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(54) **Panel heater for heating a room, comprising an inlay of thermal resistant and electric insulating material, mainly to be used as a distance holder**

(57) Heater for room heating, with an electrical heating element (11), placed in a generally plate formed housing (13) with a front panel (14) and a back plate (15) with fastening devices (12) for fastening to a wall or similar mounting surface. The heater includes a distance holder, in the form of an inlay (20) of fibre containing and/or porous, thermal resistant and electric insulating material, in plate or grid form. The inlay (20) is arranged towards the front panel (14) and fills most of the room towards the heating element (11).

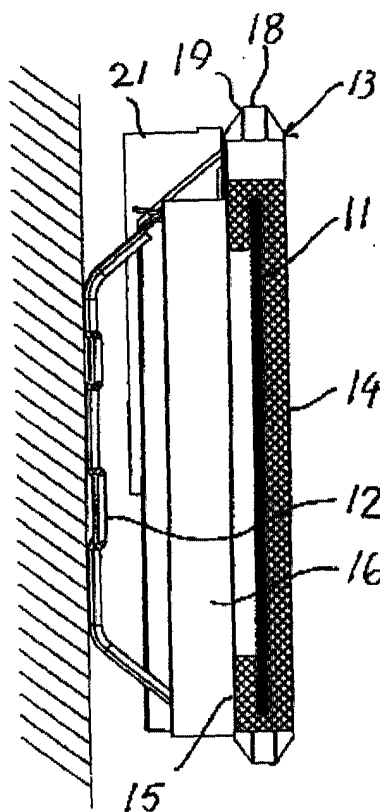


Fig.1

Description

[0001] Panel heater for heating a room, comprising an inlay of thermal resistant and electric insulating material, mainly to be used as a distance holder.

[0002] A heater for heating a room, with electric heating element, is defined by the preamble of patent claim 1.

Background

[0003] Upon the design of such heaters, often called "panel heaters", it is known to insert distance holders of a thermal resistant material, between the heating element and the housing or shell that surrounds it, the holders are partly touching the two parts. Thus the heat transfer must be carried out across a narrow gap of air.

[0004] This results in several disadvantages. Firstly, it will result in uneven heating of the shell. Because the heater must be dimensioned to limit maximum surface temperature to a given value, such uneven heating may result in the heating element being larger than necessary with ideally even heating of the exposed surfaces.

[0005] From PCT patent application WO98/26220 (Cadif 1996) is known to make a heating panel which is insulated towards a carrier of foamed plastic. This technique with exposed heating surfaces, is not suited for room heating because of the high contact temperature, because of the rapid cooling and because it demands specially mat shaped heating elements.

[0006] From EP patent application 611 922 (SEB 1994) is known to place a heating element between the back wall and the front of a panel heater, so that air insulation to the two parts, arises. This insulation creates difficulties in achieving even temperatures across the whole front face. The heater must be dimensioned according to an allowed maximum temperature, this means an unnecessary limitation of the capacity.

[0007] From EP patent application 926 925 (Messier-Bugatti 1997) is known to laminate a heating panel with carbon fibre heating elements, which are covered by one or several thin layers or webs of glass fibre mat, on both sides. The purpose of this is primarily electric insulation. With this heater, one wishes to lead most of the heat towards the front panel. Therefore it has a reflecting metal foil behind the heating element, and behind this an insulation mat of plastic material.

[0008] With such a direct contact between the heating element and a front panel of metal, the temperature will vary rapidly upon connecting and disconnecting the heating element, and the heater will be chilled rapidly when disconnected, for example in a saving interval.

[0009] From UK patent application 2 265 211 (McGorry, 1992) is known a heating panel where a heating element is immobilized in a plate of composite material, and insulated towards a back wall with a plate of foamed plastic. In this solution, as much heat as possible shall be emitted from the front, so that the heating panel can

be fastened directly to a wall. Towards the front, the heating element is covered with two layers of plastic. This solution has large limitations concerning the heat that may be radiated, and is not suited for panel heaters which are to transfer considerable heat without being dangerous to touch.

[0010] From SU patent 1 749 636 (Tula 1992) is known a cooking apparatus with a heating element placed below a metal plate, carried by a layer of thermal insulated material, which may be a fibre glass fabric, and which prevents the heat being transferred downwards. Such a cooking device will not be suitable as a panel heater for fastening to a wall, in particular because the radiated heat will be low due to high local contact temperature.

