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(54) Electrically-powered heating panels

(57) A multi-heat electric panel blanket eg a blanket 10 is provided with coils 1, 2, of a dual coil heating element. A single coil heating element 3 is connected in series with coil 1. The circuit is provided with four terminals *A, B, C* and *D* and current limiting means eg comprising a diode 8 is connected across *B* and *C*.

The dual coil heating element is disposed tortuously over the area of an electric blanket and is interlocated with the single coil element 3, which is also tortuously disposed.

A selection switch *S* is provided. The blanket 10 is operable whereby:—

(A) one of the coils of the dual coil heating element is connected in series with the single coil heating element 3, with the diode 8 by-passed (terminals A, B); or

(B) one of the coils of the dual coil heating element is connected in series with the single coil heating element 3, with the diode 8 included in the circuit (terminals A, C); or

(C) all three heating coils are connected in series with the diode 8 in circuit (terminals A, D);

so that three differing heat outputs are available.

A modification, (Figure 3), makes available four different heat outputs and a resistor may replace the diode.

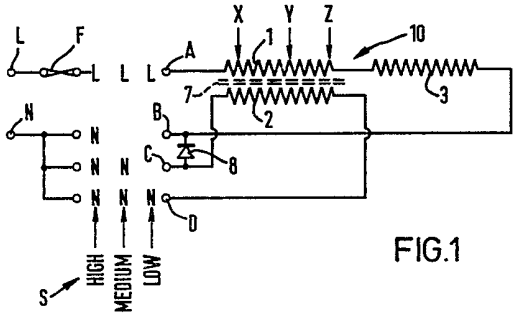

FIG.1

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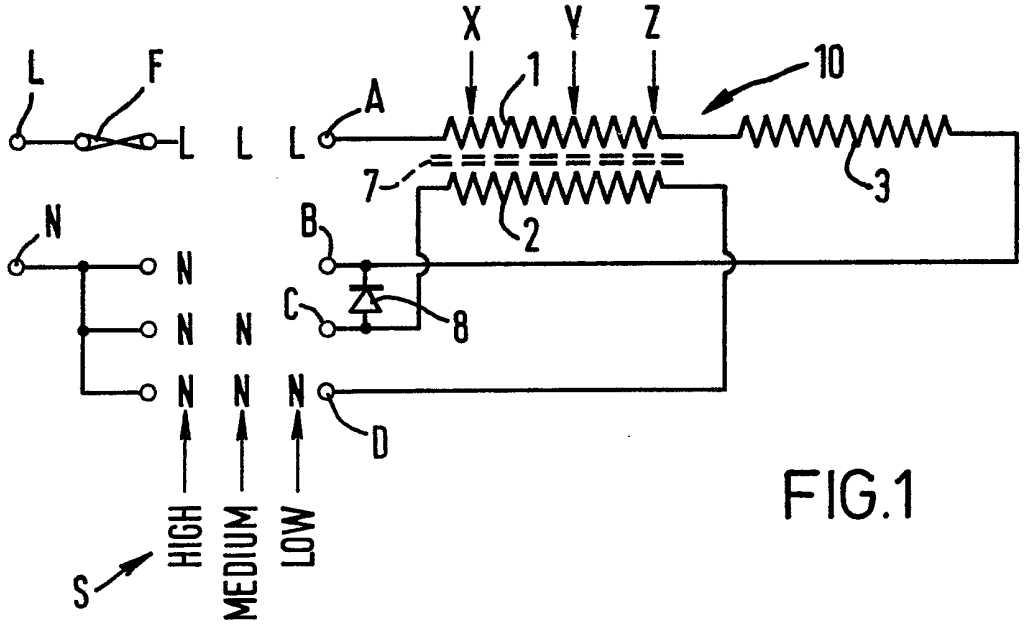

