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(54) **HEATING DEVICE AND PIECE OF FURNITURE HAVING THE HEATING DEVICE**

(57) A piece of furniture (5, 6) having: a first board (1) having a PCM material having a phase change temperature between 40 and 55°C, the first board (1) being attachable to the piece of furniture (5, 6) such that a first surface (11) of the first board (1) is placed facing the piece of furniture (5, 6) and a second surface (12) is placed opposite to the piece of furniture (5, 6); a power resistor (2) in contact with a surface of the first board (1), so that the PCM material of the first board (1) is thermally loaded by the power resistor (2); a temperature detector (7) for detecting the temperature of the second surface (12) of the first board (1); and control equipment (8) to activate the power resistor (2) when the temperature of the second surface (12) is below 37°C.

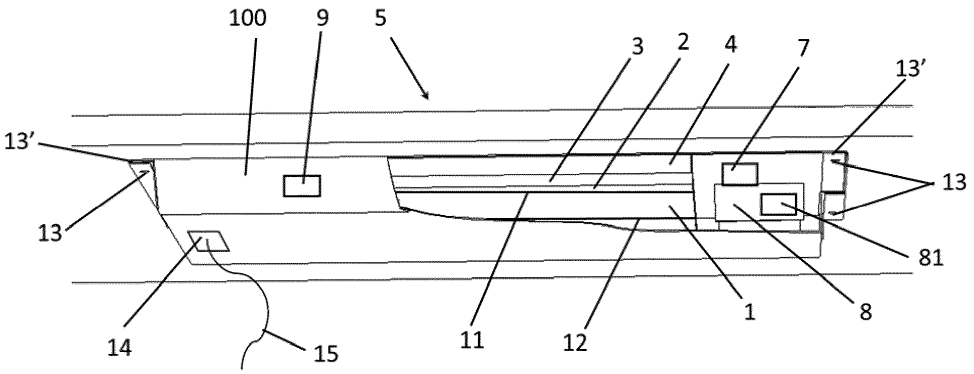

FIG. 2

EP 3 329 802 A1

Description

TECHNICAL FIELD

[0001] The present invention relates to the field of heating devices. In particular, it relates to heating devices that can be integrated in pieces of furniture, such as tables, desks and footrests, in order to provide individual comfort in rooms occupied by several persons, such as offices.

STATE OF THE ART

[0002] A building is a complex thermal system, in which the habitability and comfort of its users should be ensured. A building changes its temperature due to outdoor climate excitations and internal loads, but when the building is not within a comfort zone, a certain amount of additional energy needs to be added in order to acclimatize it instantly. This energy is provided by heating and cooling systems which in turn transform one type of energy (usually natural gas and electricity) in hot or cold temperatures to ensure indoor comfort ranges regardless of the external temperature variation.

[0003] Air conditioning systems in a building must be sized to ensure certain conditions of thermal comfort for its occupants. This thermal comfort is expressed as an assessment of satisfaction with certain thermal conditions. But this assessment is subjective and can be influenced by many variables that depend on the person itself, such as his/her age, physical condition, sex, clothing, etc.

[0004] General heating systems act on the temperature of the air volume in the area, but in many cases this is not enough for counteracting the feeling of cold and ensuring thermal comfort of users. In other words, with general heating, ventilation and air conditioning (HVAC) systems, adjusting the comfort of a maximum number of people while maximizing savings, can result in a loss of quality in comfort. As a consequence, in many cases, users themselves supplement the general HVAC systems with inefficient individual equipment, such as portable heaters and convectors.

[0005] Therefore, there is a need for maximizing comfort in the area around a user, giving the user decision-making power regarding the temperature conditions, in order to improve individual comfort, permit the operation of general HVAC systems in less demanding ranges and try to improve the energetic efficiency in the building. An attempt for improving individual temperature conditions is described in United States patent US8822885B2, which discloses an adjustable table that holds an adjustable heating means. The heating means has two sources of heat: a more potent unit for the initiation of heat and a second smaller unit in order to maintain a low level heat. Each of the two heating units is individually controlled by respective control means.

[0006] In turn, German patent DE102004060392B4 discloses pieces of furniture having cavities in which a heat storage element based on a phase change material (PCM) is arranged. A phase-change material (PCM) is a substance with a high heat of fusion which, melting and solidifying at a certain temperature, is capable of storing and releasing large amounts of energy. Heat is absorbed or released when the material changes from solid to liquid and vice versa. Among others, in DE102004060392B4 a table and a chair are shown. In both cases, the heat storage element is arranged within cavities disposed in the respective legs or in the form of a plate under the table board. The heat storage element can be fixed under the board by means of a rail system or using an adhesive element. In spite of the examples of DE102004060392B4, DE102004060392B4 does not explain how the PCM elements are integrated into the pieces of furniture, or the operating temperature range or the operation of the system. DE102004060392B4 assumes that the PCM element is loaded with ambient temperature in the building and no additional element is used to load the PCM element. However, using the temperatures in the building, the PCM element cannot reach the required temperature to be loaded, whereby the system cannot perform as claimed. Thus, the technical problem to be solved is to improve comfort of the user drastically reducing energy consumption in comparison to the conventional individual heating systems.

