INTERNAL BODY HEATING DEVICES

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This invention relates to heat producing devices for use within the human body. More particularly, this invention relates to devices for applying heat produced by electrical or chemical means to body cavities where warmth would alleviate pain and otherwise provide comfort and aid in healing infections and other bodily malfunctions.

The use of heat as a therapeutic agent in the treatment of disease conditions of the human body is a time-honored procedure, and its effectiveness in reducing muscular tension and pain, and as a help to the body in overcoming other effects of our modern day and industrial infections, has been established. Although many devices have been constructed to apply heat to the body, they all suffer from one or more disadvantages which restrict their use.

Many of these known devices, particularly those electrical types for application of heat to the human pelvis, require the patient to remain in a bed when they are being used. This is very undesirable, particularly where the treatment period is prolonged and the patient is otherwise able to go about a normal daily routine. Many of these devices are expensive; some are so highly specialized that a skilled technician is required to operate them, so that the patient must go to the doctor's office for each treatment. Some of the heating devices are quite uncomfortable, and thus their use often results in complaints from the patient. Many of these heating devices can be used either only in body cavities or only on the outside of the body. Cleaning problems, bulkiness, and other aesthetic drawbacks are additional disadvantages of many common heating devices.

Treating diseased conditions of the body with antibiotics, creams, and other medicinals can be expensive, particularly when the treatment period is prolonged, as for instance in pelvic, prostatic, and gum infections. Sometimes, too, the response of the patient to this type of treatment is not as quick or complete as expected. Although heat will enhance the efficacy of this type of therapy, until the present invention no means were available to provide the heat in a satisfactory manner.

Accordingly, an important object of our invention is to provide portable heating devices for use in body cavities as well as on the outside of the body, all while the patient remains completely ambulatory.

Another object of our invention is to provide lightweight and comfortable heating devices, for use either within or outside of the body, which can be worn and carried about easily by the patient.

Another object of our invention is to provide less expensive body heating devices that, because they make possible more economical therapy, will be better accepted and utilized, resulting in more effective therapy.

A further object of our invention is to provide body heating devices that are quick and easy to clean and to sterilize.

Another object of our invention is to provide new heating devices that elicit ready acceptance by patients, especially from the aesthetic and psychological viewpoints.

Still another object of our invention is to provide new devices for heating the body in conjunction with, as well as in lieu of, treatment with antibiotics, creams, and other medicinals.

Further objects and advantages of our invention will become more apparent from the following detailed description thereof taken in conjunction with the accompanying drawings in which:

FIG. 1 is a plan view of one form of electrical heating device of this invention, including a diagrammatic representation of a case containing a small, lightweight portable battery that supplies an electric current to the heating element for heating generation;

FIG. 2 is a view in side elevation of the device of FIG. 1, showing how its central portion can have a slightly concave-convex configuration;

FIG. 3 is a view in section, taken along the line 3—3 of FIG. 1, showing how the metallic heating element is encased in the central portion of the heating device;

FIG. 4 is a plan view of a modified form of electrical heating device that fits over the teeth and adjacent gum tissue of one side of the mouth for treating abscessed teeth and gum infections;

FIG. 5 is a view in section, taken along the line 5—5 of FIG. 4, showing the shape of the device in the area that covers the incisor teeth;

FIG. 6 is a view in section, taken along the line 6—6 of FIG. 4 showing the shape of the device in the area that covers the molars;

FIG. 7 is a plan view of another modified form of electrical heating device designed primarily for intra-rectal use;

FIG. 8 is a view in section, taken along the line 8—8 of FIG. 7, showing the inner construction of the device;

FIG. 9 is a view in section, taken along the line 9—9 of FIG. 7, showing the cross-sectional shape of the device;

FIG. 10 is a view in side elevation of another modified form of electrical heating device, designed primarily for intra-urethral use in women;

FIG. 11 is a view in section, taken along the line 11—11 of FIG. 10, showing the cross-sectional shape of the device;

FIG. 12 is a plan view of one form of chemical heating device of this invention, similar in shape to the electrical device of FIGS. 1—3, showing the wafer-like container enclosing heat-producing chemicals in two separate compartments;

FIG. 13 is a view in section taken along the line 13—13 of FIG. 12, showing how the wafer-like container fits in between the central portion and the rim of the holding unit;

FIG. 14 is a plan view in reduced scale of a completely disposable form of chemical heating device of this invention, very similar in shape to that of FIGS. 12 and 13, but with the chemical container serving as its own holding unit;