FIG.1

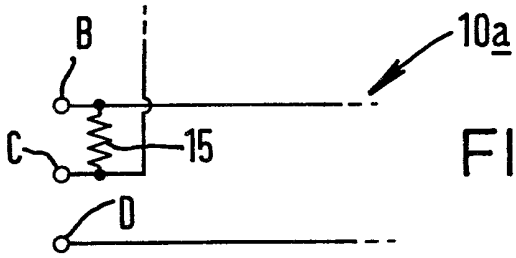

FIG.2

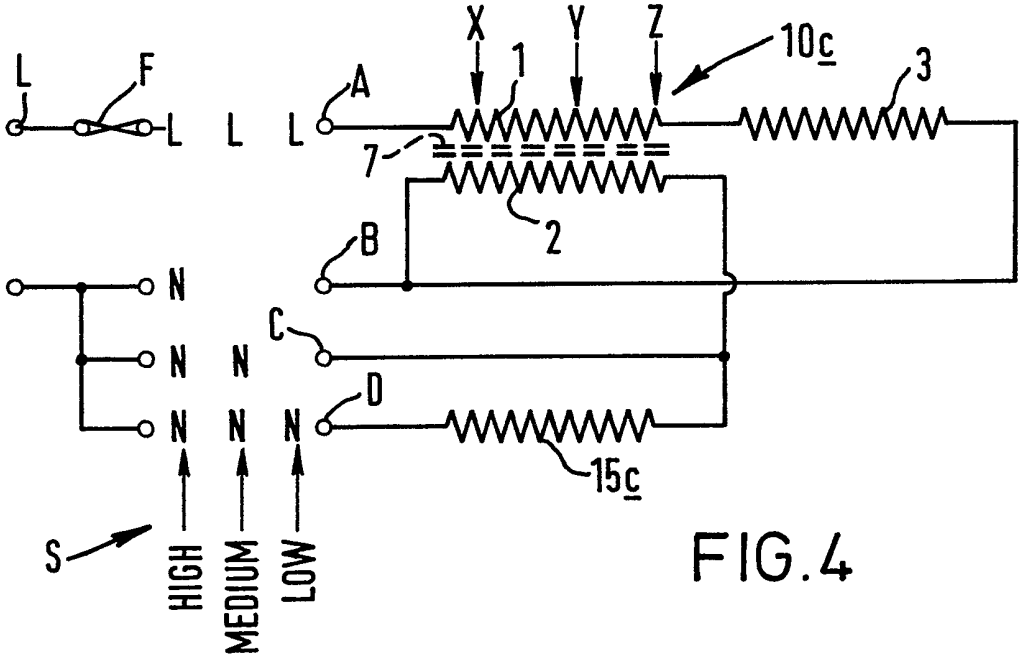

FIG.4

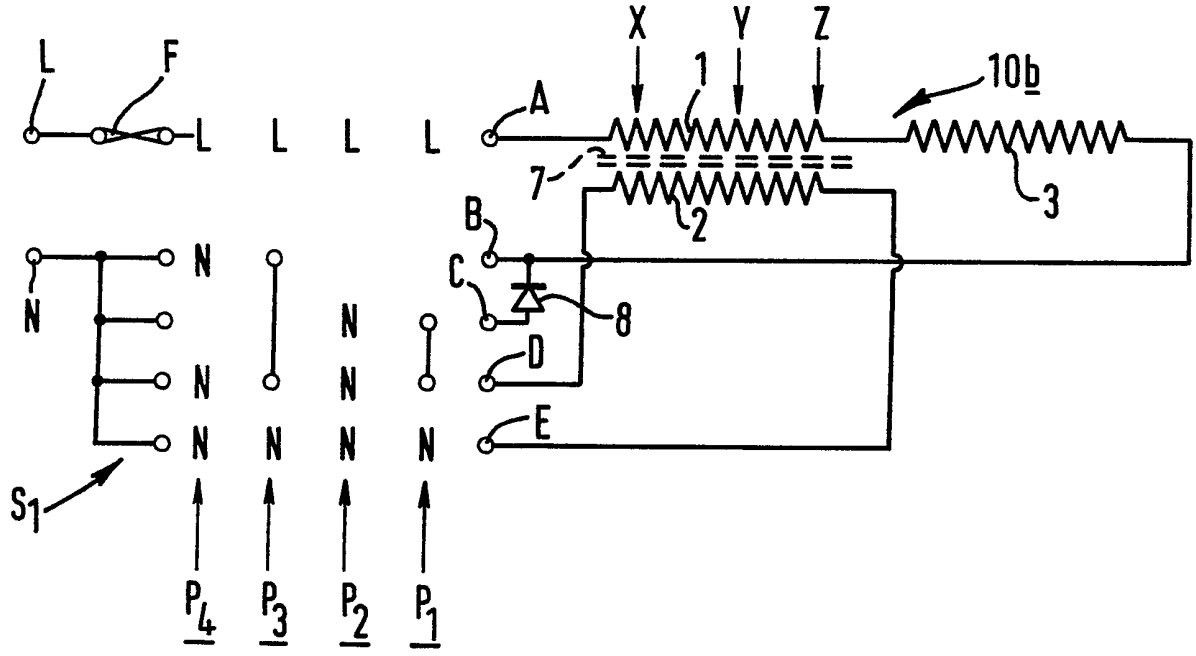

FIG. 3

SPECIFICATION

Improvements in or relating to electrically-powered heating panels

BACKGROUND TO THE INVENTION

This invention relates to electrically-powered heating panels.