[0007] Despite the state of the art discloses systems which apparently improve how to heat the environment surrounding a user, none of the cited documents teaches how to achieve said improvement.

DESCRIPTION OF THE INVENTION

[0008] It is an object of the invention to provide a personal heating device that enables the regulation of temperature in the surroundings of a user according to the personal comfort criterion of the user. The device can be integrated into conventional pieces of furniture, in particular office furniture, therefore enabling the development of new office furniture that help to maintain the temperature of comfort for the user, by stabilizing the temperature in the proximity of the user's area (in particular his/her working area). Thus, the need of conditioning the total volume of air in an office at a high temperature (or at very demanding conditions) is reduced. As a consequence, the energy consumed by the building is also reduced.

[0009] The device aims at creating a climate bubble around the user, so that he/she can be in conditions of user comfort, without requiring acting throughout the whole space (building or room). Confining the area to be acclimatized, energy savings is achieved and user comfort is guaranteed.

[0010] The device is based on a low temperature emitting element (radiating means) that stores and releases heat in the course of a time period, such as a day or several hours. The heat storage and heat release is achieved through phase change materials (PCM), which dampen any abrupt temperature change that may be pro-

duced by startup, shutdown or intermittent operation of a resistor or any other source of heat/cold. Thus, the device of the invention is configured to work at temperatures higher than the ambient temperature of the building and the device of the invention comprises elements to load and control the thermal storage of the PCM element. The device comprises a PCM-based heat storage means, which makes use of the latent heat due to the phase change of a suitable material. Phase change materials (PCM) maintain stable temperature during phase change (melting and solidification). Therefore, those materials that change phase in a comfort temperature range can guarantee the stability of temperatures in the user's environment and increase his/her satisfaction. Heat storage and heat release is thus achieved in the new device by:

(1) using any residual heat/cold produced by the different energy sources in the office or by any other exogenous sources, such as an electrical resistor;

(2) storing said heat/cold at phase change materials (PCM) located next to the user; and

(3) gradually and constantly radiating this heat without causing temperature peaks that may contribute to the sensation of heat or cold.

[0011] According to an aspect of the invention, there is provided a piece of furniture comprising:

a first board comprising a PCM material having a phase change temperature between 40 and 60°C, the first board being attachable to the piece of furniture such that a first surface of the first board is placed facing the piece of furniture and a second surface is placed opposite to the piece of furniture (the second surface of the first panel is a radiant surface that will be facing the user when a user is near or using the piece of furniture; that means that this second surface is the surface that radiates heat towards the user, for instance when the user is sitting at a table or when the feet of the user are upon a footrest);

a power resistor in contact with the first surface of the first board so that the PCM material of the first board is thermally loaded by the power resistor;

a temperature detector for detecting the temperature of the second surface of the first board; and

control means to activate the power resistor when the temperature of the second surface is below 37°C.

[0012] The power resistor heats the first board by means of the Joule's effect. Also, the power resistor is not on the surface of the first board facing the user, the second surface, but on the opposite surface, the first surface. Positioning the power resistor on the first surface has the advantage of avoiding excessive heat from the power resistor to reach the user when the power resistor is on to heat the first board; thus, when the power resistor is placed on the first surface, the power resistor only directly heats the first board, but not the user; in other words, the first board acts as a thermal accumulator and the power resistor acts as a thermal charger, the power resistor thermally charging the first board so that, when the user demands heating, the first board is capable of providing the user with thermal comfort by gradually liberating the accumulated thermal energy.

[0013] The piece of furniture can comprise a thermal insulating layer placed between the piece of furniture and the power resistor.

[0014] The thermal insulating layer is configured to prevent heating loss from the power resistor to a distancing area from a user. The thermal insulating layer is configured to stop heat loss by forming a barrier which diminishes heat transfer by conduction from the power resistor to other areas of the piece of furniture which are at a further distance to the user. Thus, the most is made of the heat emitted by the board, because the heat is directed to the area where the user is. The thermal insulating layer can be placed on a surface of the board opposite to the surface facing the user.

[0015] The piece of furniture can comprise a second board comprising a PCM material having a phase change temperature between 40 and 60°C, the second board being in contact with the power resistor so that the PCM material of the second board is thermally loaded by the power resistor; and wherein the power resistor is placed between the first board and the second board.

[0016] The piece of furniture can comprise a thermal insulating layer placed between the piece of furniture and the second board to prevent heating loss from the second board to a distancing area from a user.

[0017] The power resistor can have a power between 180 and 200 W.

[0018] As described below, the PCM material of the first board and the second board can be a paraffin or a salt having a density between 800 and 1600kg/m^3. Since salts have a greater density, around 1600kg/m^3, salts are preferred when limitations with the space available are present.

[0019] Regarding specific known products suitable for the PCM material of the first board and the second board, they can be selected from one of the above-mentioned materials or its mixes and a phase change temperature between 40 and 60°C.

