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(54) **Heating apparatus.**

(57) Heating apparatus includes a generally circular tray (1) having a layer (2) of insulative material deposited therewithin and supporting a number of tungsten-halogen lamps (5), the tray (1) being mounted beneath a layer (11) of glass ceramic to form a cooking hob. To ensure that the temperature of the glass ceramic does not exceed a maximum operating temperature, metallic strips (12) are deposited on the layer (11) to monitor the resistance thereof, which is

indicative of the temperature of the layer (12). A voltage signal (13) indicative of the measured resistance of the layer (11) is compared with a reference signal (15), which is indicative of the said maximum temperature, and the lamps (5) are de-energised when the amplitude of the voltage signal (13) is substantially the same as, or less than, that of the reference signal (15).

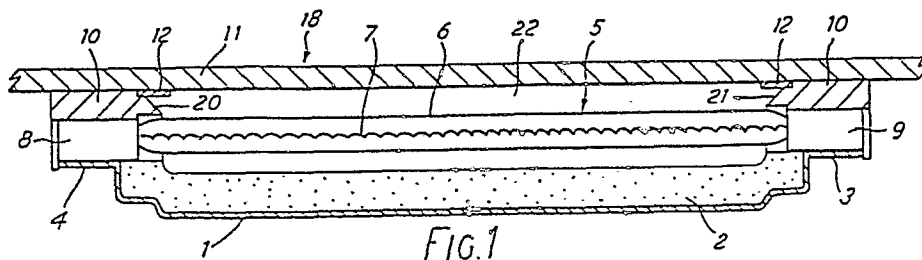


FIG.1

: 1 :

HEATING APPARATUS

This invention relates to heating apparatus and in particular, though not exclusively, to such apparatus described in our co-pending U.K. Patent Application No.8320717, incorporating one or more sources of infra-red radiation.

5 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, usually along with a number of similar members, is mounted beneath a layer of glass ceramic, so as to form a
10 cooking hob.

It is necessary to ensure that the operating temperature of the undersurface of the glass ceramic layer does not exceed a maximum value, typically about 700°C. To this end, the heating apparatus described in the afore-mentioned application
15 includes a thermal limiter, disposed in any suitable position beneath the glass ceramic and consisting of a metallic rod, which is adjusted to trip a microswitch when the maximum operating temperature of the glass ceramic is reached, so as to disconnect the power supply to the infra-red lamps.

20 However, the requirement of a mechanically-operated thermal limiter for use in heating apparatus of this kind may be considered undesirable.

It is therefore an object of the present invention to provide an alternative type of thermal limiter to that known
25 hitherto.

According to the present invention there is provided heating apparatus including at least one source of infra-red radiation mounted beneath a layer of glass ceramic, characterised in that said apparatus further includes means for
5 measuring the resistance of said layer of glass ceramic, said measured resistance being indicative of the operating temperature of said layer, and circuit means for controlling said operating temperature in accordance with said measured resistance.

10 The present invention is preferably employed as a thermal limiter, so that the circuit means is arranged to compare a voltage signal indicative of the measured resistance with a reference voltage signal and to de-energise the source or sources of infra-red radiation when the voltage signal indicates
15 an operating temperature substantially at or above a predetermined maximum value of approximately 700°C.

It is preferable that the resistance of the glass ceramic is measured by metallic strips deposited on the layer by thick film techniques or by sputtering, for example.

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

Figure 1 shows a sectional view of one embodiment of the heating apparatus, in accordance with the present invention,

25 Figure 2 shows a schematic circuit diagram for use in conjunction with the heating apparatus shown in Figure 1, and

Figures 3 and 4 show plan views of two alternative embodiments of the present invention.

Figure 1 shows a generally circular tray 1, which is
30 preferably formed from metal and has a layer 2 of a suitable insulative material deposited therewithin, on the base thereof. 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
35 radiation, one being shown at 5. In a preferred example, four sources are arranged across the circular area of the tray 1.