As used herein, the term "electrically-powered heating panel" is intended to include electrically-powered under-carpet heaters, blankets, mattresses and pads. The invention is particularly applicable however, to electrically-powered blankets, or, more simply, "electric blankets".

The present invention is concerned with that form of electrically-powered heating panel comprising a tortuously-disposed dual coil heating element (as herein defined), interlocated with a tortuously-disposed single coil heating element (as herein defined).

As used herein, a "dual coil heating element" is defined as an inner heating coil covered with a first insulation, with an outer heating coil wound on the first insulation and insulated with a second insulation, and a "single coil heating element" is defined as a single heating coil covered with insulation.

SUMMARY OF THE INVENTION

According to the present invention, an electrically-powered heating panel comprises a tortuously-disposed dual coil heating element (as herein defined) interlocated with a tortuously-disposed single coil heating element (as herein defined), and provided with current limiting means as well as selectable connecting means, the panel being operable whereby:—

(A) one of the coils of the dual coil heating element is connected in series with the single coil heating element with the current limiting means by-passed; or

(B) one of the coils of the dual coil heating element is connected in series with the single coil heating element with the current limiting means included in the circuit; or

(C) all three heating coils are connected in series with the current limiting means in circuit;

so that three different heat outputs are available.

All three heating coils may be connected in series with the current limiting means by-passed, so that four differing heat outputs are available.

The current limiting means may comprise diode means connected between the single coil heating element and one of the coils of the dual coil heating element.

Alternatively, the current limiting means may comprise resistor means connnected between the single coil heating element and one of the coils of the dual coil heating element. The resistor means may serve as an additional heating element.

The invention also comprises any novel subject matter or combination including novel subject matter herein disclosed, whether or not within the scope of or relating to the same invention as any of the succeeding claims.

BRIEF DESCRIPTION OF THE DRAWINGS

Embodiments of the invention will now be described by way of example only, with reference to the accompanying drawings, wherein:—

Figure 1 is a circuit diagram,

Figure 2 illustrates one modification of the circuit of Figure 1,

Figure 3 illustrates another modification of the circuit of Figure 1, and

Figure 4 is another circuit diagram.

In the figures, like reference numerals refer to like features and components.

DETAILED DESCRIPTIONS OF THE PREFERRED EMBODIMENTS

With reference first to Figure 1, a three-heat electrical panel in the form of an electric blanket 10 is shown wherein outer and inner coils 1 and 2 are the coils of a dual coil heating element. Insulation between coils 1 and 2 is indicated by numeral 7. The single coil heating element 3 is shown connected in series with outer coil 1. The circuit is provided with four leads, namely leads *A, B, C* and *D*. Current limiting means comprising a diode 8 is provided, connected across leads *B* and *C*. The two coils 1, 2 of the dual coil elements are of the same resistance value. Resistance of coil 3 is about 1.5 times that of coils 1 and 2.

The dual coil heating element is disposed tortuously over substantially the whole area of an electric blanket. The blanket of this embodiment uses tunnel-contructed blanket material but alternatively, sheets of blanket material may be secured together by adhesive. The dual coil element is interlocated with the single coil element 3, which is also tortuously disposed. Figure 2 of U.K. Patent No. 1,456,684 illustrates this kind of arrangement in more detail.

The dual coil heating element comprises the inner coil 2 wound on a central core of rayon and covered with an insulating sheath (which is insulation 7) of thermoplastics material. A suitable thermoplastics material is a polyethylene compound, such as ALKATHENE (Registered Trade Mark), which is obtainable from I.C.I. Limited of the U.K. The material enables electrical conduction to take place between coils 1 and 2 at an elevated temperature. The outer coil 1 is wound on the insulating sheath 7 and itself covered with an outer sheath of insulating material such as polyvinyl chloride (P.V.C.).

A heat selection switch *S* is provided, having High, Medium and Low selector positions. The switch makes lines (*L*) and neutral (*N*) connections of an A.C. power supply to leads, *A, B, C* and *D*.

With the heat selection switch *S* in the "High" setting, the circuit from line to neutral is via lead *A*, coil 1, coil 3, and lead *B*. Coil 2 is by-passed by virtue of leads *C* and *D* being connected to neutral at the switch *S*. Diode 8 is also by-passed. Heating is at a maximum as resistance, (coil 1 in series with coil 3), is at a minimum and current flows on all half-cycles of the supply.

