

(19)



(11)

EP 2 438 364 B1

(12)

EUROPEAN PATENT SPECIFICATION

(45) Date of publication and mention
of the grant of the patent:

08.01.2014 Bulletin 2014/02

(51) Int Cl.:

F24H 9/20 (2006.01)

(21) Application number: **10705275.5**

(86) International application number:

PCT/EP2010/000786

(22) Date of filing: **09.02.2010**

(87) International publication number:

WO 2010/091836 (19.08.2010 Gazette 2010/33)

(54) **ELECTRICAL HEATING DEVICE**

ELEKTRISCHES HEIZGERÄT

DISPOSITIF DE CHAUFFAGE ÉLECTRIQUE

(84) Designated Contracting States:

**AT BE BG CH CY CZ DE DK EE ES FI FR GB GR
HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL
PT RO SE SI SK SM TR**

(30) Priority: **16.02.2009 GB 0902533**

(43) Date of publication of application:

11.04.2012 Bulletin 2012/15

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(56) References cited:

WO-A1-97/12182 DE-A1- 19 545 155

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Description

[0001] This invention relates to an electrical heating device for heating water and in particular to a dual element electrical heating device having a common thermostat.

[0002] Electrical resistance heating elements are commonly used to heat water. Dual element heating devices are often used where different rates of heating are required, for example to suit the flow rate and/or temperature of the water to be heated. Such arrangement of dual heating elements is often provided in an electric shower to compensate for variation in the temperature of the water supply to the shower while providing a substantially constant flow rate through the water heater.

[0003] In order to prevent damage to the heating element(s) and/or the risk of fire due to overheating, for example when the heating element is heated while not fully submerged in water, the or each heating element is typically associated with a thermostat arranged to cut off power to the heating element should the temperature of the heating element exceed safe levels. Where dual heating elements are provided, a separate thermostat is typically required for each heating element, resulting in increased cost and complexity.

[0004] DE19545155 and WO97/12182 are examples of known electrical heating devices.

[0005] Document DE19545155 discloses the preamble of claim 1.

[0006] According to the present invention there is provided an electrical heating device for heating water, said heating device comprising a plurality of heating elements operable to heat water stored within a vessel, wherein said plurality of heating elements are all arranged to be in thermal contact with a single thermostat adapted to cut off the supply of electrical power to said plurality of heating elements when the temperature of the thermostat exceeds a predetermined maximum temperature, indicating overheating of at least one of said heating elements, wherein the heating elements are mounted on a common support plate, said thermostat being mounted on said common support plate, at least a portion of each heating element remote from the ends of the heating element being in contact with the support plate adjacent the thermostat.

[0007] By placing all of the heating elements in thermal contact with a single thermostat, the need for a separate thermostat for each heating element is avoided, reducing the cost and complexity of the heating device.

[0008] Each heating element may comprise an elongate member having electrical connectors on opposite ends thereof, at least a portion of the elongate member of each heating element being in thermal contact with said thermostat.

[0009] Each electrical heating element may comprise an electrical resistance heating element disposed within an outer sheath and connected to the electrical connectors at opposite ends thereof. In one embodiment the

outer sheath may comprise a stainless steel tube.

[0010] The support plate may define at least part of a wall of a vessel for containing water to be heated by the heating elements. Each heating element may pass through the support plate to define an elongate internal portion that extends into at least part of the vessel interior and an external portion provided with said electrical connectors for connecting the heating elements to a power supply.

[0011] Preferably the internal portion of each heating element extends in a loop. Preferably a portion of the loop of each heating element, preferably a distal end of the loop, engages the support plate at a common location, preferably spaced from or adjacent to said electrical connectors. Preferably all of the heating elements engage the support plate at said common location on said support plate, whereby the thermostat may be mounted on an outer side of the support plate adjacent said common location such that the thermostat is simultaneously in thermal contact with all of the heating elements.

[0012] In a preferred embodiment the heating device comprises two heating elements.

[0013] The internal portion of each heating element preferably comprises a first portion extending from the support plate in a direction substantially perpendicular to the support plate and a distal portion extending parallel to said first portion, towards said support plate, such that the heating element is effectively folded back on itself, whereby a looped end of the distal portion each heating element contacts the inner surface of the support plate to be in thermal contact with the thermostat.

[0014] Preferably the heating device comprises dual heating elements, a second heating element being arranged substantially parallel to and diagonally offset from a first heating element to be in nested or overlapping relationship therewith.

