is accomplished, in my improved method, by resting the patient's body directly upon a supporting surface having, as a component part thereof, a vapor delivery pad provided with a series of outlets, and adjusting the pad as necessary with the area to be treated. The area of the patient's body extending beyond the margin of the pad will, under the weight of the body, sag into substantial sealing contact with the supporting surface around the pad, and thus there will be a tendency to confine the vapors in a pocket defined by the impression of the pad in the patient's body. This results in a greatly improved efficiency of treatment. I am of course aware that the broad idea of applying heated vapors to a patient's body through a pad having a series of vapor outlets, has been previously proposed, but in each instance wherein attempt has been made to utilize this broad principle, so far as I am aware, there has been a failure to appreciate the possibility of concentrating the application of vapor to the area to be treated, and greatly improving the efficiency of the action of the vapor on such area, by resting the patient's body on a supporting surface including the pad as a component part thereof.

Fig. 8 shows a modified form of the invention in which a pad 10a is preformed to a spirally rolled form for use in treating a patient's limb (e.g. an arm). The pad is sufficiently flexible to permit of its being adjusted to a larger or smaller diameter as required. It may be secured in place about a limb by fastener straps 66 having button holes (not shown) to receive buttons 66 anchored in the outer side of the pad.

I claim:

1. In a hydrotherapy treatment apparatus, for use in connection with a means for supplying steam or heated water vapor, a delivery pad having at one end an inlet connection to receive the vapor and having in its upper face a series of depressions and a series of vapor outlets discharging into said depressions, said pad being provided with duct means connecting said inlet to said vapor outlets.

2. In a hydrotherapy treatment apparatus, a generally flat vapor delivery pad having an inlet to receive vapor from a suitable source of heated water vapor, said pad having an upper face provided with a series of depressions and a number of vapor outlets in said depressions, said pad including duct means branching from said inlet to said outlets for distributing the vapor from said inlet to said outlets.
3. In a hydrotherapy treatment apparatus, a vapor delivery pad, generally flat, having at one end a vapor inlet and a distributing manifold communicating therewith, said pad comprising a continuous body portion and a number of upwardly projecting portions having imperforate upper supporting faces, with a series of depressions between said portions, said portions having a number of vapor outlets opening into said depressions, and said pad including duct means providing communication between said manifold and said outlets.

4. In a hydrotherapy treatment apparatus, a vapor delivery pad, generally flat, having at one end a vapor inlet and a distributing manifold connected thereto, said pad comprising a continuous body portion and a series of spaced, generally parallel ribs projecting upwardly therefrom to define an upper supporting surface and a series of elongated channel shaped depressions between said ribs, each of said ribs having a vapor duct extending longitudinally therein, communicating with said manifold at one end and closed at the other end, and having, in its side walls, a plurality of apertures communicating with the respective vapor duct and opening into an adjacent one of said depressions, whereby vapor may be distributed from the entire area of the pad to the body of a patient resting thereupon.

5. In a hydrotherapy treatment apparatus, a vapor delivery pad comprising a generally flat body portion having at one end a vapor inlet and a distributing manifold connected thereto, and including a series of spaced, generally parallel ribs projecting upwardly therefrom to define an upper supporting surface and a series of elongated channel shaped depressions between said ribs, each of said ribs having a vapor duct extending longitudinally therein, communicating with said manifold at one end and having, in its side walls, a plurality of apertures communicating with the respective vapor duct and opening into an adjacent one of said depressions, whereby vapor may be distributed from the entire area of the pad to the body of a patient resting thereupon.

6. A vapor delivery pad as defined in claim 1, in which said ribs have walls of such thickness relative to the dimensions of said channels and ducts as to provide support for the body of a patient, sufficient to prevent such collapse of said ribs as would result in restriction of the free flow of vapor from said outlet.

7. As defined in claim 1, including an envelope of Turkish towel material enclosing said pad and functioning to assist in the distribution of the vapor to the patient's body and also to provide a soft contact surface for the patient's body.

8. In a hydrotherapy apparatus, a vapor delivery pad of flexible material having at one end a vapor inlet and a manifold defining a plenum chamber communicating with said inlet, said pad including a continuous body portion and a series of spaced, generally parallel ribs, integral with said body portion, extending upwardly therefrom and having imperforate top walls collectively defining a supporting surface and each having lateral walls spaced to define, with said top wall, a vapor duct communicating with said plenum chamber, said ribs being spaced to define a series of vapor distribution channels, open at said supporting surface, and said lateral walls each having a series of vapor outlets opening into a respective channel, said ducts tapering in cross section from a maximum at said plenum chamber to a minimum at their ends remote from said plenum chamber.

9. In a hydrotherapy apparatus, a vapor delivery pad of flexible material having at one end a vapor inlet and a manifold defining a plenum chamber communicating with said inlet, said pad including a continuous body portion and a series of spaced, generally parallel ribs, integral with said body portion, extending upwardly therefrom and having imperforate top walls collectively defining a supporting surface and each having lateral walls spaced to define, with said top wall, a vapor duct communicating with said plenum chamber, said ribs being spaced to define a series of vapor distribution channels, open at said supporting surface, and said lateral walls each having a series of vapor outlets opening into a respective channel, said ducts tapering in cross section from a maximum at said plenum chamber to a minimum at their ends remote from said plenum chamber.

10. In a hydrotherapy apparatus, a vapor delivery pad of flexible material having at one end a vapor inlet and a manifold defining a plenum chamber communicating with said inlet, said pad including a continuous body portion and a series of spaced, generally parallel ribs, integral with said body portion, extending upwardly therefrom and having imperforate top walls collectively defining a supporting surface and each having lateral walls spaced to define, with said top wall, a vapor duct communicating with said plenum chamber, said ribs being spaced to define a series of vapor distribution channels, open at said supporting surface, and said lateral walls each having a series of vapor outlets opening into a respective channel, said ducts tapering in cross section from a maximum at said plenum chamber to a minimum at their ends remote from said plenum chamber.
a series of supporting posts extending through said plenum chamber and supporting said manifold against collapse.

13. In a hydrotherapy apparatus, a vapor delivery pad of flexible material having at one end a vapor inlet and a manifold defining a plenum chamber communicating with said inlet, said pad including a continuous body portion and a series of spaced, generally parallel ribs, integral with said body portion, extending upwardly therefrom and having imperforate top walls collectively defining a supporting surface and each having lateral walls spaced to define, with said top wall, a vapor duct communicating with said plenum chamber, said ribs being spaced to define a series of vapor distribution channels, open at said supporting surface, and said lateral walls each having a series of vapor outlets opening into a respective channel, said pad being preformed in spirally rolled, tubular shape with said ribs projecting inwardly, and having separable fastener elements for securing the pad about the limb of a patient.

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