April 30, 1940. K. L. COOLEY 2,198,989

WET COMPRESS

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Fig. 1.

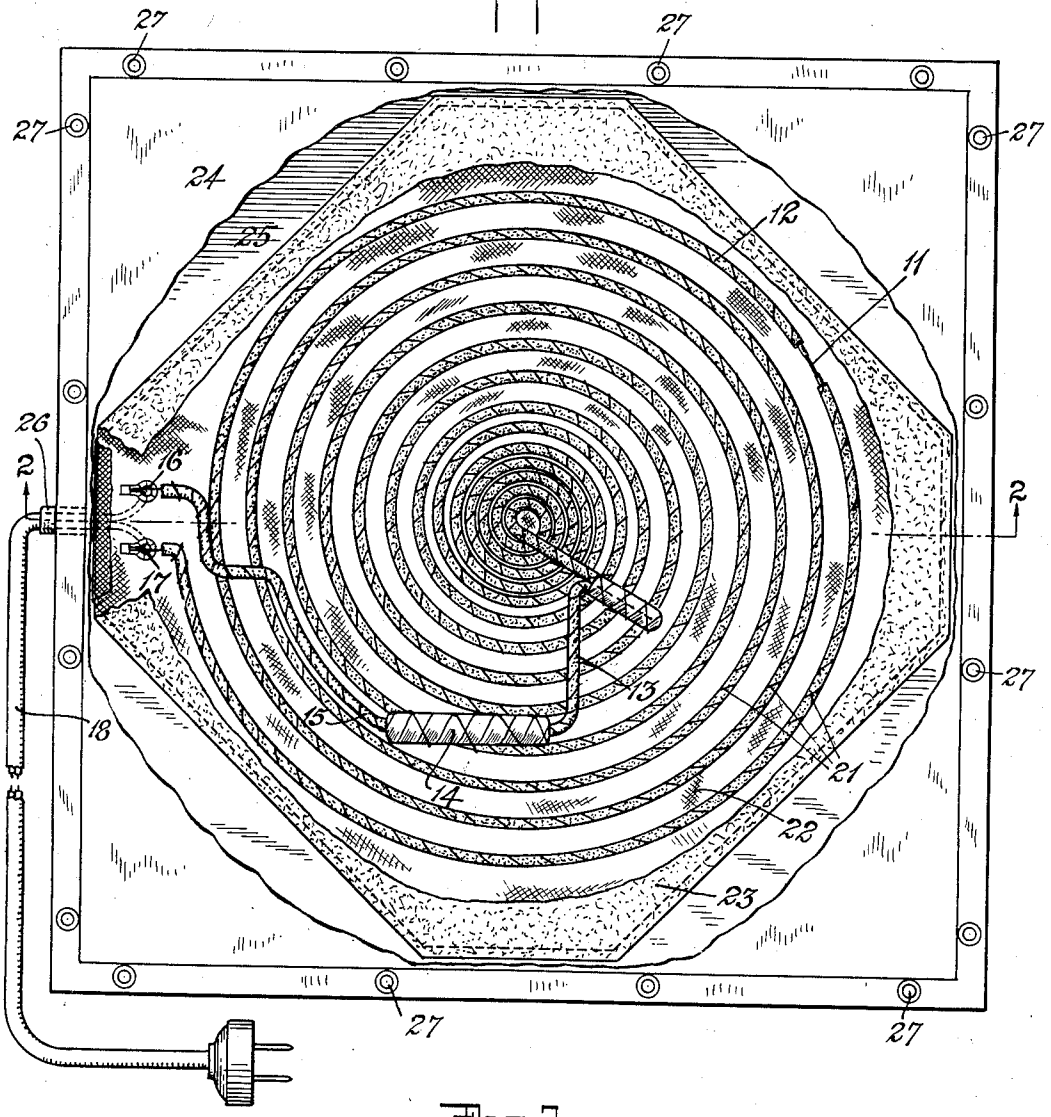
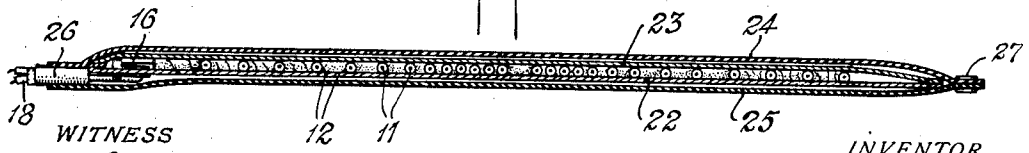


Fig. 2.



WITNESS

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BY

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April 30, 1940. K. L. COOLEY 2,198,989

WET COMPRESS

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Fig. 4.

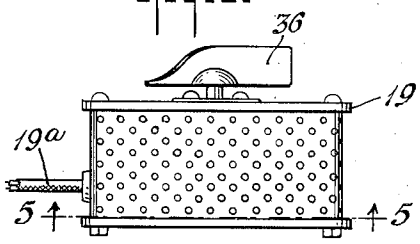


Fig. 3.