[0020] On the other hand, the thermal insulating layer can comprise mineral wool. Alternatively, the thermal insulating layer can comprise vacuum panels having a conductivity comprised between 0.0005-0.011W/m. The conductivity range can be comprised between 0.001-0.009W/m. Preferably the conductivity range can be comprised between 0.003-0.007W/m. More preferably, the conductivity can be around 0.005W/m. In a preferred embodiment, the conductivity can be 0.005W/m.

[0021] As for the control means, they can be configured to activate the power resistor so that the temperature of the second surface is kept between 36°C and 50 °C.

[0022] Additionally, the control means can comprise scheduling means for the activation of the power resistor during a predetermined time.

[0023] The piece of furniture of the invention can comprise a metal housing for housing the first board, the second board, the power resistor and the thermal insulating layer. The metal housing can comprise detachable means for fixing the metal housing to the piece of furniture. The metal housing can further comprise an electric connector for the electrical supply of the power resistor.

[0024] According to diverse embodiments of the invention, the piece of furniture can be a table or a footrest.

[0025] When the piece of furniture is a table, the metal housing can be placed on a lower face of a table-top, so as to emit heat to the legs of a user.

[0026] When the piece of furniture is a footrest, the metal housing can be placed on a lower face of a footrest, so as to emit heat to the feet of a user.

[0027] In the case where the heating device is placed on the lower face of a table-top, the emitted heat surrounds the legs of the user, since the heating device is placed in a proximity of the legs of the user. In the case where the heating device is placed on the lower face of a footrest, the emitted heat surrounds the feet of a user and ascends towards the legs of the user, since the heating device is placed in a proximity of the feet of the user.

[0028] The thermal insulating layer can be placed in a location selected from above the board(s), when the housing is placed on the lower face of a table-top and under the board(s), when the device is placed on the lower face of a footrest.

[0029] When the piece of furniture is a table, the table can comprise a side panel configured to confine heat surrounding the legs of the user. The side panel can extend downwards from the table-top. There can be one side panel, for example on the front side of the table, or more side panels, also including one or both lateral sides of the table.

[0030] Combinations of pieces of furniture as the ones described above can also be chosen so as to improve comfort of a user. Thus, a possible combination is a table together with a footrest. In this combination, the table and the footrest complement each other providing the user with a more complete and comfortable personal heating equipment.

[0031] The PCM comprised in the heat storage means is conventional and therefore out of the scope of the present invention. However, not any conventional PCM is suitable for the device. The device makes use of the property according to which the temperature of the material is maintained stable both in melting and solidification process. Since solidification occurs at about 2°C below the melting temperature, the most suitable PCMs are those having a nominal temperature of phase change according to the manufacturer which enables the device of the invention to keep a temperature of the second surface between 36 and 50°C.

[0032] One centimeter of PCM that changes its phase at around 27°C, fully loaded and at ambient temperature of 18°C, preserves the heat for more than 3 hours. Under similar circumstances, this time is reduced to 40 minutes for a PCM that changes its phase at a temperature varying between 40-60 °C. This time can be increased by increasing the thickness of the PCM.

[0033] Non-limiting examples of currently commercially available PCMs that change their phase within the already mentioned comfort range of 40-60 °C, are for example, phase change materials manufactured by Rubitherm® GmbH company, commercially denominated RT 44HC, RT 50 and RT 42. In the invention, the PCM is encapsulated into an aluminum case called CSM (compact storage modules).

[0034] Taking into account both the temperature comfort range and the amount of time for which heat is preserved, among the commercially available PCMs, the following ones are especially suitable for operating in heating mode: RT 44HC and RT 50.

[0035] RT 50 changes its phase into solidification at a temperature close to 50 °C (temperature at which solidification starts). When a single CSM board 1cm thick is used, it maintains a temperature higher than 40 °C for 20 minutes and it maintains a temperature higher than 37 °C for 40 minutes.

[0036] In turn, RT 44HC starts its solidification at 42 °C. When a single CSM board 1cm thick is used, it maintains a temperature higher than 42 °C for 20 minutes and it maintains a temperature higher than 35 °C for 60 minutes.

[0037] When the amount of CSM of RT 44HC is increased, and two boards 1cm thick each are used instead of one board 1 cm thick, the amount of time for which the temperature is maintained above 37 °C increases to 90-100 minutes. Therefore, in a preferred embodiment, RT 44HC is chosen having a configuration having two CSM 1cm thick boards.

[0038] On the other hand, the storage capacity of a PCM is determined by its mass. In the mentioned temperature range, the most common PCMs are salts and paraffins, whose densities are 1600 and 800kg/m^3, respectively. In a particular embodiment, if space is a limitation, a salt is preferably used because of its higher density. This means that, in the future, as new PCMs are developed, new PCMs consisting of a salt or comprising a salt may replace the currently preferred RT 44HC, which is a paraffin.

[0039] In sum, the device enables maximization of comfort in the area around the user, alleviating the temperature constraints of general air conditioning systems, therefore improving the energy efficiency of the building. Because the operating temperature (temperature of comfort perceived by the user) under the table comprising the device or above the footrest comprising the device, is higher than the overall air temperature in the of-

fice, the general air conditioning system can operate at several degrees below said operating temperature, thus saving energy. The difference between the operating temperature under the table comprising the device (or above the footrest comprising the device) and the overall room temperature depends on the chosen phase change material. For example, the operating temperature for RT27 (a commercially available PCM commercialized by Rubitherm® GmbH) is 0.5 °C above the overall room temperature, or the operating temperature for RT44 is 1.5 °C above the overall room temperature.