[0015] The thermostat may comprise material which undergoes physical changes in response to changes in the temperature. In response to this physical change, thermostat may open a switch that deactivates the heating elements. Alternatively the thermostat may comprise an electronic control unit and a temperature sensor that transmits signals to the control unit indicative of the temperature of the heating elements.

[0016] An embodiment of the present invention will now be described, by way of example only, with reference to the accompanying drawings, in which:

Figure 1 is a plan view of an electrical heating device according to an embodiment of the present invention;

Figure 2 is an end view of the heating device of Figure 1; and

Figure 3 is a sectional view of the heating device of Figure 1 along line A-A.

[0017] As shown in the drawings, an electrical heating device 10 according to an embodiment of the present

invention comprising dual heating elements 20,30 for heating water within a vessel, comprising a first heating element 20 and a second heating element 30 arranged substantially parallel to each other in nested or overlapping relationship, each heating element 20,30 being adapted to be in thermal contact with a single overhear prevention thermostat 40, as will be described below in more detail.

[0018] The heating elements 20,30 are mounted a common support plate 50, the support plate 50 being adapted to form part of the wall of a water vessel or tank for holding water to be heated.

[0019] Each heating element 20,30 comprises an elongate element comprising a stainless steel tubular outer sheath 100 having an electrical resistance heating wire 102 disposed therein. The ends of each heating element 20,30 extend through the support plate 50 and electrical connectors 104, 106, 108 are provided on the terminal ends thereof for connection to a power supply whereby each heating element 20,30 can be independently heated.

[0020] A first end of each heating element 20,30 is provided with a respective electrical connector 104,106 for connection to a respective positive terminal of a power source and a second end of each heating element 20,30 is connected to a common electrical connector 108 for connection to an earth point or negative terminal of the power supply.

[0021] Each heating element 20,30 extends from an inner surface of the support plate in a loop, each element having first and second sides extending from the respective ends of the heating element in parallel relationship the first and second sides being joined by a distal loop 60,70. Approximately half way along their length, the first and second sides of each heating element 20,30 are bent or folded through 180° such that the distal loop 60,70 thereof is located adjacent and vertically spaced from the terminal ends of the heating element 20,30, whereby the distal loops 60,70 are in contact with the inner surface of the support plate 50 at a location spaced from the terminal ends of the heating element.

[0022] The terminal ends of each heating element 20,30 extend through the support plate 50 at respective locations spaced from one another diagonally on the support plate 50 (see Figure 2) such that the heating elements 20,30 are arranged in nested or overlapping parallel relationship with the distal loops 60,70 of the heating element 20,30 being in contact with the inner face of the support plate 50 alongside one another at a common location. The thermostat 40 is mounted on the outer face of the support plate 50 adjacent said common location, whereby the thermostat 40 is in thermal contact with the distal loop 60,70 of both the first and second heating elements 20,30, through said common location on the support plate 50.

[0023] The distal loops 60,70 of the heating elements 20,30 may be joined to the support plate by brazing or welding to enhance thermal contact between the heating

elements and the thermostat and to increase the strength of the heating device.

[0024] While a dual element heating device is described, it is envisaged that three or more heating elements may be provided, all in thermal communication with a single overhear prevention thermostat arranged to cut off power to the heating elements should one or more of the heating elements overheat.

[0025] The invention is not limited to the embodiment (s) described herein but can be amended or modified without departing from the scope of the present invention as defined in the appended claims.

15 Claims

1. An electrical heating device (10) for heating water, said heating device comprising a plurality of heating elements (20,30) operable to heat water stored within a vessel, wherein said plurality of heating elements (20,30) are all arranged to be in thermal contact with a single thermostat (40) adapted to cut of the supply of electrical power to said plurality of heating elements when the temperature of the thermostat exceeds a predetermined maximum temperature, indicating overheating of at least one of said heating elements, said plurality of heating elements (20,30) being mounted on a common support plate (50), said thermostat (40) being mounted on said common support plate (50), **characterised in that** at least a portion of each heating element (20,30) remote from the ends of the heating element is in contact with the support plate (50) adjacent the thermostat (40).
2. An electrical heating device as claimed in claim 1, wherein each heating element (20,30) of said plurality of heating elements comprises an elongated member having electrical connectors (104,106,108) on opposite ends thereof, at least a portion of the elongate member of each heating element being in thermal contact with said thermostat (40).
3. An electrical heating element as claimed in claim 2, wherein each of said heating elements (20,30) comprises an electrical resistance heating element disposed within an outer sheath and connected to the electrical connectors (104,106,108) at opposite ends thereof.
4. An electrical heating device as claimed in claim 3, wherein said outer sheath of each heating element (20,30) comprises a stainless steel tube.
5. An electrical heating device as claimed in any preceding claim, wherein the support plate (50) defines at least part of a wall of a vessel for containing water to be heated by the heating elements (20, 30).

