April 8, 1941. E. C. TAYLOR 2,237,852

THREE-HEAT PAD

Filed Nov. 20, 1940

Fig. 1.

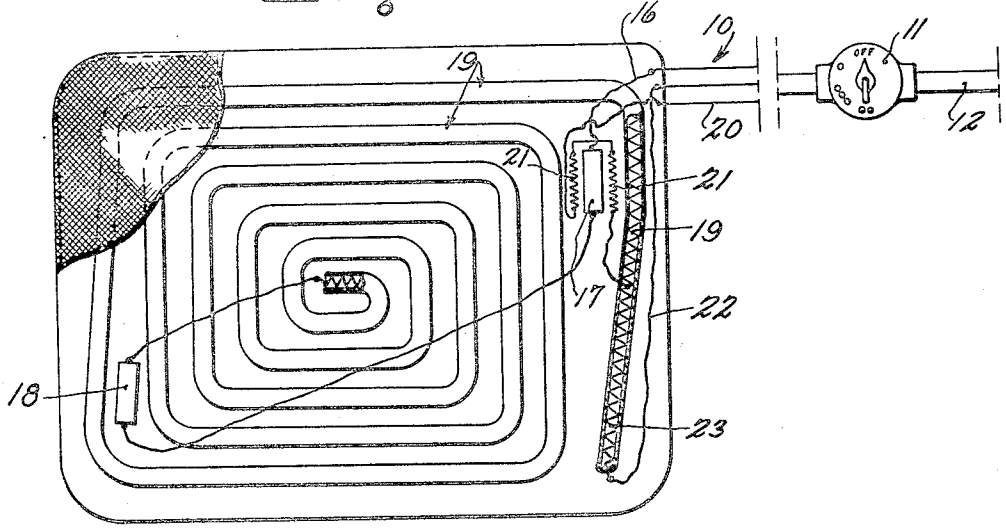


Fig. 2.

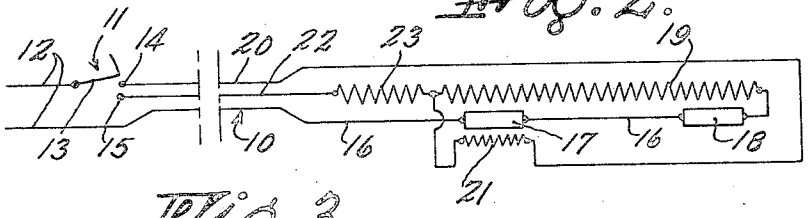


Fig. 3.

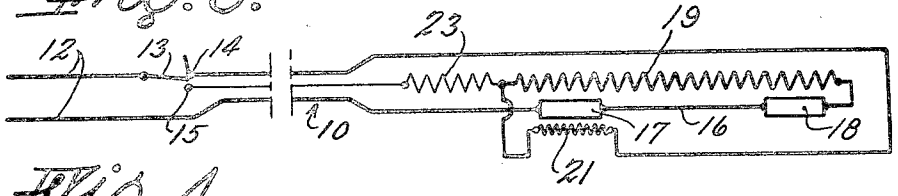


Fig. 4.

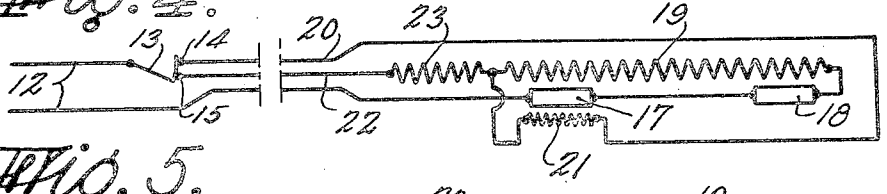


Fig. 5.

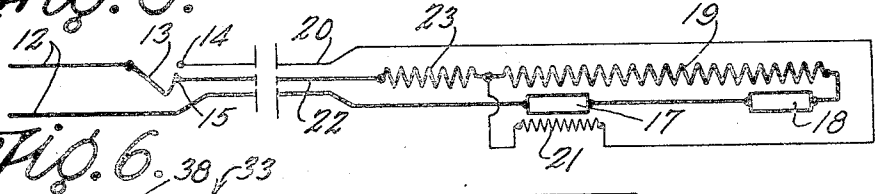
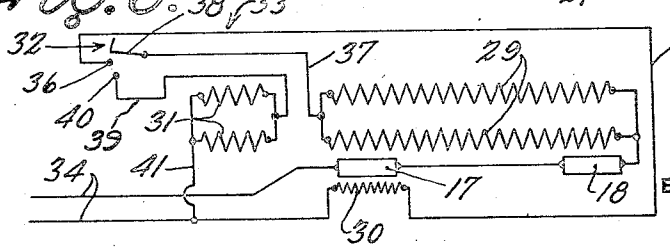


Fig. 6.