[0040] Additional advantages and features of the invention will become apparent from the detail description that follows and will be particularly pointed out in the appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0041] To complete the description and in order to provide for a better understanding of the invention, a set of drawings is provided. Said drawings form an integral part of the description and illustrate an embodiment of the invention, which should not be interpreted as restricting the scope of the invention, but just as an example of how the invention can be carried out. The drawings comprise the following figures:

Figure 1 shows a system of the invention comprising two devices.

Figure 2 shows a first embodiment of the device of the invention.

Figure 3 shows a perspective of the first embodiment of the invention.

Figure 4 shows another perspective of the first embodiment of the invention.

Figure 5 shows a second embodiment of the device of the invention.

Figure 6 shows an alternative shape for the second embodiment of the device of the invention.

[0042] The heating device incorporated in a piece of furniture comprises:

1, 3	boards
1	first board
2	power resistor
3	second board
4	thermal insulating layer
5, 6	piece of furniture
5	table
6	footrest
7	control means, controller
8	temperature detector, thermocouple
81	scheduling means
9	switch
11	first surface
12	second surface
13	detachable means
13'	guides
14	electric connector
15	wiring
16	timer
17	display
18	side panels
100	metal housing

DETAILED DESCRIPTION OF THE INVENTION

[0043] The following description is not to be taken in a limiting sense but is given solely for the purpose of describing the broad principles of the invention. Next embodiments of the invention will be described by way of example, with reference to the above-mentioned drawings showing apparatuses and results according to the invention.

[0044] In order for the device to store and release heat, the device first has to be loaded with heat. To guarantee phase change, as mentioned above, heat from different sources or other exogenous sources available in the working area or office can be used.

[0045] Thus, the device can use a power resistor 2 as a method to load the device for heat storage. The power resistor 2 can be turned on for a brief period of time, up to guaranteeing phase change of the PCM and remain off during the time where the PCM keeps the temperature in the working area within comfort range.

[0046] To optimize (comfort time)/(energy consumption) ratio and, consequently device yield, once PCM has been established, power resistors 2 with low electric consumption are used. The lower energy consumption, (energy being calculated as the product of the power and the time at maximum power) is achieved by high power resistors 2. The high power resistors 2 guarantee total load of the PCM, require shorter turning on time and have lower losses to the surfaces.

[0047] In an embodiment with two boards 1, 3, a power resistor 2 around 180-200W between the two CSM RT 44HC boards 1, 3 is used. A thermal insulating layer 4 is also included between the PCM board 1 and the table 5 top so as to avoid heat to pass to the table 5 top.

[0048] The thermal insulating layer 4 under the table 5 top not only protects the table 5 top from the temperature of the device, but also enhances load of the device in a shorter period of time, which implies reducing energy consumption during load phase. For instance, a VIP (Vacuum Insulating Panel) thermal insulating layer 4 having a thickness of 1cm and a conductivity of 0.005W/m is enough to preserve integrity of the table 5 top upon a temperature peak.

[0049] For the embodiment having two CSM boards 1, 3 filled with RT 44HC, the 180W heating power resistor

2 offers more stability in temperature terms to the device.

[0050] Having a 200W power resistor 2, the device works, but part of the heating energy is under-used in sensible heat, whereby it is recommended to increase thickness of the boards.

[0051] To control the device, device temperature must be checked so that surface temperature on the lower side, when the device is on the lower side of a table 5 top, remains in a range between 40 and 60°C.

[0052] This control can be performed checking temperatures or time. Controlling temperatures by a thermostat appears to be the most appropriate way, since controlling time requires an exhaustive characterization of the device behavior in the environment where the system is used.

[0053] As mentioned above, to increase comfort grade or comfort sensation by the user, the user must be able to control the device and to turn it on and off when they consider it convenient.

[0054] Thus, for an embodiment of a device under a table 5 top having two boards 1, 3 with a thickness of 1 cm each, the device may be in the following states:

- Initial turning on of a surface 180W power resistor 2, having a power density 2900W/m^2, for approximately 30minutes, until temperature on the lower side of the device reaches 50°C.

- Ulterior turning on of the power resistor 2 when surface temperature on the lower side of the device drops until 37°C. In office environments, this can represent a turning on of around 15min. every 1h15min. so that temperature of the lower surface of RT 44HC, in other words, of the side closer to the legs of the user, remains between 42 and 40°C.

[0055] Under this operation, when the device comprises a thermal insulating layer 4, temperature of the top surface of RT 44HC can lightly increase in every step; however, structural configuration of the device and established working conditions, allow the PCM of the device to be thermally loaded in full. To achieve proper working of the device, a clever selection of the power resistor 2 proves to be crucial.

[0056] Figure 1 shows a system comprising two devices, a first device as a metal housing 100 configured to be placed under a table 5 top and a second device configured to be placed in a footrest 6.

