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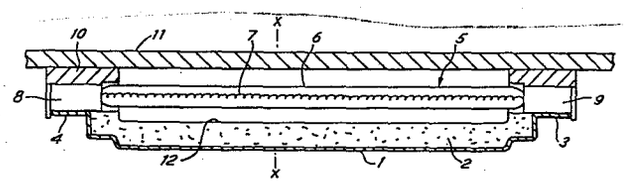
(54) Heating apparatus.

(57) Heating apparatus includes a generally circular tray (1), having a layer (2) of insulative material disposed therewithin. The tray (1) supports, above the layer (2) each end of a number of tungsten-halogen lamps (5) and the tray (1) is urged upwardly towards the undersurface of a layer (11) of glass ceramic to form a cooking hob.

A coating (12) or an infra-red reflective material, typically an oxide material, such as titanium dioxide, may be deposited on the layer (2) of insulative material so as to cause the layer (2) to be substantially impervious to infra-red radiation. As an alternative to the coating (12), the layer (2) may be surface-enriched with an infra-red reflective material.



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HEATING APPARATUS

This invention relates to heating apparatus and in particular, though not exclusively, to such apparatus of the kind described in our copending European Application No.83307338.0 incorporating one or more sources of infra-red radiation.

Heating apparatus of this kind consists of, in one example, a shallow tray member containing insulative material and supporting four infra-red-emitting tungsten-halogen lamps. The tray member is mounted beneath a layer of glass ceramic, together with, say three similar trays so as to form a cooking hob.

Although the insulative material may be highly efficient at preventing heat dissipation from the apparatus, it may only absorb and re-radiate a limited amount of the infra-red radiation, so that it may be necessary to provide each of the lamps with a reflective coating on the underside thereof, thereby ensuring that infra-red radiation emitted in a downward direction from the filament is reflected back thereto in an upward direction, thereby preventing considerable dissipation of the infra-red radiation from the apparatus.

It is an object of the present invention to alleviate further any undesirable dissipation of infra-red radiation from the heating apparatus.

According to the invention, there is provided heating apparatus including at least one source of infra-red radiation disposed above, or partially embedded in, a layer of insulative

material, said insulative material having been treated so as to cause it to be substantially impervious to infra-red radiation.

The insulative material is preferably treated by application of an infra-red reflective coating to the surface thereof, or alternatively, by enriching a surface layer thereof with an infra-red reflective material.

The or each source of infra-red radiation preferably comprises a tubular tungsten-halogen lamp and the surface of the insulative material may have grooves provided therein to accommodate an underside portion of the surface area of each of the lamps, thereby causing infra-red radiation emitted in a downward direction from each filament to be reflected back partially theretowards and partially in an upward direction away from the insulative material.

The invention will now be further described by way of example only with reference to the accompanying drawings, wherein:-

Figure 1 shows a cross-sectional view of one embodiment of the present invention, and

Figure 2 shows a simplified cross-sectional view, which is not to scale, along the line X-X in Figure 1, and incorporating an alternative embodiment of the invention.

Referring to Figure 1, a generally circular tray 1, preferably formed from metal, has disposed therewithin, on the base thereof, a layer 2 of a suitable insulative material. The tray 1 has two extending flanges, 3 and 4, arranged on opposite sides of the rim thereof, which support respectively each end of a number of sources of infra-red radiation, one being shown at 5. In a preferred example, four sources are arranged across the circular area of the tray 1.

Each source 5 of infra-red radiation comprises a tungsten-halogen lamp including a tungsten filament 7 supported within a quartz envelope 6, as described in co-pending European Application No.84301636.1 in the name of THORN EMI plc. Each lamp has moulded ceramic end caps, 8 and 9, which each enclose a pinch seal (not shown) with an electrical lead connected to the respective end of the filament sealed therein, the lead being

welded to an appropriate electrical connector.

A moulding 8 of ceramic fibre material is disposed above the tray 1 and press-fitted around the ends of each source 7 to provide a suitable packing therefor.

The tray 1 is urged upwardly, by a resiliently-mounted support plate (not shown), towards the undersurface of a layer 11 of glass ceramic, which forms the top surface of a cooking hob.

A thermal limiter (not shown) may also be provided within the apparatus to de-energise the lamps when a maximum operating temperature of the glass ceramic layer is reached, so as to prevent damage to the glass ceramic.

The limiter may be in the form of a metallic wire supported within a quartz tube, the wire being arranged to undergo thermal expansion to activate a microswitch, which causes de-energisation of the lamps, when the maximum temperature is reached.