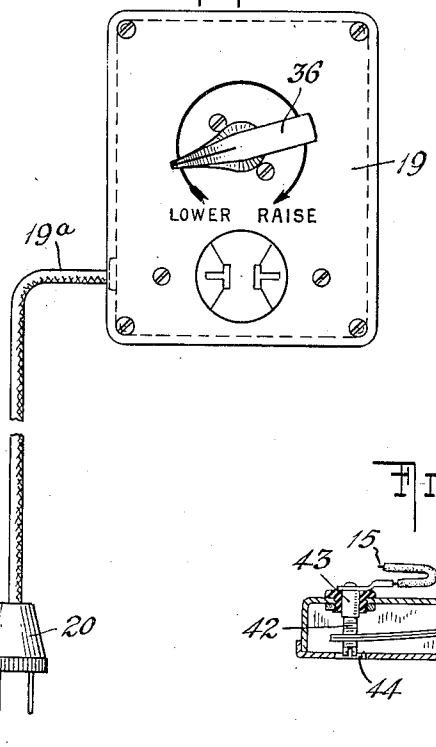


Fig. 5.

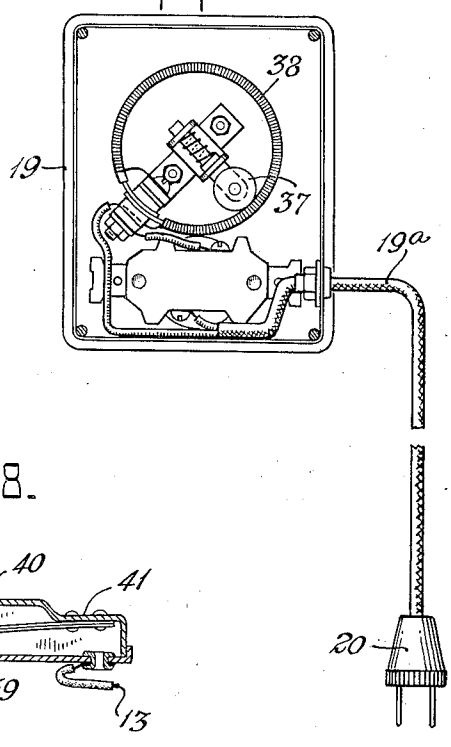
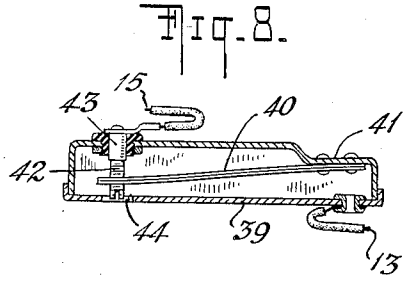


Fig. 8.



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WET COMPRESS

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Fig. 6.

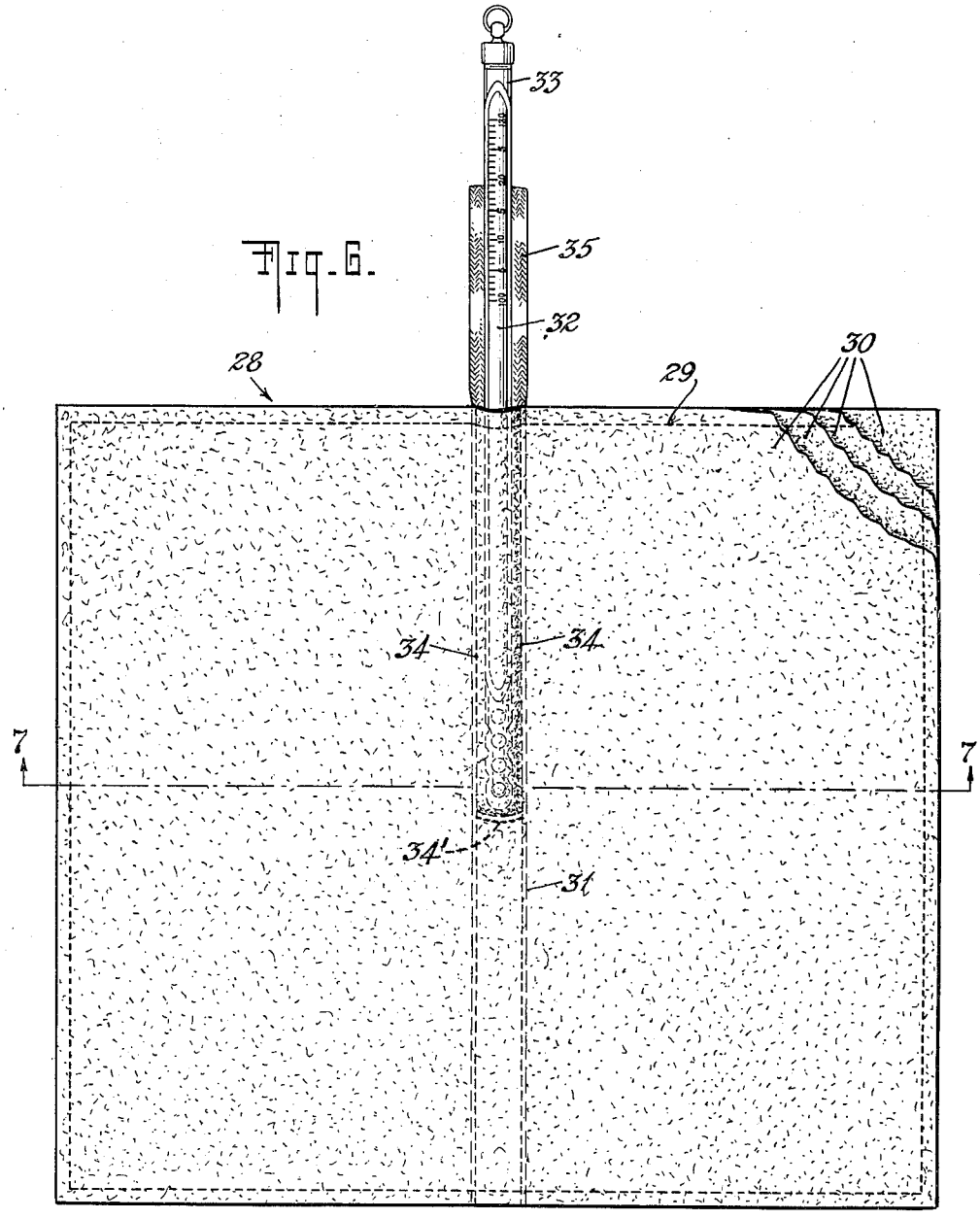
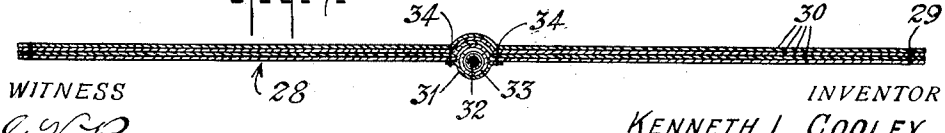