Object

[0011] The main object of the invention is therefore to create a heater having a surface temperature as even as possible, on contact surfaces. Another object is to increase the average surface temperature, and thereby providing higher efficiency for a given heater dimension.

[0012] A particular object is to reduce or convert noise generated in the heater, so that it does not bother users.

[0013] Further objects will follow from the description below.

The invention

[0014] The invention is stated in patent claim 1. With this solution, several advantages are achieved:

- more even transfer of heat to the front of the heater, resulting in even temperature on the contact surfaces,
- possibility for control of heat transfer, so that it is possible to have higher temperature on parts of the back side than on the front,
- increased heating storage, offering a more even temperature curve upon connection and disconnection,
- possibility for smaller dimensions having the same effect, as a larger heater, respectively increase of efficiency without increase of dimensions,
- noise reduction so that vibration noise ("frequency noise") is no longer heard from the heating element when vibrating,
- possibility to use heating elements with more even temperature than otherwise possible, which may increase the number of possible heating element types,
- muting resonance in the front- and back plate, so that the heater gets a "compact" and not "empty" sound when touched,
- makes it possible to use a corrugated front panel without getting substantial temperature variations between the tops and the bottoms and between the

lower and upper edge of the heater.

[0015] Further advantageous features of the invention, are stated in patent claims 2-6.

Example

[0016] The invention is described below in detail, with reference to the drawings, where Figure 1 shows a vertical cross section of a heater according to the invention, and Figure 2 shows a plan view of the heater in Figure 1.

[0017] In the Figures, is shown a heater with a plate formed heating element 11, which may be manufactured by on known techniques. The heating element 11 is encapsulated in a housing 13 comprising a front cover 14, a back cover 15 with a cooling element 16 that is fastened to the wall with two carrying brackets 12 with known shape.

[0018] The heating element 11 may in principle have a any known shape. In an advantageous embodiment, it may be made of glass with a layer that may function as a resistance element. This offers the advantage of a higher heating capacity and better capability to emit heat during disconnection. This may be a features of interest in some areas with capacity problems in the power system.

[0019] The front cover 14 has the shape of a low rectangular bowl with corrugations 17 shaped as corrugated iron, with tops and bottoms stretching vertically, as the depth of the bottoms may be about 3-7 mm. The low side edges 18 stretching all around this element, are designed for joining the back cover 15.

[0020] The back cover 15 in the example, has a corresponding rectangular bowl form like the front cover, but without corrugations. The back cover 15 has an even surface, and is provided with side edges 19 fitting with the side edges 18 of the front cover 14, so that they may be locked together with screws (not shown) or squeezed, welded or adhered permanently together.

[0021] The cooling element 16 is provided with large corrugations increasing the surface area for this part. This part is outside the contact area, and may therefore have higher surface temperature.

[0022] The heating element 11 is placed on an inlay 20 shaped as a plate or mat of mineral wool, preferably glass wool, that entirely covers the front of the heating element 11, and covers a narrow area at the upper and lower edge of the back side of the heating element. In this way, the heating element 11 is fastened in mineral wool. It will not be necessary with distance holders to hold the heating element in place, as the mineral wool inlay 20 will give sufficient firm and lasting support. Most of the back side of the heating element will be open to thermal radiation towards the back cover 15, and extra transfer of heat to the cooling element 16.

[0023] The inlay of mineral wool in the front, has proven to result in strong evening out of the temperature across the front panel 14. This provides a better tem-

perature distribution and means that the average temperature of the front cover 14 can be closer to the maximum surface temperature.

[0024] At one of the upper edges of the housing 13, there is placed a combined switch and control unit 21 controlling the heating element 11, eventually influenced by control signals received over a power line, separate connection or radio signals.

[0025] The heating element 11 is preferably placed on glass wool or ceramic "wool", which is electrically insulating and not hygroscopic. The inlay 20 may be compressed from a relatively loose glass wool mat, or made as a compressed mat from the manufacturer. Eventually, synthetic fibre material may be used with sufficient thermal resistance and electrical insulating properties, and composite materials with corresponding structure and material characteristics.

[0026] The inlay 20 may be completely plate formed, or provided with perforations, or have the shape of a grid with holes. It is not necessary to be continuous between the heating element and the front, as long as it is close to the front panel, and provides for evening out of the temperature on this.

[0027] An alternative to the illustrated heating element, may be a heating element based on steel bars with cooler flanges, for example of aluminium or another metallic, generally plate formed element.