[0057] Figure 2 shows the structure of the device configured to be placed under a table 5 top. The device for the table 5 top comprises:

1. A VIP having a thickness of 1cm;

2. Two boards 1, 3 CSM 440x320x10mm filled with PCM (Rubitherm® RT44)

3. A 180W power resistor 2 to heat the two boards 1, 3, the power resistor 2 having a heating tape shape.

4. A controller 7 to switch on/off the device in the 35-55°C temperature range.

5. A thermocouple 8 to read temperatures.

6. A switch 9

7. A metal housing 100 to hold the PCM

8. Guides 13' and detachable means 13 to fasten the metal housing 100 to the table 5 top.

9. An electric connector 14 on the metal housing 100 for connecting the device to the grid.

10. Wiring 15

[0058] In order to house the necessary components, the metal housing 100 is conformed from a stainless-steel plate shaped to contain inside all the components of the device.

[0059] Figure 3 shows a perspective of the metal housing 100 where the switch 9 and the electric connector 14 may be seen on a side of the metal housing 100 to connect the device to the electric grid by means of the wiring 15.

[0060] Figure 4 shows another perspective of the metal housing 100 where the guides 13' and the detachable means 13 may be seen. These guides 13' and detachable means 13 are on a side of the metal housing 100 configured to face the lower side of the table 5 top.

[0061] To ensure the user cannot manipulate the device, the metal housing 100 is locked with bolting having a special head. Thus, the professional operator in charge of maintenance can gain access to the interior of the metal housing 100 by means of special tools and can change the PCM, if performance is not satisfactory, or can replace the PCM when the PCM no longer works (the estimated lifespan of the PCM is 5 years).

[0062] Figure 5 shows the structure of the device configured to be placed in a footrest 6. The device for the footrest 6 comprises:

1. A CSM 1cm thick RT44HC board 1.

2. A 200W heating power resistor 2.

3. A thermal insulating layer 4 made of mineral wool.

4. A controller 7 to switch on/off the device depending on the superficial temperature of the board 1.

5. A thermocouple 8 to read temperatures.

6. A switch 9

7. Footrest 6.

8. An electric connector 14 on the metal housing 100 for connecting the device to the grid.

9. Wiring 15

[0063] Figure 6 shows another shape for the footrest 6.

[0064] The device for the footrest 6, is also locked with the same security barriers as the device for the table 5 top.

[0065] The device, be it the one to be installed under a table 5 top, the one to be installed in a footrest, or both, can be configured by the user. To this end, the device may comprise additional elements. A timer 16 may ensure a continuous operating cycle for the PCM, maximizing the efficiency of the device.

[0066] Moreover, to provide a high-end device, the switch 9 can be tactile, the device may comprise a little display 17 configured to be placed on the table 5 top to easily control the temperature, or the device may even be configured to be controlled by means of mobile devices.

[0067] Complementarily, as shown if figure 1, the device may collaborate with skirts or frontal and side panels 18 provided on the table so as to confine heat surrounding the legs of the user. The footrest 6 can be connected to the one of the frontal and side panels 18 of the table.

[0068] To direct the wiring 15 which enables connection of the device to the electric grid, the structure of the table can be used as shown in figure 1.

[0069] The structure of the device of the invention allows for energy savings: the option to locally heat the area surrounding a user, makes it possible for the general heating systems to operate at lower temperatures, which consequently implies energy savings upon diminishing ventilation and heating leaks.

[0070] Additionally, given that the device stores heat and acts locally, the device also makes it possible to earlier turn off the general heating systems, to accumulate heat in the device at times where the electric bill is lower or to delay the turning on of the device.

[0071] In conclusion, on the one side, the heating device increases comfort of the user while, on the other side, it saves energy otherwise wasted on over conditioning the premises where the user is located. The invention also provides a device economical to manufacture, which can be installed on already existing furniture requiring a simple maintenance, which can be performed only by an authorized operator, given that the device incorporates means to avoid hampering by unauthorized personnel.

[0072] In this text, the term "comprises" and its derivations (such as "comprising", etc.) should not be understood in an excluding sense, that is, these terms should not be interpreted as excluding the possibility that what is described and defined may include further elements, steps, etc.

[0073] In the context of the present invention, the term "approximately" and terms of its family (such as "approximate", etc.) should be understood as indicating values very near to those which accompany the aforementioned term. That is to say, a deviation within reasonable limits from an exact value should be accepted, because a skilled person in the art will understand that such a deviation from the values indicated is inevitable due to measurement inaccuracies, etc. The same applies to the terms "about" and "around" and "substantially".

[0074] On the other hand, the invention is obviously not limited to the specific embodiment(s) described herein, but also encompasses any variations that may be considered by any person skilled in the art (for example, as regards the choice of materials, dimensions, components, configuration, etc.), within the general scope of the invention as defined in the claims.