To ensure that the wire is sensitive primarily to radiation, which has been absorbed and re-radiated from the glass ceramic and not to radiation directly from the lamps or reflected from the insulative material, a coiled nickel or silver foil may be disposed between the wire and the quartz tube. Once inside the tube, the coiled foil is allowed to expand to contact the inner surface of the tube.

Infra-red radiation directly from the lamps is transmitted through the wall of the quartz tube and reflected back by the foil, so that the wire remains insensitive to the radiation. However radiation, which has been absorbed by and re-radiated from the glass ceramic is of a different wavelength to that of the reflected radiation and is absorbed by the quartz tube. The wire therefore becomes heated, and thus undergoes thermal expansion by thermal conduction from the tube.

The insulative material, which is typically a microporous material, such as that known as Microtherm, may reflect only a limited amount of the infra-red radiation emitted in a downward direction from the lamps.

The present invention therefore provides, in one

embodiment, a coating 12 of an infra-red reflective material, typically an oxide material, such as titanium dioxide.

The infra-red reflective material may be applied to the insulative material in any suitable form and by any suitable method, for example it may be formed into a finely divided slurry and sprayed onto the surface of the insulative material, so as to cause the insulative material to be substantially impervious to incident infra-red radiation.

Figure 2 shows an alternative embodiment of the invention, wherein four infra-red lamps, 13 to 16 inclusive, each having a filament, 17 to 20, respectively, supported therein, are partly accommodated within linear grooves, 21 to 24, respectively, formed in the layer 2 of insulative material.

Each filament, 17 to 20, is thus situated at the focal point of the semi-circular reflective surface formed in each groove by the reflective coating 12, so that infra-red radiation emitted from each filament, 17 to 20, in a downward direction, is reflected back theretowards, as well as some radiation being reflected up to the glass ceramic layer 11.

In an alternative embodiment of the present invention, the layer 2 of the insulative material may be surface enriched with an infra-red reflective material, such as titanium dioxide, which acts as an opacifier for causing the insulative material to be substantially impervious to the infra-red radiation.

Any suitable infra-red material may be used to cause the insulative material to be impervious to a particular optical range, within which the lamps operate.

The present invention is therefore advantageous in that it provides heating apparatus incorporating an insulative material which is capable of reflecting infra-red radiation, as well as absorbing a certain amount thereof, which is subsequently re-radiated therefrom into the area of the heating apparatus, thereby substantially reducing the dissipation of infra-red radiation from the heating apparatus.

CLAIMS

1. Heating apparatus including at least one source (5) of infra-red radiation disposed above, or partially embedded in, a layer (2) of insulative material, characterized in that said layer (2) of insulative material has been treated so as to cause it to be substantially impervious to infra-red radiation.

2. Heating apparatus as claimed in Claim 1 wherein said layer (2) has been treated by application of an infra-red reflective coating (12) to the surface thereof.

3. Heating apparatus as claimed in Claim 2 wherein said infra-red reflective coating (12) consists of an oxide material, such as titanium dioxide.

4. Heating apparatus as claimed in Claim 1 wherein a surface layer of said layer (2) of insulative material has been enriched with an infra-red reflective material.

5. Heating apparatus as claimed in Claim 4 wherein said infra-red reflective material consists of an oxide material such as titanium dioxide.

6. Heating apparatus as claimed in any preceding claim wherein the surface of said layer (2) of insulative material is formed with one or more grooves (21) to accommodate an underside portion of the surface area of the or each source (5) of infra-red radiation.

7. Heating apparatus as claimed in any preceding claim wherein the or each source (5) of infra-red radiation comprises a tungsten-halogen lamp including a tungsten filament (7) supported within a generally tubular quartz envelope (6).