INVENTOR
EDWARD C. TAYLOR
BY Clapin & Neal
ATTORNEYS

Patented Apr. 8, 1941 2,237,852

UNITED STATES PATENT OFFICE

2,237,852

THREE-HEAT PAD

Edward C. Taylor, Longmeadow, Mass., assignor to William Bradford, Taunton, Mass.

Application November 20, 1940, Serial No. 366,357

10 Claims. (Cl. 219—46)

Electrical heating devices of the flexible type used for application of heat to the human body require exact, easily regulated control of the temperature at which they operate. Various forms of control, such as a plurality of thermostats having their contacts permanently set for different temperatures or a single thermostat with adjustable contacts, have been proposed for this purpose. Such devices are bulky and increase the rigidity and bulk of the pad where this is undesirable. This is particularly true of the adjustable type of thermostat, while the use of plural thermostats of different settings requires the use of a four conductor cord to an outside switch in order to secure three heats, and the use of at least four thermostats since for the sake of safety one high temperature thermostat must be placed at each end of the pad and at least two others are needed for the other two heats.

A second suggestion has been the use of a supplementary thermostat-heating coil, the current through which was regulated either by an external resistance, objectionable because of the waste of current in the external resistance and the danger and inconvenience caused by this external source of heat; or by connecting one or more of these supplementary heating coils in various ways with a plurality of main heating coils which were operated either in series or parallel to obtain low, medium, or high heat. The latter type of circuit, because of the necessity of connecting the coil in series alternatively with two active main heating elements limits the separation obtainable between low and medium temperatures, which tend to be only a few degrees apart.

It is the object of the invention to provide a circuit for a heating pad which will, with a three wire conductor leading to an outside switch and a single non-variable control thermostat, produce three well separated heats which can be set relative to each other in any way desired. A further object is to cause operation of the thermostat by a supplementary heating coil which is in series with the main heating coil on low heat, is cut out of the circuit on high heat, and has a part of the current shunted around it on medium heat. A further object is to provide shunting means for the thermostat heating coil which forms part of the main heating coil on high and medium heats, so that all the energy converted into heat in the several resistances is utilized directly in the heating of the pad. A further object is to provide a circuit of this character in which all control of the pad may be secured from the outside through a simple switch, and which will require no additional structure in the pad itself besides the main heating coil, a simple thermostat with a loop of resistance wire around it, and a few lead wires.

These results are accomplished by placing in the pad a supplementary thermostat heating loop or coil of resistance wire positioned closely adjacent the control thermostat, which is placed between one or more turns of the main heating coil. On low heat the loop is in series with the main heater, and thus receives through it all the current passing through the main heating coil. The thermostat will in this case be heated by both coils, although mainly by the thermostat loop, and will warm up much more rapidly than the body of the pad which is heated only by the main heater. The thermostat will be caused to reach the temperature at which it opens quicker than the body of the pad, and since the opening of the thermostat breaks the current through the main heating coil the pad will be kept at this lower temperature. For medium heat the amount of heat supplied to the thermostat by the supplementary coil is reduced by shunting a part of the current away from it by a control or ballast resistance which may for convenience be formed as a continuation of the main heater. On high heat this control resistance is in series with, and acts as a part of, the main heater; the supplementary thermostat heater being entirely disconnected.

These various features will be made clear by reference to the accompanying drawing, in which—

Fig. 1 is a diagrammatic view of a heating pad constructed in accordance with this invention;

Fig. 2 is a diagram of the circuit where a single main heating coil is used;

Figs. 3, 4, and 5 are diagrams showings the circuit in low, medium, and high heat settings respectively; and

Fig. 6 is a diagram showing certain modifications.

Referring first to Figs. 2 to 5, the circuit is connected to a source of electric power by a three wire conductor 10 and a switch 11 to which the usual two wire power line 12 is coupled. The switch has a switch blade 13 coacting with a pair of points 14 and 15, the blade being wide enough so that it may contact each point separately or take an intermediate position in contact with both of them. The blade of course has an "off" position where it makes contact with neither point. This form of switch is standard in the art and need not be described in detail, although as will be pointed out below it is utilized in an unconventional way, since the medium rather than the high heat setting is with the blade bridging the contacts 14 and 15.

One of the power lines by-passes the switch and extends through the three-conductor cord to the pad, appearing as a line 16 in which the control thermostat 17 is introduced. The line 16 is connected, preferably through a safety thermostat 18 located in a part of the pad re-

mote from thermostat 17, to one end of the main heater resistance 19. A wire 20 from contact 14 extends through the three-conductor cord to a supplementary heater 21 positioned closely adjacent the control thermostat, and continues from there to the second end of the main heater resistance 19. This supplementary heater is conveniently formed of a loop of resistance wire of a length just sufficient to pass around the control thermostat, and secured in place as by taping. The second contact point 15 is joined by a wire 22, which passes through the three-wire conductor, with a control or ballast resistance 23 which is coupled to the end of the main heater resistance and is preferably formed as a continuation of it.