Fig. 7.



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WET COMPRESS

Filed March 20, 1937 5 Sheets-Sheet 4

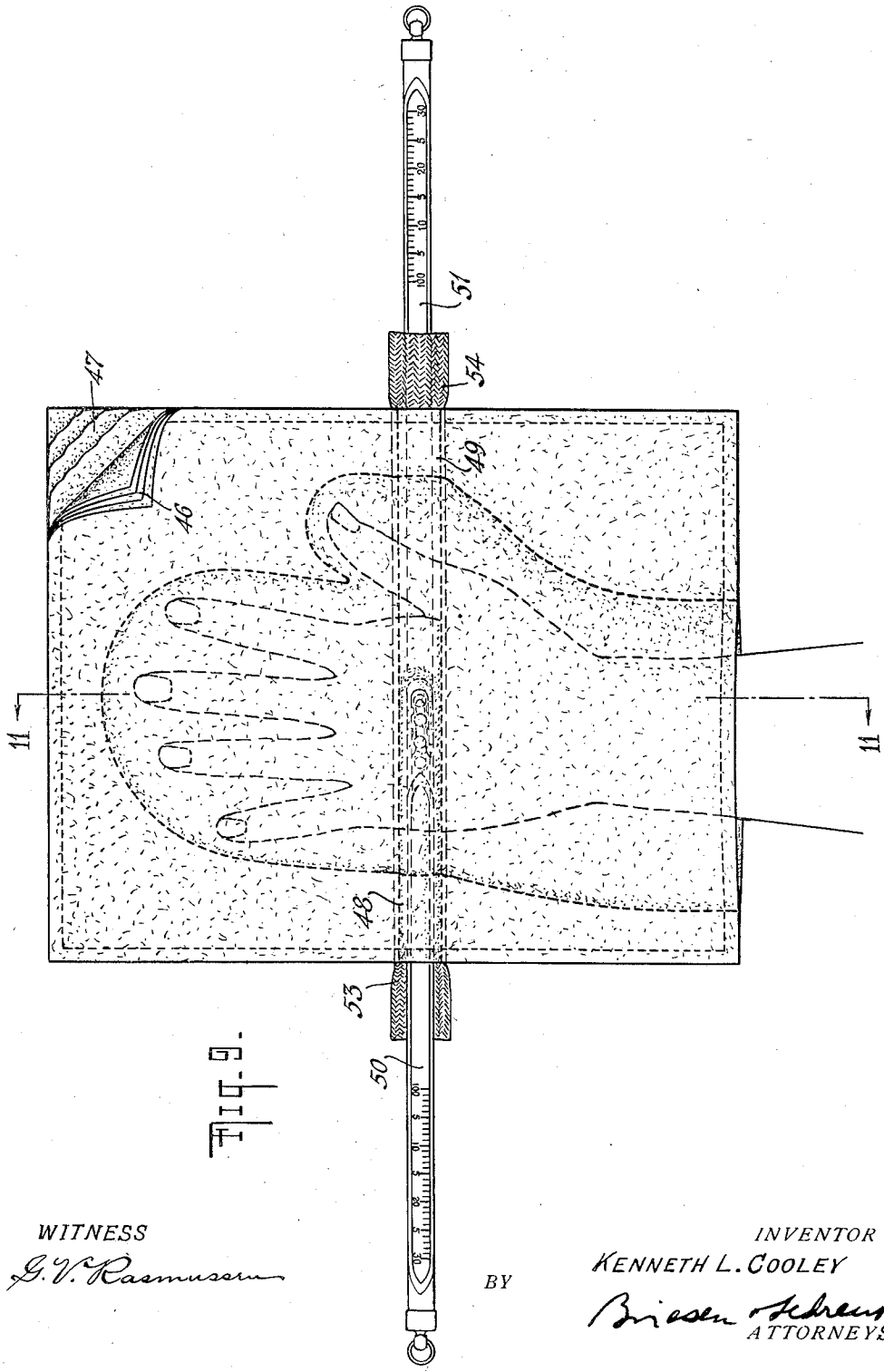

Fig. 9.

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WET COMPRESS

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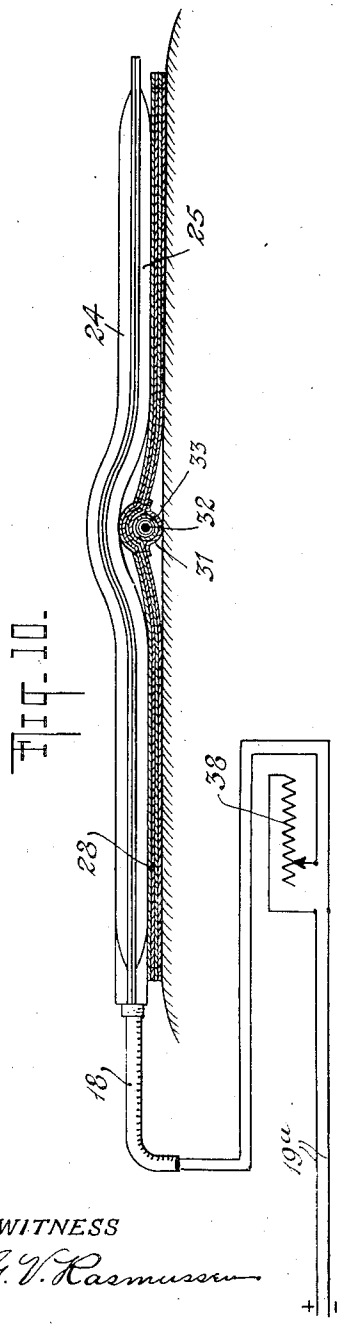

Fig. 10.

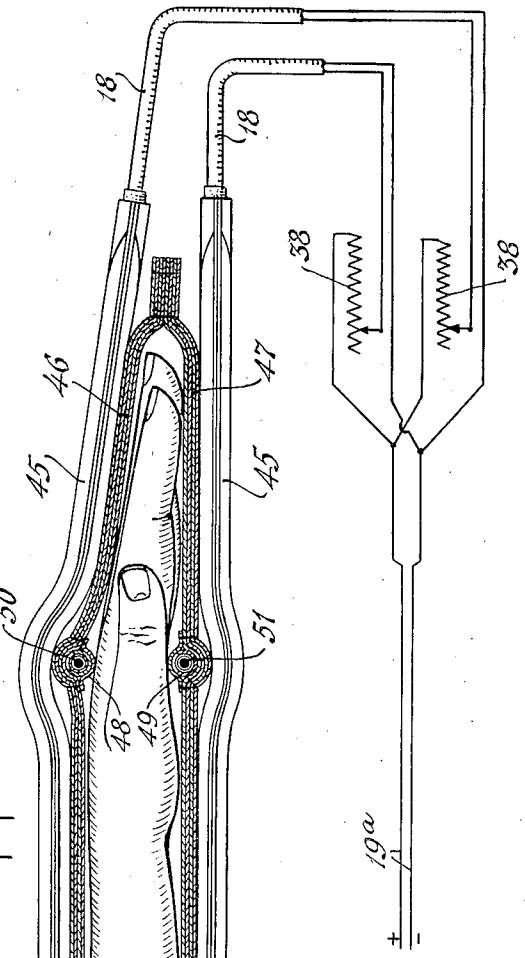

Fig. 11.

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Patented Apr. 30, 1940 2,198,989

UNITED STATES PATENT OFFICE

2,198,989

WET COMPRESS

Kenneth L. Cooley, New York, N. Y.

Application March 20, 1937, Serial No. 132,047

8 Claims. (Cl. 128—254)

My invention relates to wet compresses and more particularly to electrically operated devices of this type for use in the local application of wet heat to diseased or infected parts of the body.

It is the general object of the invention to provide an improved heating appliance of simple and reliable construction wherewith it is possible to maintain wet compresses at controlled, relatively high temperatures, say of about 110° to 118° F., at the surface of the skin without danger to it or to the surrounding tissue.