8. A cooking hob incorporating at least one heating apparatus as claimed in any preceding claim.

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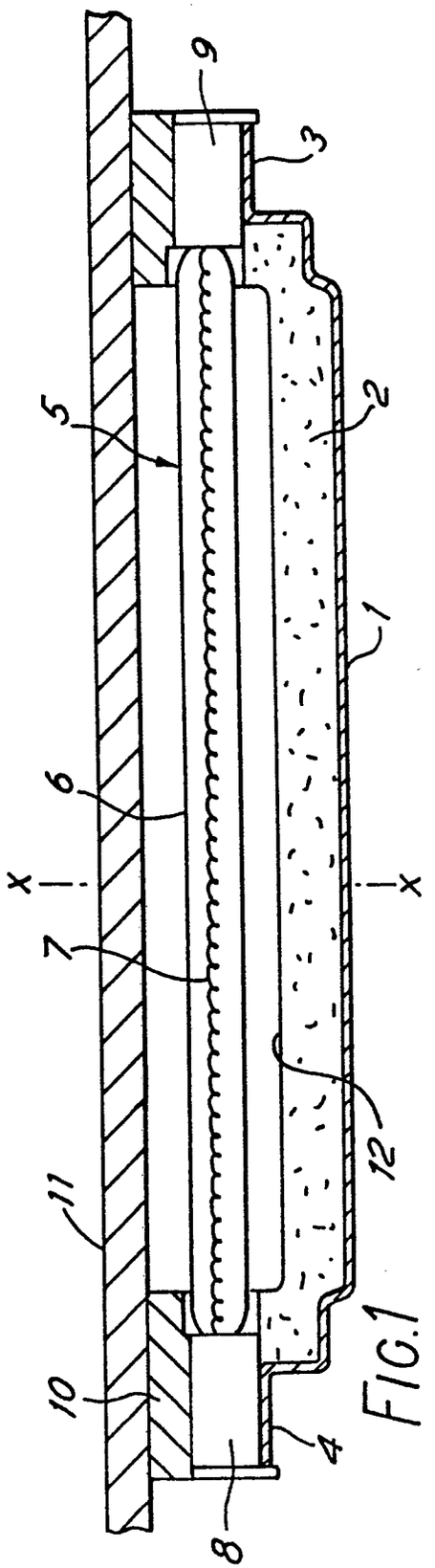

FIG.1

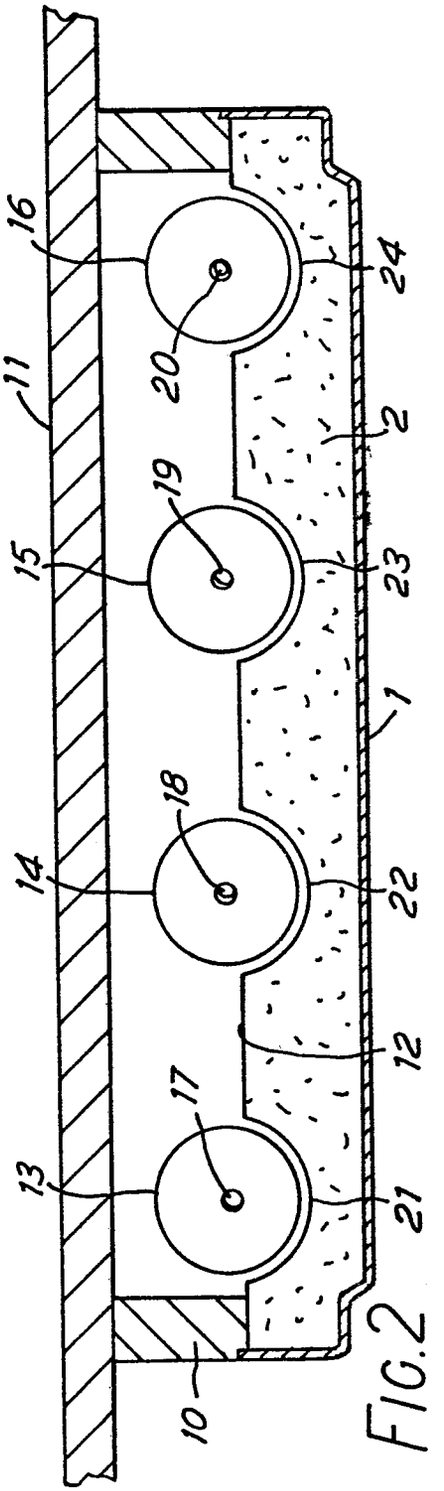

FIG.2

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EUROPEAN SEARCH REPORT

0134090
Application number

EP 84304671.5

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
Y	US - A - 3 355 574 (A.T. BASSETT) * Column 2, line 60 - column 4, line 34; fig. 2-4 *	1-3,6,7	H 05 B 3/68 F 24 C 7/06
Y	US - A - 3 718 497 (RICE) * Column 1, lines 1-6; claims 1,3; fig. *	1-3,6,7	
A	US - A - 3 345 498 (D.C. SIEGLA) * Column 2, line 47 - column 3, line 20; fig. 2,4 *	1,2,6	

TECHNICAL FIELDS SEARCHED (Int. Cl.4)

H 05 B 3/00
F 24 C 7/00
F 24 C 15/00

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
VIENNA	31-10-1984	TSILIDIS

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
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T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

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