Fig. 3 shows the condition of the circuit for low heat, all the current passing through the thermostat heating coil 21 and through the main heating coil 19. Due to its reception of heat both from the main heater and from the coil 21, the control thermostat heats up more rapidly than the body of the coil and shuts off the current through the main heater while the pad is still at a comparatively low temperature. By regulating the resistance, and therefore the heat output of the coil 21 relative to the coil 19, the rapidity of heating of the thermostat can be changed and the pad temperatures set as desired for low heat.

Fig. 4 shows the condition of the circuit for medium heat, the significant difference being that the heater 21 is now shunted by the resistance 23. This latter resistance is not in heat-transferring adjacency to the thermostat 17, although it is preferably formed of the same wire as, and as a continuation of, the main heater 19. Its function on the medium heat setting is solely to reduce the current flowing through the thermostat heating coil 21. Although the control thermostat is still heated both by the main heater and from the supplementary heater 21 the heat received from the latter source is reduced as compared with the condition on low heat. The thermostat must, however, still heat up more rapidly than the pad itself.

In the high heat connection shown in Fig. 5 the thermostat heater 21 is entirely cut out of the circuit, and the current flows in series through the coil 23 and the main heater 19, the two in this instance acting as a single heater. Control in this case is through the thermostats 17 and 18 acting in the usual way and with no supplementary heating. Since the resistance 23 is in series with the main heater 19 on high heat, while the resistance 21 was in series with it on low heat, the total wattage of the pad will remain substantially constant as differences between the resistances 21 and 23 are unimportant as compared with the much larger resistance 19.

The different resistances must be in proper balance with each other in order to produce the desired results. The two resistances 21 and 23 are preferably much less than the resistance 19 and will in general be of roughly equal magnitudes, as this results in a substantial but not excessive reduction of the current through the heating loop 21 on the medium setting. The specific resistances of the two may, however, be quite different; it being convenient to have the specific resistance of the thermostat heater in ohms per linear inch such that the length of this heater wire will be just sufficient to permit it to be looped around the thermostat. In the ballast resistance 23, on the contrary, the specific resistance may be and preferably is the same as that of the main heater, the wire of which is so chosen that for the desired wattage the wire will cover the area of the pad with sufficiently close spacing to produce a uniform heating effect.

Assuming the main heating coil to be chosen with the desired wattage, the thermostat heating loop should have its total resistance chosen to produce the low heat desired. The ballast resistance is then chosen so that the divided current occurring on medium heat will produce the required medium temperature. Large changes in the resistances may unbalance the whole circuit, but if the changes are small the following guides may be noted. Decreasing the total resistance of the thermostat heating loop relative to the resistance of the main heater will raise the low temperature of the pad, while increasing this resistance will lower the low temperature. Decreasing the total resistance of the ballast coil relative to the resistance of the thermostat heating loop will increase the temperature at which the pad operates on the medium setting, and increasing this resistance will lower the medium temperature. The high setting, of course, has its temperature affected only by the setting of the thermostats themselves. Without in any way limiting the invention to the specific proportions given, I have found that a pad of 50–55 watts capacity can be made with a main heating coil of 215 ohms, a thermostat heater of 20 ohms, and a ballast resistance of 27 ohms. With the thermostats set to open at 180°, which determines the high heat, the low temperature will be in the neighborhood of 120° and the medium temperature about halfway between them.

If a double heating coil 29 is to be used, as in Fig. 6, certain changes need to be observed. The current density per inch in the thermostat heater 30 on low heat is in this case twice that in the two wires in parallel which form the main heater, and its heating effect is proportionally increased. On high heat it is desirable that the heating effect of the ballast coil be kept the same as that of the main heater, and for that reason the ballast resistance is formed of two wires 31 in parallel. This figure also shows further modification whereby a switch 32 in a separate three-wire conductor 33 is used instead of a switch in the main power line 34. This result is secured by connecting the heating coil 30 on one side to the power line and on the other to a wire 35 passing to a switch terminal 36. The coils 29 and 31 are in this case separated, a wire 37 from the coil 29 passing to the switch blade 38 and a wire 39 from one end of the coils 31 passing to the switch point 40. The other end of the parallel coils 31 are connected to the power line by a wire 41. The functioning of this circuit is exactly the same as that of the form first described if due allowance is made for the increased current density in the thermostat heater.