FIG. 15 is a view in section, taken along the line 15—15 of FIG. 14, showing the inner construction of the device;

FIG. 16 is a plan view of a modified form of completely disposable chemical heating device, similar in shape to that of FIGS. 7—9, also designed primarily for intra-rectal use;

FIG. 17 is a view in section, taken along the line 17—17 of FIG. 16, showing the inner construction of the device;

FIG. 18 is a view in section, taken along the line 18—18 of FIG. 16, showing the cross-sectional shape of the device;

FIG. 19 is a view in side elevation of a modified form of chemical heating device similar in shape to that of FIGS. 10 and 11, and also designed primarily for intra-urethral use in women;

FIG. 20 is a view in section, taken along the line 20—20 of FIG. 19, showing the cross-sectional shape of the device;

FIG. 21 is a view in side elevation, partially broken away, of another form of chemical heating device of our
invention, showing an ampoule-like container enclosing heat-producing chemicals in two separate compartments, and removable handle for inserting the device in a body cavity; and

FIG. 22 is a view in section, taken along the line 22-23 of FIG. 21, showing the cross-sectional configuration of the device.

Broadly considered, our invention involves several forms of body heating devices employing, as the heat producing means, either electrical or chemical energy. These devices have several common characteristics, yet they also necessarily differ in several respects. Each device may be in any appropriate size, shape and configuration to suit the particular use for which they are intended. For example, they can be rod-like, disc or wafer-like, etc., and can be flat or contoured, round, rectangular, long or short, slender or fat, and straight or curved. They also can be perforated to avoid trapping of secretions or discharges. All the devices are constructed from innocuous materials, including plastic, rubber, or rubber-like compositions, and all are safe for use under conditions where moisture is present without danger of shock, or electrical or chemical burn.

The electrical device

As illustrated in FIGS. 1, 2, and 3, one form 30 of electrical heating device of our invention comprises a round, wafer-like diaphragm 31 with a relatively thin central membrane 32 surrounded by a peripheral annular rim 33 and a metallic electrical resistance heating element 34 encased within the member 32. In effect, the membrane 32 forms a housing for holding the heating element 34 in a fixed, generally planar position, and in a predetermined pattern extending across the membrane. A suitable length of small gauge insulated electrical conductor 35 connects the heating element 34 to a small, portable battery 36 through a plug 37 and an "off-on" switch 38 for convenience in carrying, the battery 36 can be placed in a suitable case 39, and placed in a pocket or clipped to an article of clothing by a clip 40.

The pliability of the rim 33 may vary from stiff to flexible, as long as it has sufficient strength to retain the diaphragm 31 in place: for some applications the rim may be omitted altogether. As a help in maintaining the diaphragm 31 in proper position, a helical or flat metallic, plastic, rubber, or rubber-like spring 41 (FIG. 3) can be enclosed within the annular rim 33 preferably completely sealed off from the outside so that no body fluids contact it.

In addition to the round form illustrated in FIGS. 1-3, the diaphragm 31 can be of other shapes and configurations, and can be made in any size, depending on its intended use. Although the illustrated membrane 32 is of one layer, a two-layered membrane with the heating element 34, and perhaps a few drops of heat dispersing liquid, between the layers can also be used if desired.

The membrane 32 and the rim 33 can be constructed from plastic, rubber or rubber-like material, all of which are non-conductors of electricity yet transfer heat. The rim 33 also can be made of metal, and then enclosed within any of these plastic, rubber or rubber-like materials. The insulated electrical conductor 35 connecting the battery 36 to the heating element 34 can be covered with a soft fluffy material (not shown) to prevent irritation to the patient; this material is designed to stay on when the diaphragm 31 and conductor 35 are cleansed.

Various types of batteries producing a potential of between about 1.5 to 6 volts are suitable to power the heating element 34; for example, a battery that can be recharged by connecting it to a conventional 110 volt alternating current outlet can be used, and conventional dry flash-light type batteries connected together to provide the desired voltage are also operable. In cases where mobility of the patient is not a primary consideration, a larger battery with a longer life-span will provide the proper voltage and energy to yield a comparable desired temperature rise.

The heating element 34 preferably is a wire of Nichrome, Chromel, or other suitable electrically resistant material, of a size appropriate to produce the desired amount of heat. The configuration, length, and diameter of this wire can be varied to suit particular needs, and thus the element 34 in FIGS. 1 and 3, and the corresponding elements in the other figures, are merely illustrative and not intended to be limiting.