Claims

1. A piece of furniture (5, 6) comprising:

   a first board (1) comprising a PCM material having a phase change temperature between 40 and 60°C, the first board (1) being attachable to the piece of furniture (5, 6) such that a first surface (11) of the first board (1) is placed facing the piece of furniture (5, 6) and a second surface (12) is placed opposite to the piece of furniture (5, 6);
   a power resistor (2) in contact with the first surface (11) of the first board (1) so that the PCM material of the first board (1) is thermally loaded by the power resistor (2);
   a temperature detector (7) for detecting the temperature of the second surface (12) of the first board (1); and
   control means (8) to activate the power resistor (2) when the temperature of the second surface (12) is below 37°C.

2. The piece of furniture (5, 6) of claim 1 comprising a thermal insulating layer (4) placed between the piece of furniture (5, 6) and the power resistor (2).

3. The piece of furniture (5, 6) of claim 1 comprising a second board (3) comprising a PCM material having a phase change temperature between 40 and 60°C, the second board (3) being in contact with the power resistor (2) so that the PCM material of the second board (3) is thermally loaded by the power resistor (2); and wherein the power resistor (2) is placed between the first board (1) and the second board (3).

4. The piece of furniture (5, 6) of claim 3 comprising a thermal insulating layer (4) placed between the piece of furniture (5, 6) and the second board (3).

5. The piece of furniture (5, 6) of any of the previous claims wherein the power resistor (2) has a power between 180 and 200 W.

6. The piece of furniture (5, 6) of any of claims 3 to 5 wherein the PCM material of the first board (1) and the second board (3) is a paraffin or a salt having a density between 800 and 1600kg/m^3.

7. The piece of furniture (5, 6) of claim 6 wherein the PCM material of the first board (1) and the second board (3) is selected from one of the following materials or its mixes thereof: RT 42, RT 44HC and RT 50.

8. The piece of furniture (5, 6) of any of claims 2 to 7 wherein the thermal insulating layer (4) comprises mineral wool.

9. The piece of furniture (5, 6) of any of claims 2 to 7 wherein the thermal insulating layer (4) comprises vacuum panels having a conductivity of around 0.005W/m.

10. The piece of furniture (5, 6) of any of the previous claims wherein the control means (8) are configured to activate the power resistor (2) so that the temperature of the second surface (12) is kept between 36°C and 50 °C.

11. The piece of furniture (5, 6) of any of the previous claims wherein the control means (8) comprises scheduling means (81) for the activation of the power resistor (2) during a predetermined time.

12. The piece of furniture (5, 6) of any of claims 3-11 comprising a metal housing (100) for housing the first board (1), the second board (3), the power resistor (2) and the thermal insulating layer (4), the metal housing (100) comprising detachable means (13) for fixing the metal housing (100) to the piece of furniture (5, 6).

13. The piece of furniture (5, 6) of claim 12 wherein the metal housing (100) further comprises an electric connector (14) for the electrical supply of the power resistor (2).

14. The piece of furniture (5, 6) of any of the previous claims, wherein the piece of furniture (5, 6) is a table (5).

15. The piece of furniture (5, 6) of any of the previous claims, wherein the piece of furniture (5, 6) is a footrest (6).