It is a further object of the invention to provide an electrically heated wet compress wherewith the desired elevated temperature is applied within a restricted area, so that the compress becomes eminently adapted for the treatment of superficial infections such as furuncles, carbuncles, cellulitis, lymphangitis, etc., or any condition where wet compresses of constant temperature are indicated as in cases of skin grafting, etc.

It is also an object of the invention to provide an electrically operated wet compress which can be safely employed without danger of short circuiting the heating elements.

It is a still further object of the invention to provide an electrically heated wet compress in which the distribution of the heat-emitting elements is such that a maximum heat area is provided within a selected portion of the compress, generally at the center of the compress, while the areas surrounding such high heat area are maintained at a gradually falling heat concentration gradient, whereby the surfaces of the body adjoining the treated portion receive a lower degree of heat concentration than the treated portion.

The present invention contemplates also the provision of a recess or receptacle in a cloth portion of a compress for the insertion of a thermometer whereby the temperature as near as possible to the treated skin surface can be easily ascertained; and also of mechanism associated with the pad for controlling the degree of the applied heat.

The present invention embodies certain principles and discoveries which I have made during the course of a long study of the action of wet compresses and the influence of such compresses and the treated portion of the body upon each other. I have found that when a hot compress whose temperature exceeds that of the skin is brought into contact with the human body the entire body functions as a heat-absorbing or refrigerating member because of the physiological forces which the body brings into action in the attempt to reduce the temperature of the hot compress at the heated part of the body. The control mechanism of the body strives normally to equalize the temperature of the body and keep it, as is known, at a constant temperature of roughly 97°–99° F. When, therefore, an electrically heated compress is applied at a temperature of a value of, say, 110° F., the body seeks to reduce the temperature of the skin surface which is in contact with the compress by absorbing and conveying away the excess heat. This action takes place by way of the vascular system.

Due to this refrigerating effect of the human body, it becomes necessary to maintain a temperature of the order of 150°–180° in the metal coils of the heating unit in order that a temperature of the order of 110°–118° may be realized at the skin surface. This condition in turn creates the difficulty that when an ordinary heating pad is used the temperature developed at the parts thereof not in contact with the skin will be so high that if the patient moves and his skin comes into contact with the hotter parts of the pad, a burn will ensue. In the ordinary heating pad the mass of heat is more or less equally distributed throughout the heating unit and when such pads have been attempted to be used, burns have resulted, particularly at or near the periphery of the coiled wire. The reason for this is that the periphery of the wire often loses its contact with the skin for one reason or another with the result that a temperature approaching that in the unit itself builds up in the cloth compress between it and the skin in these regions. If thereupon the patient moves so as to approach this area and to permit its excessive temperature to become effective against the surface of the skin, the result would be a burn. Furthermore, when the usual manner of heating unit construction is adopted as in the case of ordinary electric heating pads, experiments have demonstrated that when such heating pads enclosed within a waterproof cover are used to supply heat to a wet compress, hot spots result. For these and similar reasons the use of electrically heated wet compresses has generally been unsatisfactory and relatively a complete failure. I have found, however, that by constructing the heating unit in a special manner I am able to eliminate the major factors which caused past difficulties. The principle involved is based upon a conception that the heating unit itself should

be so constructed that it shall have an area of maximum heat concentration in the region where the compress is to contact with the patient and that all other parts of the heating unit shall be such as to supply heat areas of diminishing heat concentration. This result is brought about by arranging the heating coil itself in the heating unit in the form of an involute coil, the coils being fairly close together at the center and becoming more and more widely spaced toward the periphery of the heating unit. In this type of construction, although the temperature of the wire is the same, the gradually increasing space between the wires establishes a condition in the direction of the periphery of the unit such that the heating areas of the compress becomes gradually less and less in directions toward the periphery of the unit. Accordingly, if the temperature of the wires is maintained at say 180°, and the heat which reaches the skin has a temperature of say 118° where the skin is in contact with the most concentrated heat area of the compress, the heating areas of the compress in all directions away from the point of contact with the skin are of reduced intensity because the wire constituting the coil becomes gradually more and more spaced apart. In this way that proper distribution of heat which is of the highest importance both for efficiency and safety of the patient is accomplished.

In the preferred manner of employing the heating unit of this invention, a wet cloth compress is positioned between the heating unit and the skin. In that connection it is highly desirable to keep the cloth compress moist for a period of approximately twelve to fifteen hours. In order to do this several thicknesses of water-absorbing material are necessary and I have found by experience that a compress of four-ply outing flannel will absorb sufficient fluid to keep the hot compress wet for the desired length of time and that if the cloth portion of the compress is made much thicker it would operate to over-insulate with respect to temperature. On the other hand, if the cloth portion of the compress is less thick, it would not remain moist for a sufficiently long period. The fluid may, of course, be water, a germicide, a salt solution, or in fact any fluid appropriate to the condition under treatment. The cloth portion of the compress can be autoclaved to become absolutely sterile so that it can be used directly on and in connection with open wounds.

Another important item is the control of the temperature as near as possible to the skin in the area of contact. Accordingly provision is made for the maintenance in the compress, as close to the skin as possible, of a thermometer. The thermometer itself should not touch the skin directly. The temperature recorded on the thermometer is, of course, not the actual temperature of the skin but it is approximately that temperature.