The diaphragm 31, the conductor 35, and the plug 37 are immersible in water, and by simply unplugging the battery 36 they all can be cleansed, as with soap and water, for further use. If desired, they can also be sterilized by autoclaving, cold chemicals, and other conventional sterilizing methods well known in the medical art.

Another form of electrical heating device of this invention is illustrated in FIGS. 4, 5 and 6. This device 45 is designed for treating abcessed teeth and gum infections, and has somewhat of an I-beam cross-sectional configuration with lateral flanges 42 and 43 joined by a medial web 44. The heating element 46 courses in a continuous path through the flanges and exits as an insulated conductor 47 which is connected to a battery, etc. (not shown), in the same manner as in the diaphragm device 31 of FIGS. 1, 2 and 3.

The anterior end 48 of the gum device 45 is shaped to fit over the incisor teeth, and the posterior end 49 is shaped to fit over the molars, with the area in between shaped to fit the intermediate teeth.

In the same manner as the diaphragm device 31, the device 45 is constructed from plastic, rubber, or rubber-like material, is washable, and can be sterilized. The configuration, length, and diameter of the heating element can be varied to suit any need, as can be the composition thereof, so that the element 46 is merely illustrative and not intended to be limiting.

FIGURES 7, 8 and 9 illustrate yet another form of electrical heating device of our invention. This device 50 comprises a relatively long, narrow, and flat body 51 through which a heating element 52 courses, exiting at one end of the body 51 as an insulated conductor 53 which is connected to a battery, etc. (not shown), as are the conductors 35 and 47 of the devices 31 and 45. This device 50 is designed primarily for intra-rectal use, although it can be used within other body cavities, or upon other parts of the body if desired. The body 51 also is constructed of plastic, rubber, or rubber-like material that is washable and sterilizable, and the configuration, length, and diameter of the heating element 52 can be as illustrated or otherwise, and its composition can be varied, all just as with the elements 34 and 46.

The electrical heating device 60 of FIGURES 10 and 11 is especially suitable for intra-urethral use in women. It is comprised of a relatively long, slender, cylindrical body 61, also of plastic, rubber, or rubber-like composition, containing a heating element 62 with a convoluted or other desirable configuration and of a suitable length and diameter, as with the previous described electrical devices, the heating element 62 emerges from the body 61 as an insulated conductor 63 which is connected to a suitable battery (not shown). This intra-urethral device is washable and sterilizable as are the other electrical devices, and thus can be used repeatedly.

The chemical devices

The heating devices of our invention that make use of a chemical reaction to supply the heat all operate in the
same general manner. Broadly speaking, these devices comprise two chemical agents encapsulated separately within a plastic, rubber, or rubber-like container that is shaped to fit the particular part of the body to which it is to supply heat. These containers are so constructed that the chemicals, before use, are isolated from each other by a barrier which can be removed, separated, or even ruptured by digital pressure without damaging the outer walls of the container. When this barrier is thus eliminated, the chemical reaction occurs producing the required heat for treating the patient. The chemical agents utilized in the heating process are arranged within the container so that, as the exothermic reaction progresses, the heat produced is maintained throughout the entire heating cycle and is evenly distributed across the entire container surface.

One form of chemical heating device of this invention is illustrated in FIGS. 12 and 13. This device 70 is very similar to the electrical device 30 in that it too comprises a round, wafer-like diaphragm 71, constructed from the same 45 material and having the same properties as the diaphragm 31, with a relatively thin membrane 72 surrounded by a peripheral rim 73 enclosing a flat (or helical) spring 74.

However, here the similarity ends, for instead of a wire heating element, etc., the device 70 is fitted with a disposable wafer 75 containing the exothermically reacting chemicals 76 and 77 in two distinct compartments 78 and 79 divided by a removable, separable or fragile barrier 80. The disposable wafer 75 fits snugly into the reusable diaphragm 71 with its periphery 75e extending into the V-shaped joint formed at the intersection of the membrane 72 with the rim 73 of the diaphragm 71, yet can be inserted and removed easily by the fingers. As is evident, this diaphragm 71 may be prepared for reuse simply by cleansing, sterilizing, and inserting a new wafer 75. A length of cord 81 can be attached to the device 70 to facilitate its removal from the body cavity.