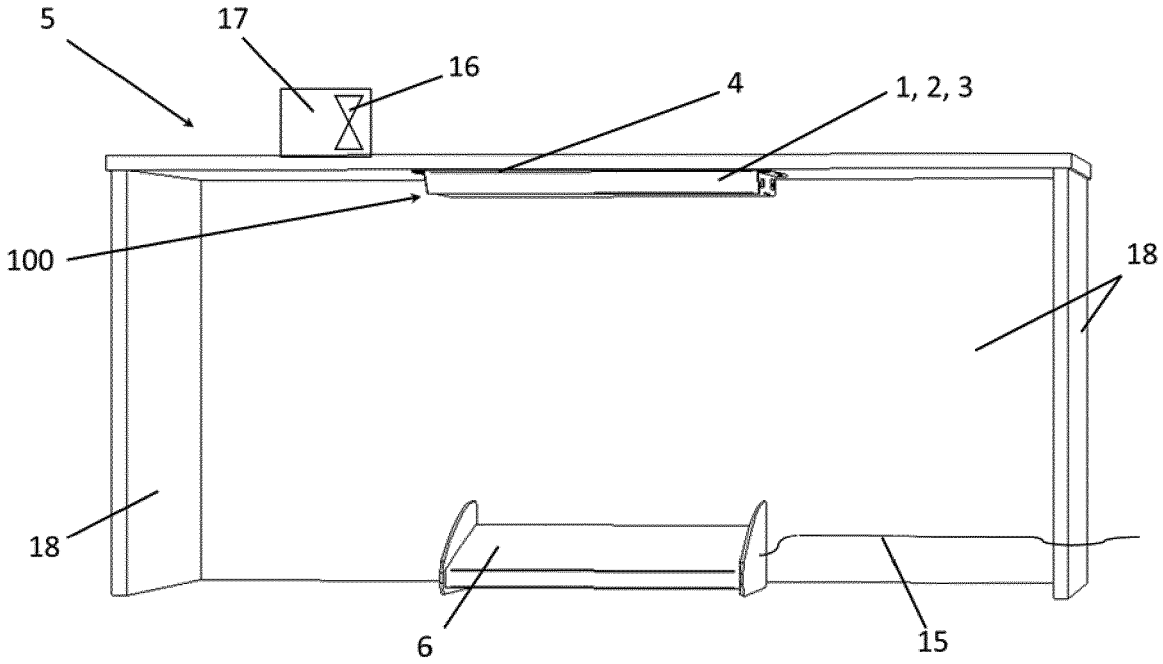

FIG. 1

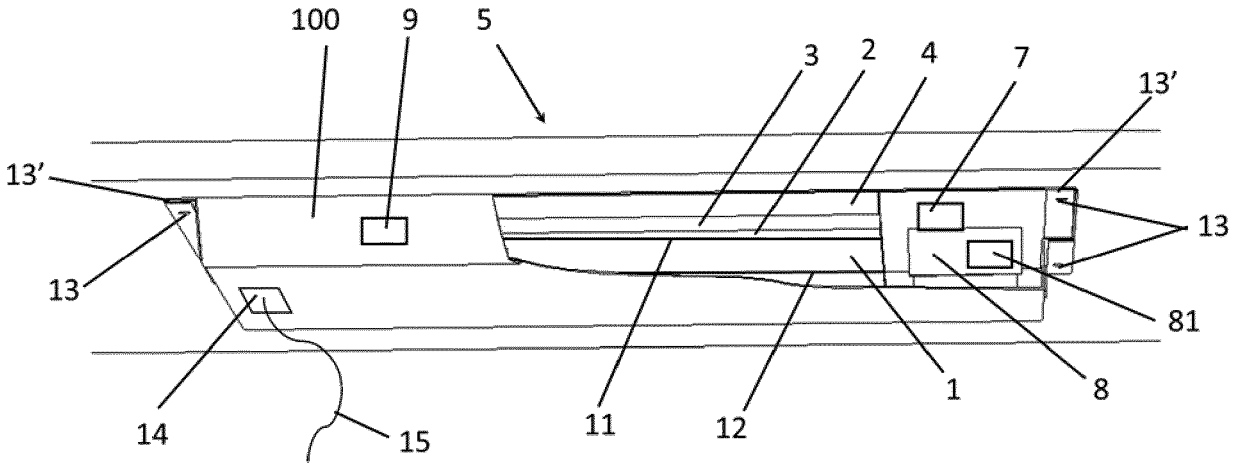

FIG. 2

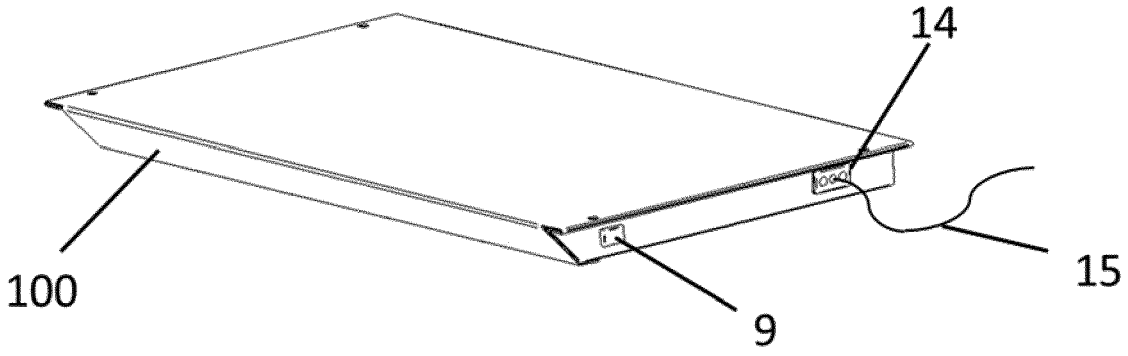

FIG. 3

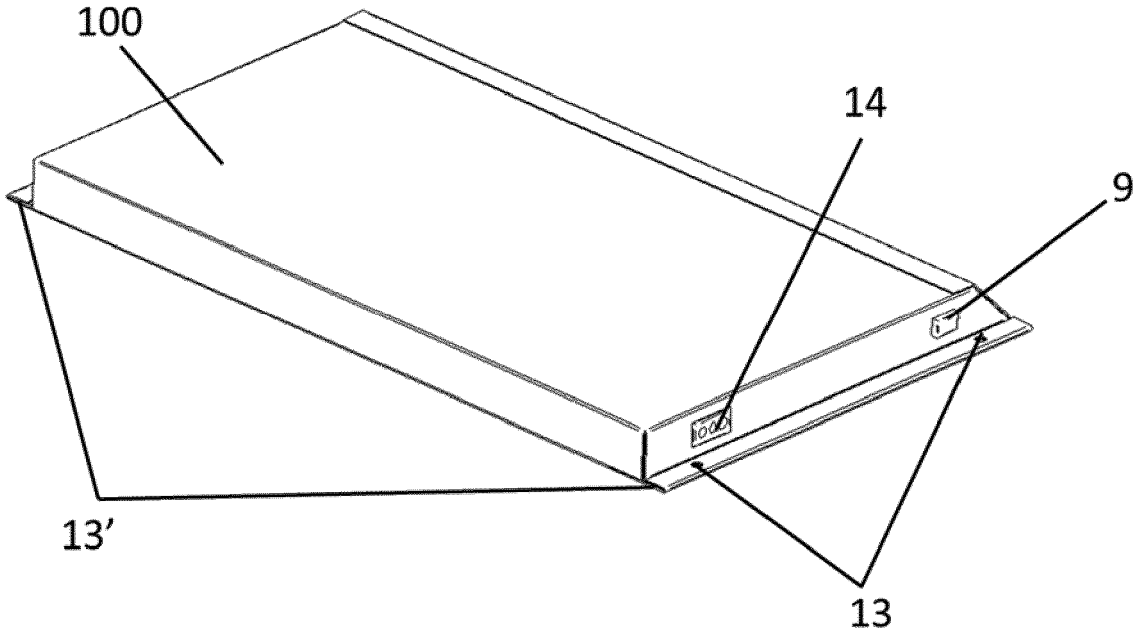

FIG. 4

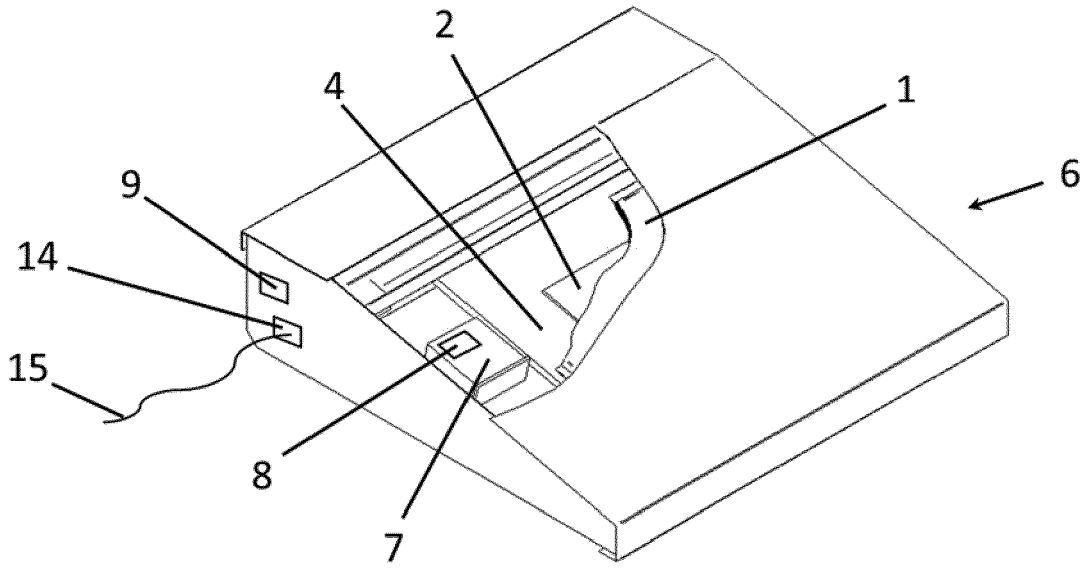

FIG. 5

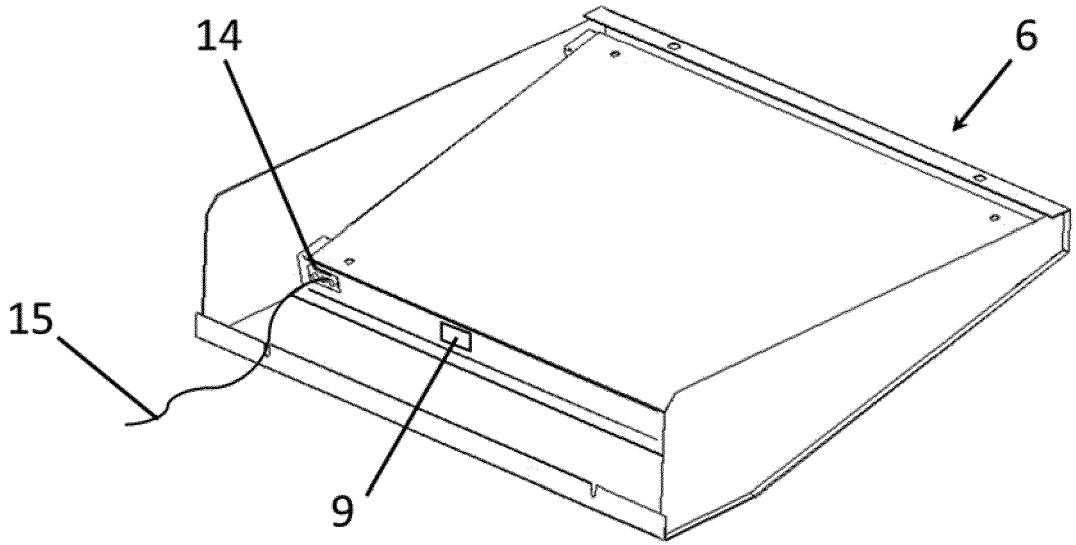

FIG. 6

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EUROPEAN SEARCH REPORT

Application Number
EP 16 38 2585

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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A47B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	6 April 2017	Sroka, Christian

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