Claims

1. Heater for room heating, with an electric heating element (11), being placed in a generally plate formed housing (13) with a front panel (14) and a back plate (15) with fastening devices (12) for fastening to a wall or similar mounting surface, for positioning of the heating element (11) between the front panel (14) and back plate (15) is placed elements (20) bearing against the heating element (11) and the housing (13) to act as distance holder, **characterized in that** the distance holder is substantially in the form of an inlay (20) of fibre containing and/or porous, thermal resistant and electric insulating material, shaped as a plate or grid, bearing towards the front panel (14) and filling the room towards the heating element (11) across the whole or main parts of the areal and/or distance.
2. Heater according to claim 1, **characterized in that** the inlay (20) covers the whole front side of the heating element (11), and at least parts of a lower edge of the heating element (11).
3. Heater according to claim 1 or 2, **characterized in that** at the rear edge of the heating element (11) there is an opening to the back plate (15), substantially not covered by insulating

material.

4. Heater according to anyone of the claims 1-3,
characterized in that a mat of fibre glass or any
other thermal insulating wool, may be used as the
inlay (20). 5
5. Heater according to anyone of the claims 1-4,
characterized in that a plate of glass or other min-
eral, preferably having a resistant layer or foil-ele-
ment with resistant layer, may be used as a carrier
for the heating element (11), as the resistant layer
is placed on the side of the heating element, turning
towards the front panel (14). 10
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6. Heater according to anyone of the claims 1-5,
characterized in that the front panel (14) is either
smooth, or corrugated with shallow vertical tops and
bottoms with a trapezoidal cross section, the dis-
tance between top and bottom being 3-7 mm. 20

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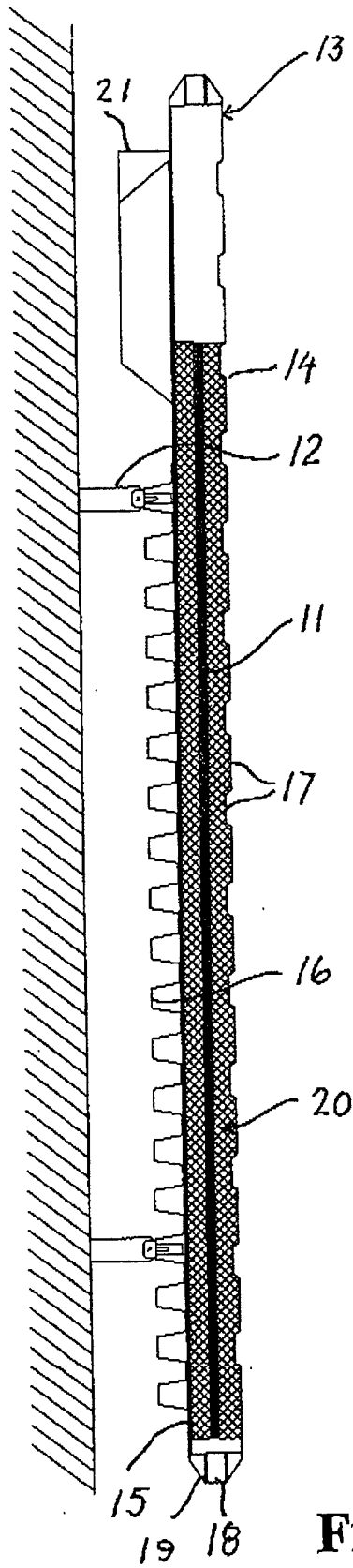


Fig.2

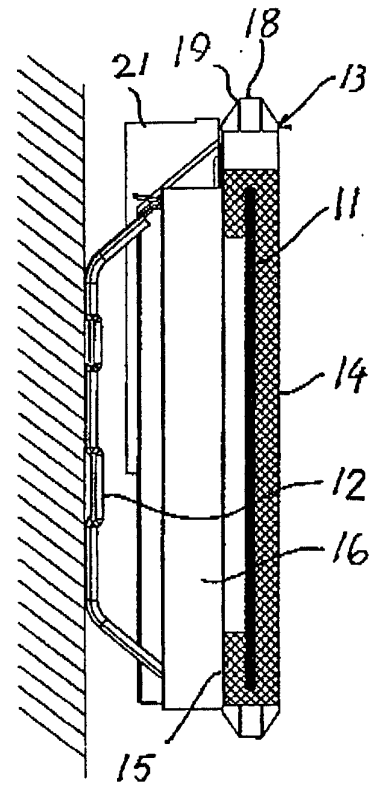


Fig.1