I also regard it as important that the heating unit be under the control of a rheostat because so many elements enter into the question of obtaining the most desired temperature at the skin of the patient. It is necessary to get sufficient heat and also quite as necessary not to get too much heat and the temperature at the skin depends on factors such as the size of the patient, the part of the body which is under treatment, humidity, atmospheric pressure, and many other conditions which necessitate having the apparatus under control so that the result aimed at so far as temperature at the skin of the patient is concerned, can be definitely achieved.

All of the different components of the structure are therefore interrelated and the combination between them is necessary to produce the most desirable result.

A preferred form of the invention embodying the principles above set forth is shown by way of illustration with the accompanying drawings. In said drawings:

Fig. 1 shows a section through my improved heating unit, parts being broken away to reveal the internal structure, the pad being of a type adapted to be tied or strapped to a part of the body, such as the back;

Fig. 2 is a cross section taken along line 2—2 of Fig. 1;

Fig. 3 is a plan view of a control box or rheostat for regulating the temperature of the heating coil;

Fig. 4 is an elevational view of the control box;

Fig. 5 is a section of the control box taken along the line 5—5 of Fig. 4;

Fig. 6 is a plan view of a cloth compress adapted to be employed in conjunction with the heating unit shown in Fig. 1;

Fig. 7 is a cross section along line 7—7 of Fig. 6;

Fig. 8 shows a thermostatic safety switch which may be, and preferably is, employed with the heating unit;

Fig. 9 shows a cloth compress constructed in the form of a mitten and embodying two heating units for applying heat to both sides of the hand;

Fig. 10 is an outside edge view of the heating unit of Figs. 1 and 2 of the compress and thermometer of Figs. 6 and 7, and, diagrammatically, of the rheostat and its electrical connections, all in their relative positions when in use;

Fig. 11 is a section on line 11—11 of Fig. 9, the heating units being shown in outline and the rheostat and electrical connections diagrammatically.

In the preferred form of the invention the heat-generating unit of the apparatus is composed of a heating coil 11 enveloped by a closed casing 24—25 (Fig. 2) completely impervious to hot moisture so that it may be placed in contact with a wet compress without danger of short circuiting the heating element or elements.

In the form of the invention illustrated, the heat-generating unit includes a heating element 11 in the form of a woven resistance wire of standard type which is sheathed by asbestos 12. This heating element is arranged in the form of an involute coil wherein, as illustrated, the coils are positioned relatively close to each other at the center of the pad but increase in diameter toward the periphery of the pad. In this way the heat is concentrated at the center of the pad, such center, in the use of the pad, being positioned directly over the part of the body to be treated, there being an increased spacing between the coils, as the distance from the center increases. The involute coil arrangement of the heating element shown in Fig. 1 has been found by me to provide the most satisfactory distribution of the heat, enabling the infected part to be kept at the desired elevated temperature without danger of overheating or burning the adjacent tissues. The involute arrangement of the heating element produces a uniform and gradual diminution of the heat areas along any radius from the center toward the periphery, and is ex-

cellently suited for the local application of high temperatures to diseased areas.

The inner end of the involute resistance coil is connected to an asbestos-covered wire 13 leading to a thermostatic safety switch 14, described in detail below, a conductor 15 leading from the switch to a terminal 16, while the outermost coil of the resistance element is connected to a terminal 17. From the terminals 16 and 17 runs a cable 18 to a device for controlling the magnitude of the heating current, such as a rheostat 19 (Figs. 3, 4, and 5). The rheostat is adapted to be connected by way of a cable 19a and plug 20 to a socket connected with a source of electric energy, such as the house current supply.

The resistance coil 11 is secured (Fig. 1), as by stitching 21, to a relatively light backing 22, such as cheese-cloth, which acts to keep the coil in its predetermined shape and position without interfering with the transmission of heat. Above the coil it is desirable to position one or more layers of flannel 23, whose function is to reduce the temperature on the upper surface of the heating unit. The heating unit, together with the layers of cheese-cloth and flannel, are positioned between layers of waterproof material, preferably rubber or rubberized sheets 24 and 25 which are vulcanized along the edges so as to produce a completely waterproof casing for the heating coil. This rubber or rubberized casing is provided with a sleeve 26 vulcanized to the upper and lower parts of the casing, the sleeve receiving the cable 18 in water-tight manner.

The casing for the heating element shown is roughly of square form and, if desired, may be provided with reinforced apertures 27 for receiving tapes or straps by means of which the heating unit may be secured to the body of the patient or with the aid of which a detachable compress may be secured to the heating pad.

The cloth portion of the compress adapted to be employed with the heating unit above described, is shown at 28 in Fig. 6 and consists preferably of four plies 30 of outing flannel, secured to each other, as by stitching 29, each ply being of the usual thickness in which this material is obtained. The flannel of the compress is adapted to be moistened and is placed upon the part of the body to be treated with the heating unit held in position upon the flannel compress 28.