6. An electrical heating device as claimed in claim 5, wherein each heating element (20,30) passes through the support plate (50) to define an elongated internal portion that extends into at least part of the vessel interior and an external portion provided with said electrical connectors for connecting the heating elements (20,30) to a power supply.
7. An electrical heating device as claimed in any preceding claim, wherein the internal portion of each heating element extends in a loop (60,70), wherein a portion of the loop (60,70) of each heating element (20,30) engages the support plate (50) at a common location adjacent the thermostat (40).
8. An electrical heating device as claimed in claim 7, wherein said portion of the loop (60,70) of each heating element (20,30) engaging the support plate (50) comprises a distal end thereof.
9. An electrical heating element as claimed in any preceding claim, wherein an internal portion of each heating element (20,30) comprises a first portion extending from the support plate in a direction substantially perpendicular to the support plate and a distal portion extending parallel to said first portion, towards said support plate, such that the heating element is effectively folded back on itself, whereby a looped end (60,70) of the distal portion of each heating element contacts x the inner surface of the support plate (50) to be in thermal contact with the thermostat (40).
10. An electrical heating device as claimed in claim 9, wherein the heating device comprises dual heating elements (20,30), a second heating element (30) being arranged substantially parallel to and diagonally offset from a first heating element (20) to be in nested or overlapping relationship therewith.
11. An electrical heating device as claimed in any preceding claim, wherein the thermostat (40) comprises a material which undergoes physical changes in response to changes in the temperature.
12. An electrical heating device as claimed in claim 11, wherein the thermostat (40) opens a switch that deactivates the heating elements (20,30) in response to such physical change.
13. An electrical heating device as claimed in any of claims 1 to 10, wherein the thermostat (40) comprises an electronic control unit and a temperature sensor that transmits signals to the control unit indicative of the temperature of the heating elements (20,30).
14. An electrical heating device as claimed in any preceding claim comprising two heating elements

(20,30) to provide two heat settings.

Patentansprüche

1. Elektrische Heizvorrichtung (10) zum Erhitzen von Wasser, wobei die Heizvorrichtung eine Mehrzahl von Heizelementen (20, 30) enthält, die zum Erhitzen von in einem Behälter gelagertem Wasser bedient werden können, wobei die Mehrzahl von Heizelementen (20, 30) so angeordnet sind, dass sie in Wärmekontakt mit einem einzelnen Thermostat (40) stehen, das eingerichtet ist, um die Zufuhr von elektrischem Strom zu der Mehrzahl von Heizelementen zu unterbrechen, wenn die Temperatur des Thermostats eine vorbestimmte Höchsttemperatur überschreitet, die Überhitzung mindestens eines der Heizelemente anzeigt, wobei die Mehrzahl von Heizelementen (20, 30) an einer gemeinsamen Abstützplatte (50) angebracht sind, und das Thermostat (40) an der gemeinsamen Abstützplatte (50) angebracht ist, **dadurch gekennzeichnet, dass** mindestens ein von den Enden des Heizelements entfernter Teil jedes Heizelements (20, 30) angrenzend an das Thermostat (40) in Kontakt mit der Abstützplatte (50) steht.
2. Elektrische Heizvorrichtung nach Anspruch 1, bei der jedes Heizelement (20, 30) der Mehrzahl von Heizelementen ein längliche Element mit elektrischen Verbindern (104, 106, 108) an gegenüberliegenden Enden desselben enthält, wobei wenigstens ein Teil des länglichen Elements jedes Heizelements in Wärmekontakt mit dem Thermostat (40) steht.
3. Elektrisches Heizelement nach Anspruch 2, bei der jedes der Heizelemente (20, 30) ein elektrisches Widerstandsheizelement aufweist, das innerhalb eines Außenmantels angeordnet ist und an gegenüberliegenden Enden desselben an die elektrischen Verbinder (104, 106, 108) angeschlossen ist.
4. Elektrische Heizvorrichtung nach Anspruch 3, bei der der Außenmantel jedes Heizelements (20, 30) ein Edelstahlrohr aufweist.
5. Elektrische Heizvorrichtung nach einem vorhergehenden Anspruch, bei der die Abstützplatte (50) wenigstens einen Teil einer Wand eines Behälters zum Enthalten von Wasser begrenzt, das durch die Heizelemente (20, 30) zu erhitzen ist.
6. Elektrische Heizvorrichtung nach Anspruch 5, bei der jedes Heizelement (20, 30) die Abstützplatte (50) durchquert, um einen länglichen Innenteil, der sich in wenigstens einen Teil des Behälterinneren erstreckt, und einen Außenteil zu begrenzen, der mit den elektrischen Verbindern zum Anschließen der