A completely disposable modification of this chemical heating device 70 is illustrated in FIGURES 14 and 15. Here, instead of an individual diaphragm and a chemical-containing wafer, all features are combined into one complete unit 82, with a membrane of two layers 83 and 84 both of which are joined along their common periphery to a rim 85. A removable, separable or fragile barrier 86 between the two membrane layers 83 and 84 divides the space between these layers into two distinct compartments 87 and 88 which house the exothermic reacting chemicals (not shown). Although the device 82 is illustrated without a spring in the rim 85, it can be constructed with a spring if desired, just as the devices 30 and 70. As with the device 70, a length of cord 89 attached to the device 82 helps in removing it from a cavity in the body.

As with the diaphragms 31 and 71, the device 82 is constructed from a plastic, rubber, or rubber-like material that is suitably flexible to fit the body part for which it was designed, and is physically and chemically suitable to assure containment of the heat producing agents.

In the same manner that the shape and size of the reusable devices can be varied, the completely disposable type of chemical heating device can be made in other shapes, and in any size, to suit the particular application. For example, as illustrated in FIGS. 16, 17, and 18, it can be relatively long, flat, and slender for intra-rectal use and, as illustrated in FIGS. 19 and 20, it can be tubular-shaped and curved, for intra-urethral use in women. Both the rectal device 91 and the urethral device 101 have two compartments 92, 93, and 102, 103, respectively, and a removable, separable or fragile barrier 94 and 104, respectively, for the chemicals, and are constructed from the same type of plastic, rubber, or rubber-like material as are the other devices. Also, both devices 91 and 101 preferably have lengths of cord 95 and 105, respectively, to provide an easy means of removal from a body cavity in which they might be placed. A somewhat different form of our chemical heating device which, although perhaps slightly more uncomfortable, can be used by ambulatory patients is illustrated in FIGS. 21 and 22. This device 110 is designed for rectal or vaginal use, and comprises a relatively short tubular body 111 with an oval or an egg-shaped end 112 integrally with the body side wall 113, and a rod-like inser-
3. An electrical heating device for applying a controlled amount of heat to a part of the human body within one of its natural cavities while the patient is ambulatory comprising a form-fitting, moisture-resistant, heat transmitting non-electrical-conducting housing portion constructed from a physiologically and chemically innocuous material said housing portion having a resiliently flexible relatively thin configuration and shaped to conform to a particular internal area of the body of the patient, a metallic electrical-resistance heating element incased within the material of which said housing portion is constructed, a lightweight, portable battery capable of providing a low voltage electrical current, a length of flexible, insulated electrical conductor establishing a circuit including said heating element and said battery, wherein said housing portion is I-beam shaped in cross-sectional configuration with flange-like sides joined by a medial web-like portion, is relatively long, slender, and slightly curved, and the heating element is disposed mainly along the edges of the flange-like sides.

4. A heating device for applying a controlled amount of heat to various parts of the body while the patient is ambulatory, comprising a form-fitting, moisture-resistant, heat-transmitting and generally planar housing portion constructed from a physiologically and chemically innocuous material that is resiliently flexible and shaped to be retained in a predetermined position within a natural body cavity of the patient, said housing portion having a cellular structure including a series of adjacent compartments formed by frangible barrier portions, an exothermically reacting chemical residing in each of said individual compartments, whereby said barrier portions can be fractured by digital pressure to allow the intermixing of said chemicals to produce heat within said housing portion.

5. The device of claim 4 wherein said housing portion comprises a generally round, sheet-like membrane with a thickened, annular, peripheral rim, and the chemicals are enclosed in a separate, generally round, water-like disposable package that fits into the said housing portion.

6. The device of claim 4 wherein the housing portion comprises an annular rim surrounding and continuously attached to a generally round, two-layered membrane separated by the barrier into two compartments for storing the chemicals.

7. A therapeutic heating device for applying a controlled amount of heat directly to a part of the human body within one of its natural cavities while the patient is ambulatory, said device comprising a form-fitting, heat transmitting, non-electrical-conducting membrane member constructed from a physiologically and chemically innocuous material, said membrane being resiliently flexible and relatively thin with a slight concavity in cross-section and generally circular in plan form; a reinforced and slightly thicker rim portion of elastomeric material attached to the periphery of said membrane member capable of distending folds of tissue within a body cavity adjacent the area being treated; a metallic electrical-resistance heating element incased within said membrane and extending back and forth across it in a predetermined pattern; a lightweight, portable battery capable of providing a low voltage electrical current; and a length of flexible, insulated electrical conductor establishing a circuit including said heating element and said battery.

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