In order to enable the attending physician to ascertain quickly the temperature which is being applied at the skin contact section of the compress, I provide a narrow strip of tape 31 stitched at 34 at its edges upon the underside of the cloth compress to form a tubular recess for receiving a thermometer 32. The recess extends across the center of the compress, that is, the portion underlying the center of the heating element of the heating pad, and is closed as by stitches 34' so as to position the bulb of the thermometer at the center of the compress. The cloth or tape strip 31 is relatively thin and thus enables the applied temperature at the infected part to be determined with reasonable accuracy. The tape 31 extends as at 35 beyond one edge of the compress, this serving to guide the thermometer into the recess and also to serve as a backing or screen against which the thermometer may be read and to indicate that end of the recess through which the thermometer is to be inserted.

The thermometer itself is preferably protected against breakage by inclusion within a soft rubber or metal casing indicated at 33.

The rheostat shown in Figs. 3–5 enables the patient or physician to control the degree of heat applied to the infected part. The rheostat may be of any known and suitable construction, and in the form shown includes a fingerpiece 36 which is adapted to move, if desired, over a suitable scale and to which is attached a contact member 37 in the form of a roller which rides over a resistance coil 38. By suitable operation of the fingerpiece 36 the magnitude of the current traversing the heating element 11 can be regulated.

To prevent an excessive current in the heating unit, I provide the thermostatic safety switch hereinbefore referred to, such switch consisting of a base plate 39 to which the conductor 13 leading from the heating coil is attached. The base plate is made of metal and is conductingly connected with a bi-metallic bar 40, which is secured at one end to the casing 41 mounted upon the base plate 39. The free end of the bar 40 is provided with a contact in the form of an adjustable screw 42 which is adapted to cooperate with a fixed insulated terminal 43 to which the conductor 15 is connected. When the contacts 42 and 43 are in engagement, the circuit to the heating coil 11 is closed, and the heating current traverses the bi-metallic bar 40. In the event of an excessive current, the bar 40 becomes distorted and moves downwardly at its free end, thereby separating the contacts 42 and 43 and opening the heating coil circuit. The base plate 39 is provided with an aperture 44 into which the head of the contact screw 42 extends, and by adjustment of such screw the maximum allowable current can be regulated before the safety switch together with the heating coil are enclosed in the rubber covers 24, 25, and these covers are vulcanized together at their edges. The safety switch may be entirely omitted as it provides protection to the heating unit and not to the patient being treated.

In the use of my improved heating appliance, it will be found that at the under surface of the compress, directly below the center of the involute coil, the flow of heat to the contacting body is highest, and falls off toward the periphery of the pad. The tissues of lower heat-absorbing capacity are thus compelled to take up only so much heat as they are able to dissipate without becoming overheated. This desirable heat distribution is aided by the flannel pad or compress of the four-ply constructions described.

The device shown in Figs. 9 and 11 is especially designed to apply heat to both sides of an infected hand and, as shown, is in the form of a mitten. It is composed of two heating units 45 constructed similarly to the unit shown in Figs. 1 and 2, there being a four-ply layer of flannel both above and below the hand, as shown at 46 and 47. Each of the two halves of the cloth compress is provided with a cloth casing or thermometer sleeve, sleeve 48 receiving thermometer 50 and sleeve 49 receiving thermometer 51. The two sleeves 48 and 49, formed by the use of tapes 53 and 54, are formed upon the hand side of the two halves of the cloth compress so that the thermometer 50 will indicate the temperature of the back of the hand while thermometer 51 indicates the temperature at the palm of the hand. The heating units indicated as 45 in Fig. 11 are preferably the same in general construction as those of Figs. 1 and 2, including the involute heating coil and water-tight casing. The apparatus shown in Fig. 9 affords a very convenient and safe way of applying controlled, elevated temperatures to both sides of an infected

hand area without danger of burning or overheating other parts of the hand.

Parts of my improved wet compress may be used without others although they function to best advantage when all are in proper cooperative relation, and variations in the shape, arrangement, relative size, etc. of parts may be resorted to within the scope of the appended claims without departing from the spirit of the invention.

I claim:

1. A wet compress comprising a liquid-retaining fabric pad adapted to be placed in contact with the skin, an electrical heating unit overlying said fabric pad and including a flat layer of flexible material, a resistance heating element connected to said layer and distributed over the area of the same so as to establish a substantially centrally located restricted area of maximum heat concentration and a concentrical gradually falling heat concentration gradient from such restricted area to the edges of said unit, a liquid-tight flexible casing entirely enclosing said layer of flexible material and said resistance heating element, a thermometer pocket underlying said fabric pad, for locating the bulb of a thermometer within said restricted area and means associated with said resistance heating element for establishing a connection with mechanism adapted to produce a predetermined temperature effect at said restricted area.

2. A wet compress comprising an absorbent liquid-retaining pad adapted to be placed on the part of the body being treated, an electrical heating unit overlying said pad and including a flat layer of flexible material, a resistance heating element connected to said layer and distributed over the area of the same so as to establish a restricted area of maximum heat concentration and a concentrical falling heat concentration gradient from such restricted area to the edges of said unit, a liquid-tight flexible casing entirely enclosing said layer of flexible material and said resistance heating element and means operatively associated with said resistance heating element for connection with mechanism adapted to impart the desired temperature effects at said restricted area.