With the heat selection switch *S* in the "Medium" setting, the circuit from line to neutral is via lead *A*, coil 1, coil 3, diode 8, (half-cycles), and lead *C*. The coil 2 is by-passed by having neutral potential at both ends, both leads *C* and *D* being connected to neutral at the switch *S*.

With the heat selection switch *S* in the "Low" setting, the circuit from line to neutral is via lead *A*, coil 1, coil 3, diode 8 (half-cycles), coil 2 and lead *D*. Heating is at a minimum because current only flows on

, alternate half-cycles of the supply and the maximum resistance, (all the coils and the diode 8 are connected in series), is in circuit.

Thus three differing heat outputs are available from the blanket 10.

In the event of overheating in the electric blanket 10, such as by energising it when folded or bundled, the polyethylene-compound material of the inner insulating sheath 7 of the dual coil heating element enables electrical conduction to take place between outer and inner coils 1 and 2 at the elevated temperature, whereby a short-circuit occurs between these coils. A low resistance circuit from line to neutral will be set up which causes fuse *F* to blow. The actual value of the low resistance circuit will depend upon the position along the dual coil heating element at which short-circuiting between the coils 1 and 2 occurs and upon the setting of the heat selection switch *S*. To illustrate this, three short-circuit positions *X*, *Y* and *Z* have been marked along the coils 1, 2.

If overheating is now considered, with the heat selection switch *S* on "High" or "Medium", it will be seen that electrical conduction between coils 1 and 2 at *X*, will give a "dead" short and fuse *F* will blow. Short-circuiting at *Y* gives a rather complex series "parallel network of resistances which will necessarily have an effective resistance much lower than will arise in any "normal" operation, (it will be lower than the resistance of coil 1), and hence fuse *F* can be easily rated to fuse correctly. Short-circuiting at *Z* gives an in-circuit resistance equal to the resistance of coil 1 alone, and hence fuse *F* can again be easily rated to blow.

Wherever short-circuiting occurs, at *X*, *Y* or *Z*, with the switch *S* in the "Low" position, it will be appreciated that the in-circuit resistance will never exceed the resistance of coil 1. Thus fuse *F* can again be easily rated to blow.

Figure 2 illustrated a modification wherein an electric blanket 10*a* is provided with current limiting means in the form of a resistor 15 connected across leads *B* and *C*, instead of the diode 8. The resistor 15 serves as an additional heating element, and has a resistance value about 1.5 times that of coil 1.

Figure 3 illustrates a four-heat electric blanket 10*b*, which like the blanket 10 of Figure 1, is provided with current limiting means in the form of diode 8. However, if desired, a resistor, (like resistor 15 of Figure 2), can be used to replace the diode.

A heat selection switch *S1* is provided, having positions *P1*, *P2*, *P3* and *P4*. Position *P4* is a "high" heat setting; position *P1* is a "low" heating setting; positions *P2* and *P3* are intermediate heat selector positions. The switch *S1* makes line (*L*) and neutral (*N*) connections of an A.C. power supply to leads *A*, *B*, *C*, *D* and *E* as indicated.

With the heat selection switch *S1* in the *"P4"* position, the circuit from line to neutral is via lead *A*, coil 1, coil 3, and lead *B*. Coil 2 is by-passed by virtue of leads *B* and *D* being connected to neutral at the switch. Diode 8 is by-passed as leads *C* and *D* are also connected to neutral. Heating is at a maximum as resistance, (coil 1 in series with coil 3), is at a minimum and current flows on all half-cycles of the supply.

With the heat selection switch in the *"P3"* position, the circuit from line to neutral is via lead *A*, coil 1, coil 3, lead *B*, lead *D*, coil 2 and lead *E*. Diode 8 remains by-passed.

With the heat selection switch *S1* in the *"P2"* position, the circuit from line to neutral is via lead *A*, coil 1, coil 3, diode 8, (half-cycles), and lead *C*, coil 2 being by-passed.

With the heat selection switch in the *"P1"* position, the circuit from line to neutral is via lead *A*, coil 1, coil 3, diode 8 (half-cycles), leads *C* and *D*, coil 2 and lead *E*. Heating is at a minimum because current only flows on alternate half-cycles of the supply and the maximum resistance, (all coils and diode 8 are in series), is in circuit.

Thus four differing heat outputs are available from the blanket 10*b*.

The arrangements of Figures 1, 2 or 3 result in an electric blanket which is particularly useful as an overblanket.