I claim:

1. An electrical heating pad comprising an electrical heating element, a power line connected to one terminal of said element, a thermostat connected in series with the heating element, a thermostat heating resistance and a ballast resistance each connected to the opposite terminal of the heating element, a second power line, and a switch for connecting the second power line selectively to the thermostat heat-

ing resistance, to the ballast resistance, or to both together.

2. An electrical heating pad comprising an electrical heating element, a three-wire conductor having one of its wires connected to the heating element, a thermostat heating resistance and a ballast resistance each connected to the second end of the heating element and coupled respectively to the remaining pair of wires of the conductor, a thermostat connected in series with the heating element and in heat conducting relationship to the heating element and to the thermostat heater, a switch having two points connected respectively to the last-named pair of wires and mechanism to contact said pair either individually or simultaneously, and a two-wire power line having its wires connected one to said mechanism and one to the first-named wire of said conductor.

3. An electrical heating pad comprising an electrical heating element embedded in the pad, a three-wire conductor having one of its wires connected to one end of the heating element, a thermostat heating resistance connected to the second end of the heating element, a ballast resistance embedded in the pad and also connected to the second end of the heating element, a thermostat connected in series with the heating element and in heat transferring relation to the thermostat heating resistance, a two wire power line having one wire connected to the first end of the heating element through the thermostat, and means for connecting the second wire of the power line selectively to the thermostat heater, to the ballast resistance, or to both together.

4. An electrical heating pad comprising an electrical heating element, a power wire connected to one terminal of said element, a thermostat connected in series with the heating element and in heat transferring relation thereto, a thermostat heating resistance also in heat transferring relation to said thermostat, a ballast resistance having one end coupled both to the thermostat heating resistance and to the heating element, a second power wire, and a switch for connecting the second power line selectively to the thermostat heating resistance, to the ballast resistance, or to both together.

5. An electrical heating pad comprising a power line, a main heating coil, a thermostat controlling the power line, a thermostat heating loop, a connection between said loop and the main heating coil at a point relatively near one end of the latter, a connection between the second end of the main heating coil and one branch of the power line, and switch means for connecting the second branch of the power line to the thermostat heating loop, to the first end of the main heating coil, or to both together.

6. An electrical heating pad comprising a power line, a main heating coil having a resistance on the order of 215 ohms, a thermostat controlling the power line, a thermostat heating loop having a resistance on the order of 20 ohms, a connection between said loop and a point of the main heating coil sufficiently near one end to leave a residual resistance on the order of 27 ohms, a connection between the second end of the main heating coil and one branch of the power line, and switch means for connecting the second branch of the power line to the thermostat heating loop, to the first end of the main heating coil, or to both together.

7. An electric heating pad comprising a power line, a main heating coil, a thermostat controlling the power line, a thermostat heating loop, a ballast resistance, and switch means for connecting the thermostat heating loop in series with the main heating coil excluding the ballast resistance, connecting the ballast resistance in series with the main heating coil excluding the thermostat heating loop, or connecting the thermostat heating coil and the ballast resistance in parallel with each other and in series with the main heating coil.

8. An electrical heating pad comprising a power line, a main heating coil, a thermostat controlling the power line, a thermostat heating loop, and switch means whereby the thermostat heating loop may be connected to the main heating coil at a point relatively near one end of the latter and in series with the major fraction of said coil and the power line; the whole length of the main heating coil may be connected in series with the power line excluding the thermostat heating loop; or one end of the thermostat heating loop and the minor fraction of the main heating coil may be connected to one side of the power line, the second end of the thermostat heating coil to said intermediate point of the main heating coil, and the second end of the main heating coil to the second side of the power line.

9. An electrical heating pad comprising a power line, a main heating coil having a resistance on the order of 215 ohms, a thermostat controlling the power line, a thermostat heating loop having a resistance on the order of 20 ohms, a connection between said loop and an intermediate point of the main heating coil sufficiently near one end of the latter to leave a residual resistance on the order of 27 ohms, and switch means whereby the thermostat heating loop may be connected to the main heating coil at said intermediate point and in series with the major fraction of said coil and the power line; the whole length of the main heating coil may be connected in series with the power line excluding the thermostat heating loop; or one end of the thermostat heating loop and said end of the main heating coil may be connected to one side of the power line, the second end of the thermostat heating coil to said intermediate point of the main heating coil, and the second end of the main heating coil to the second side of the power line.

10. An electrical heating pad comprising a power line, a main heating coil having one end connected to one side of the power line, a thermostat controlling the power line, a thermostat heating loop having one end connected to the second side of the power line, a ballast resistance having one end coupled to said second side of the power line exteriorly of the loop, a three wire cable having its wires coupled respectively to the second end of the main heating coil, the second end of the thermostat heating coil, and the second end of the ballast resistance, and switch means at the end of said three wire cable for connecting the second end of the main heating coil to the loop, to the ballast resistance, or to both together.

EDWARD C. TAYLOR.