Heizelemente (20, 30) an eine Energieversorgung versehen ist.

7. Elektrische Heizvorrichtung nach einem vorhergehenden Anspruch, bei der sich der Innenteil jedes Heizelements in einer Schleife (60, 70) erstreckt, wobei ein Teil der Schleife (60, 70) jedes Heizelements (20, 30) in die Abstützplatte (50) an einer gemeinsamen Stelle angrenzend an das Thermostat (40) eingreift. 5 10
8. Elektrische Heizvorrichtung nach Anspruch 7, bei der der Teil der Schleife (60, 70) jedes Heizelements (20, 30), der in die Abstützplatte (50) eingreift, ein distales Ende desselben aufweist. 15
9. Elektrisches Heizelement nach einem vorhergehenden Anspruch, bei der ein Innenteil jedes Heizelements (20, 30) einen ersten Teil, der sich von der Abstützplatte in einer Richtung im Wesentlich senkrecht zu der Abstützplatte erstreckt, und einen distalen Teil aufweist, der sich parallel zu dem ersten Teil in Richtung der Abstützplatte erstreckt, so dass das Heizelement effektiv auf sich selbst zurückgefaltet wird, wodurch ein Schleifenende (60, 70) des distalen Teils jedes Heizelements die Innenfläche der Abstützplatte (50) berührt, um in Wärmekontakt mit dem Thermostat (40) zu stehen. 20 25
10. Elektrische Heizvorrichtung nach Anspruch 9, bei der die Heizvorrichtung doppelte Heizelemente (20, 30) aufweist, wobei ein zweites Heizelement (30) im Wesentlichen parallel zu und diagonal versetzt von einem ersten Heizelement (20) angeordnet ist, um in einem verschachtelten oder überlappenden Verhältnis mit demselben zu stehen. 30 35
11. Elektrische Heizvorrichtung nach einem vorhergehenden Anspruch, bei der das Thermostat (40) ein Material aufweist, das als Reaktion auf Änderungen in der Temperatur physikalische Veränderungen durchmacht. 40
12. Elektrische Heizvorrichtung nach Anspruch 11, bei der das Thermostat (40) einen Schalter öffnet, der die Heizelemente (20, 30) als Reaktion auf eine solche physikalische Veränderung deaktiviert. 45
13. Elektrische Heizvorrichtung nach einem der Ansprüche 1 bis 10, bei der das Thermostat (40) eine elektronische Steuereinheit und einen Temperatursensor aufweist, der die Temperatur der Heizelemente (20, 30) anzeigende Signale an die Steuereinheit sendet. 50
14. Elektrische Heizvorrichtung nach einem vorhergehenden Anspruch, die zwei Heizelemente (20, 30) aufweist, um zwei Heizeinstellungen bereitzustellen. 55