3. A wet compress comprising an absorbent liquid-retaining pad adapted to be placed on the part of the body being treated, an electrical heating unit overlying said pad and including a flat layer of flexible material, a resistance heating element connected to said layer and distributed over the area of the same in the form of a spiral, the interior central coils of which are positioned closely adjacent to one another so as to establish a restricted area of maximum heat concentration and the remaining coils of which are more widely spaced from one another, the spaces between such remaining coils gradually increasing from said restricted area to the edges of the unit so as to establish a falling heat concentration gradient from such restricted area to the edges of said unit, a liquid-tight flexible casing enclosing said layer of flexible material and said resistance heating element and means operatively connected to said resistance heating element for connection with mechanism adapted to impart the desired temperature effects at said restricted area.

4. A wet compress comprising an absorbent liquid-retaining pad adapted to be placed on the part of the body being treated, an electrical heating unit overlying said pad and including a flat layer of flexible material, a resistance heating element connected to said layer and distributed over the area of the same in the form of a spiral, the interior central coils of which are positioned closely adjacent to one another so as to establish a centrally located restricted area of maximum heat concentration and the remaining coils of which are variably spaced from one another, the spaces between such remaining coils gradually increasing from said restricted area to the edges of the unit so as to establish a concentrical gradually falling heat concentration gradient from such restricted area to the edges of said unit, a liquid-tight flexible casing enclosing said layer of flexible material and said resistance heating element, a thermometer underlying said pad and having its bulb end located within said restricted area and its stem extending through said concentrical gradient area toward the outer edges of said pad, a layer of fabric underlying the bulb end of the thermometer, means securing said fabric to said pad, said means extending lengthwise of said stem and on both sides of the latter and extending transversely to said thermometer within the region defined by said restricted area so as to form a stop for locating the bulb within such area and mechanism connected to said resistance heating element for producing a predetermined temperature effect at said restricted area.

5. A wet compress comprising a flat absorbent liquid-retaining pad adapted to be placed on the part of the body being treated, an electrical heating unit overlying said pad and including a flat layer of relatively thin fabric material, a resistance heating element disposed upon one surface of said fabric material and distributed over the area of the same in the form of a spiral, the interior central coils of which are positioned closely adjacent to one another so as to establish a centrally located restricted area of maximum heat concentration and the remaining coils of which are variably spaced from one another, the spaces between such remaining coils increasing from said restricted area to the edges of the unit so as to establish a concentrical gradually falling heat concentration gradient from such restricted area to the edges of said unit, a layer of material of low heat conductivity overlying said heating element and a liquid-tight rubber casing housing said layers of material and said heating element, a pocket on said pad for a temperature responsive device within the region defined by said restricted area and mechanism connected to said resistance heating element for producing a predetermined temperature effect at said restricted area.

6. A wet compress comprising an absorbent liquid-retaining pad adapted to be placed on the part of the body being treated, an electrical heating unit overlying said pad and including a flat layer of flexible material, a resistance heating element connected to said layer and distributed over the area of the same in the form of a spiral, the interior central coils of which are positioned closely adjacent to one another so as to establish a restricted area of maximum heat concentration and the remaining coils of which are more widely spaced from one another so as to establish a falling heat concentration gradient from such restricted area to the edges of said unit, a liquid-tight flexible casing enclosing said layer of flexible material and said resistance heating element, a strip of fabric underlying said pad and extending through said concentrical gradient area to said restricted area, and means securing said

fabric strip to said pad, said means extending longitudinally of said strip so as to form with said strip a sleeve adapted to receive a thermometer and being positioned in the central portion of said strip within the region defined by said restricted area so as to form a stop for locating the bulb of the thermometer within such area.

7. A wet compress comprising an absorbent liquid-retaining pad adapted to be placed on the part of the body being treated, an electrical heating unit overlying said pad and including a flat layer of flexible material, a resistance heating element connected to said layer and distributed over the area of the same in the form of a spiral, the interior central coils of which are positioned closely adjacent to on another so as to establish a restricted area of maximum heat concentration and the remaining coils of which are more widely spaced from one another so as to establish a falling heat concentration gradient from such restricted area to the edges of said unit, and a liquid-tight flexible casing enclosing said layer of flexible material and said resistance heating element.

8. An electrical heating unit for use in a wet compress having an absorbent liquid-retaining pad adapted to be placed on the part of the body being treated, comprising a flat layer of flexible material, a resistance heating element connected to said layer and distributed over the area of the same in the form of a spiral, the interior central coils of which are positioned closely adjacent to one another so as to establish a restricted area of maximum heat concentration and the remaining coils of which are more widely spaced from one another so as to establish a falling heat concentration gradient from such restricted area to the edges of said unit, a liquid-tight flexible casing enclosing said layer of flexible material and said resistance heating element and means projecting from said liquid-tight casing for connection with a source of electric current.

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