Figure 4 illustrates a modification wherein, a three-heat electric blanket 10*c* is provided with current limiting means in the form of a resistor 15*c*, (serving as an additional heating element), included in lead *D*.

In Figure 4, the "Low" switch setting puts all three coils (1, 2 and 3) and resistor 15*c* in series, the "Medium" setting puts coils 1, 2 and 3 in series, (resistor 15*c* being short-circuited), and the "High" setting puts coils 1 and 2 in series (coil 3 and resistor 15*c* being short-circuited).

In any of the above-described arrangements, fuse *F* could be replaced by a thermal fuse, employing a heating resistance connected in series.

In the above examples, typical values are as follows:—

Figure 1

Resistance of Coil 1	—	360 ohms)	
Resistance of Coil 2	—	360 ohms)	With diode 8 in circuit
Resistance of Coil 3	—	500 ohms)	
"High" output	—	67 watts	
"Medium" output	—	34 watts	
"Low" output	—	24 watts	

Figure 2

"High" output	—	67 watts
"Medium" output	—	42 watts
"Low" output	—	33 watts
Resistor 15	—	500 ohms

Figure 3
Resistances of coils 1, 2 and 3 — as for Figure 1.

Switch Position	*Output with diode 8*	*Output with 500 ohms resistor*
P1	24 watts	33 watts
P2	34 watts	42 watts
P3	47 watts	47 watts
P4	67 watts	67 watts

Figure 4

"High" output	—	67 watts
"Medium" output	—	47 watts
"Low" output	—	33 watts
Resistor 15*c*	—	500 ohms

CLAIMS

1. An electrically-powered heating panel comprising a tortuously-disposed dual coil heating element, (as herein defined), interlocated with a tortuously-disposed single coil heating element, (as herein defined), and provided with current limiting means as well as selectable connecting means, the panel being operable whereby:—
(A) one of the coils of the dual coil heating element is connected in series with the single coil heating element with the current limiting means by-passed; or
(B) one of the coils of the dual coil heating element is connected in series with the single coil heating element with the current limiting means included in the circuit; or
(C) all three heating coils are connected in series with the current limiting means in circuit;
so that three differing heat outputs are available.

2. A heating panel as claimed in Claim 1, operable whereby all three heating coils are connected in series with the current limiting means by-passed, so that four differing heat outputs are available.

3. A heating panel as claimed in Claim 1 or 2, wherein the current limiting means comprises diode means connected between the single coil heating element and one of the coils of the dual coil heating element.

4. A heating panel as claimed in Claim 1 or 2, wherein the current limiting means comprises resistor means connected between the single coil heating element and one of the coils of the dual coil heating element, said resistor means serving as an additional heating element.

5. A heating panel as claimed in any one of Claims 1 to 4, wherein the current limiting means is by-passed, when so required, by a short-circuit applied on appropriate operation of the selectable connecting means.

6. A heating panel substantially as hereinbefore described with reference to Figure 1 of the accompanying drawings.

7. A heating panel substantially as hereinbefore described, with reference to Figure 1 of the accompanying drawings, modified substantially as hereinbefore described with additional reference to Figure 2 of said drawings.

8. A heating panel substantially as hereinbefore described, with reference to Figure 3 of the accompanying drawings.

9. Any novel subject matter or combination including novel subject matter herein disclosed, whether or not within the scope of or relating to the same invention as any of the preceding claims.

10. An electrically-powered heating panel comprising a tortuously-disposed dual coil heating element, (as herein defined), interlocated with a tortuously-disposed single coil heating element, (as herein defined), and provided with resistor means as well as selectable connecting means, the panel being operable whereby:—
(a) one of the coils of the dual coil heating element is connected in series with the coil of the single coil heating element with the resistor means by-passed; or
(b) one of the coils of the dual coil heating element is connected in series with the single coil heating element with the resistor means included in the circuit; or
(c) all three heating coils are connected in series with the resistor means in circuit;
so that three differing heat outputs are available.

11. A heating panel as claimed in Claim 10, wherein the resistor means is connected in series with one of the coils of the dual coil heating element.

12. A heating panel as claimed in Claim 10, wherein the resistor means is connected in series with the inner coil of the dual coil heating element.

13. A heating panel as claimed in any one of Claims 10 to 12, wherein the resistor means serves as an additional heating element.

14. A heating panel as claimed in any one of Claims 10 to 13, wherein current limiting means is by-passed, when so required, by a short-circuit applied on appropriate operation of the selectable connecting means.

15. A heating panel substantially as hereinbefore described, with reference to Figure 4 of the accompanying drawings.

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