Revendications

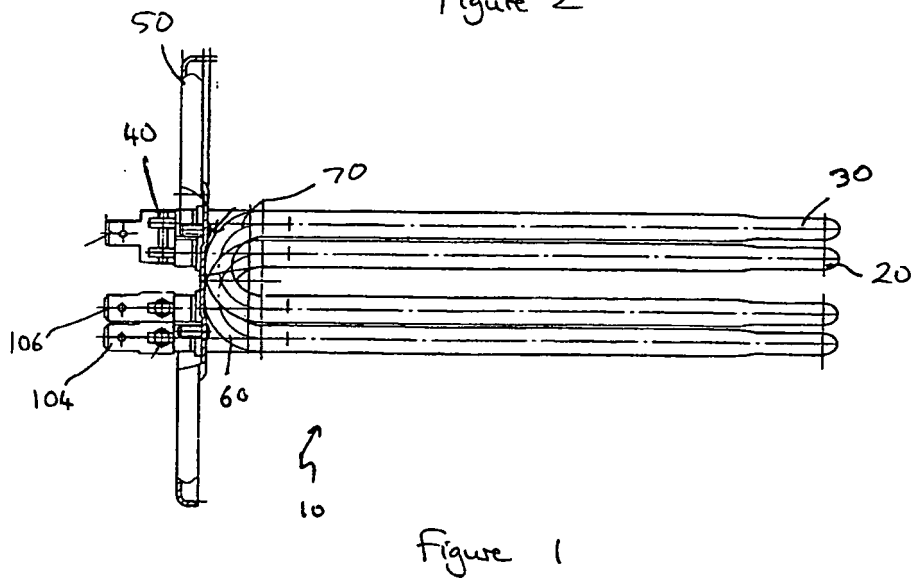
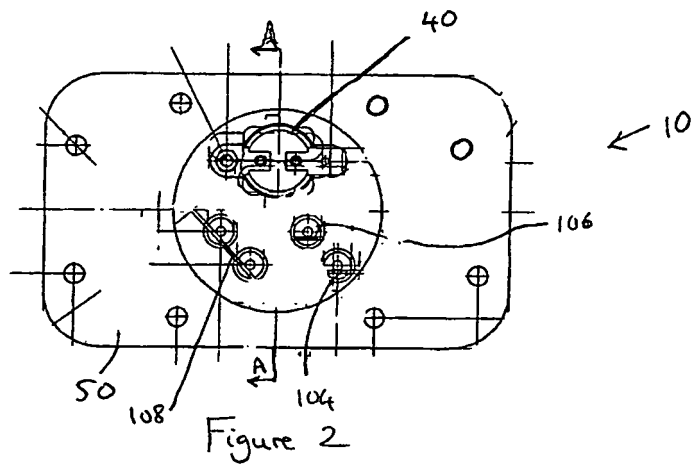
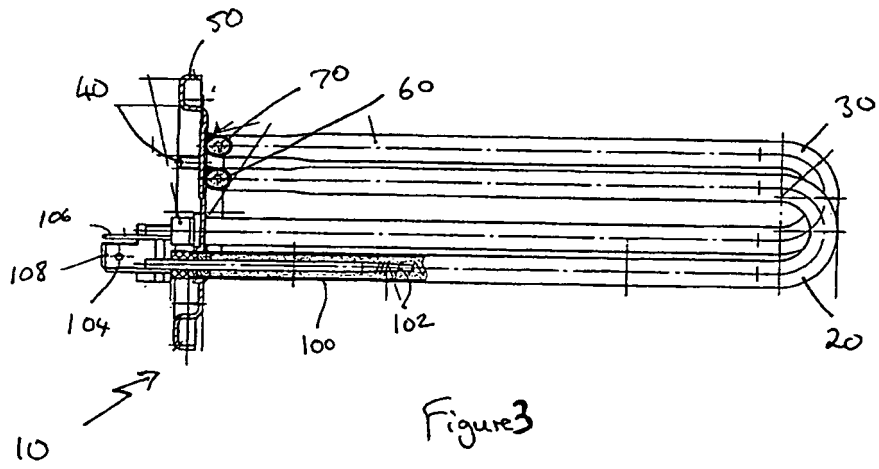
1. Dispositif de chauffage électrique (10) permettant de chauffer de l'eau, ledit dispositif de chauffage comportant une pluralité d'éléments de chauffage (20, 30) servant à chauffer de l'eau stockée dans une cuve, dans lequel ladite pluralité d'éléments de chauffage (20, 30) sont tous agencés à des fins de mise en contact thermique avec un seul thermostat (40) adapté pour couper l'alimentation en courant électrique au niveau de ladite pluralité d'éléments de chauffage quand la température du thermostat dépasse une température maximale prédéterminée, ceci indiquant la surchauffe d'au moins l'un desdits éléments de chauffage, ladite pluralité d'éléments de chauffage (20, 30) étant montés sur un plateau de support commun (50), ledit thermostat (40) étant monté sur ledit plateau de support commun (50), **caractérisé en ce qu'**au moins une partie de chaque élément de chauffage (20, 30) à distance des extrémités de l'élément de chauffage est en contact avec le plateau de support (50) de manière adjacente par rapport au thermostat (40).
2. Dispositif de chauffage électrique selon la revendication 1, dans lequel chaque élément de chauffage (20, 30) de ladite pluralité d'éléments de chauffage comporte un organe allongé ayant des connecteurs électriques (104, 106, 108) sur des extrémités opposées de celui-ci, au moins une partie de l'organe allongé de chaque élément de chauffage étant en contact thermique avec ledit thermostat (40).
3. Élément de chauffage électrique selon la revendication 2, dans lequel chacun desdits éléments de chauffage (20, 30) comporte un élément de chauffage à résistance électrique disposé à l'intérieur d'une gaine extérieure et connecté aux connecteurs électriques (104, 106, 108) au niveau des extrémités opposées de celui-ci.
4. Dispositif de chauffage électrique selon la revendication 3, dans lequel ladite gaine extérieure de chaque élément de chauffage (20, 30) comporte un tube en acier inoxydable.
5. Dispositif de chauffage électrique selon l'une quelconque des revendications précédentes, dans lequel le plateau de support (50) définit au moins une partie d'une paroi d'une cuve pour contenir de l'eau devant être chauffée par les éléments de chauffage (20, 30).
6. Dispositif de chauffage électrique selon la revendication 5, dans lequel chaque élément de chauffage (20, 30) traverse le plateau de support (50) pour définir une partie interne allongée qui s'étend dans au moins une partie de l'intérieur de la cuve et une partie

externe comportant lesdits connecteurs électriques à des fins de connexion des éléments de chauffage (20, 30) au niveau d'une alimentation en courant.

7. Dispositif de chauffage électrique selon l'une quelconque des revendications précédentes, dans lequel la partie interne de chaque élément de chauffage s'étend en une boucle (60, 70), dans lequel une partie de la boucle (60, 70) de chaque élément de chauffage (20, 30) entre en prise avec le plateau de support (50) au niveau d'un emplacement commun de manière adjacente par rapport au thermostat (40). 5
8. Dispositif de chauffage électrique selon la revendication 7, dans lequel ladite partie de la boucle (60, 70) de chaque élément de chauffage (20, 30) entrant en prise avec le plateau de support (50) comporte une extrémité distale de celui-ci. 10
9. Élément de chauffage électrique selon l'une quelconque des revendications précédentes, dans lequel une partie interne de chaque élément de chauffage (20, 30) comporte une première partie s'étendant depuis le plateau de support dans une direction sensiblement perpendiculaire par rapport au plateau de support et une partie distale s'étendant de manière parallèle par rapport à ladite première partie, vers ledit plateau de support, de sorte que l'élément de chauffage est replié de manière efficace sur lui-même, ce par quoi une extrémité bouclée (60, 70) de la partie distale de chaque élément de chauffage entre en contact avec la surface intérieure du plateau de support (50) à des fins de mise en contact thermique avec le thermostat (40). 20
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10. Dispositif de chauffage électrique selon la revendication 9, dans lequel le dispositif de chauffage comporte des éléments de chauffage doubles (20, 30), un second élément de chauffage (30) étant agencé de manière sensiblement parallèle, et décalé diagonalement, par rapport à un premier élément de chauffage (20) à des fins de relation par emboîtement ou chevauchement avec celui-ci. 40
11. Dispositif de chauffage électrique selon l'une quelconque des revendications précédentes, dans lequel le thermostat (40) comporte un matériau qui subit des changements physiques en réponse à des changements au niveau de la température. 45
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12. Dispositif de chauffage électrique selon la revendication 11, dans lequel le thermostat (40) ouvre un commutateur qui désactive les éléments de chauffage (20, 30) en réponse à un tel changement physique. 55
13. Dispositif de chauffage électrique selon l'une quelconque des revendications 1 à 10, dans lequel le

thermostat (40) comporte une unité de commande électronique et un capteur de température qui transmet des signaux à l'unité de commande pour indiquer la température des éléments de chauffage (20, 30).

14. Dispositif de chauffage électrique selon l'une quelconque des revendications précédentes, comportant deux éléments de chauffage (20, 30) permettant de fournir deux réglages de chaleur.



REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- DE 19545155 [0004] [0005]
- WO 9712182 A [0004]