Each source 7 of infra-red radiation comprises a tungsten-halogen lamp including a tungsten filament 7 supported within a quartz envelope 6. 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 10 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.

To protect the layer 11 of glass ceramic, a maximum operating temperature thereof, of approximately 700°C , should be enforced. To implement control of the operating temperature of the layer 11, the present invention provides metallic strips, shown schematically at 12, which are deposited on the underside of the layer 11 by any suitable deposition technique, such as a thick film technique, to measure the resistance of the glass ceramic as the operating temperature thereof is varied.

It has been found that the resistance of the glass ceramic varies considerably, in a logarithmic manner, with the operating temperature, such that the resistance is greater than 20M at room temperature and is reduced to approximately 1K at an operating temperature of approximately 700°C .

It can therefore be envisaged that measurement of the resistance of the glass ceramic, in accordance with the present invention, provides a simple and reliable method of monitoring the operating temperature thereof, which can be used in conjunction with a simple electronic circuit to provide temperature control.

One such circuit is shown schematically in Figure 2. A voltage signal 13, which is indicative of the measured resistance of the layer 11 of glass ceramic, which in turn is

indicative of the operating temperature thereof, is fed to a comparator 14, wherein it is compared with a voltage reference signal 15, which is indicative of the maximum operating temperature of the glass ceramic.

5 If the amplitude of the voltage signal 13 is substantially the same as, or less than, that of the reference signal 15, then a signal 16 is generated to de-activate a triac, or relay 17, so as to de-energise the infra-red lamp, one being shown at 7, as in Figure 1.

10 Alternatively, the circuit arrangement may be modified so as to provide temperature control of the infra-red lamp, in accordance with a temperature setting of a user-operable control, so as to de-energise the lamps when a set temperature is reached. This could be implemented by incorporation of a
15 variable resistor (not shown) into the circuit arrangement to provide adjustment of the amplitude of the reference signal 15, in dependence on the desired temperature setting of the control. Triac 17 can thus be activated in substantially the same manner, as in the case where the invention is used merely
20 as a thermal limiter, rather than a temperature control.

 Figures 3 and 4 show plan views of the heating apparatus shown in Figure 1, illustrating two alternative configurations of the metallic strips 12 on the underside of the layer 11 of glass ceramic, the strips being arranged to monitor one of the
25 hot plate areas 18 of the cooking hob.

 The metallic strips 12 are connected to the circuit arrangement via high temperature leads (not shown) connected to ends 19 of the strips 12.

 To ensure that the metallic strips efficiently monitor the
30 hotplate area 18, the strips are arranged so that they overlap the ends of the infra-red lamps 5. It may also be preferable to chamfer the edges of the ceramic fibre moulding 10, as shown at 20 and 21 in Figure 1, so that the strips 12 can receive heat from within heated area 22 below the hotplate area 18.

CLAIMS

1. Heating apparatus including at least one source (5) of infra-red radiation mounted beneath a layer (11) of glass ceramic, characterised in that said apparatus further includes means (12) for measuring the resistance of said layer (11) of glass ceramic, said measured resistance being indicative of the operating temperature of said layer (11), and circuit means (14, 17) for controlling said operating temperature in accordance with said measured resistance.
2. Heating apparatus as claimed in claim 1 wherein said circuit means (14, 17) is arranged to compare a generated signal (13) indicative of the measured resistance with reference signal (15) to de-energise said source or sources (5) of infra-red radiation when said generated signal (13) indicates an operating temperature substantially at or above a predetermined maximum value.
3. Heating apparatus as claimed in claim 1 or 2 wherein said circuit means (14, 17) includes a user-operable temperature control and is arranged to provide temperature control of said source or sources (5) of infra-red radiation, in accordance with a temperature setting of said control, so as to de-energise said source or sources (5) when a set temperature is reached.
4. Heating apparatus as claimed in claim 1, 2 or 3 wherein said means (12) for measuring the resistance of said layer (11) consists of metallic strips (12) deposited on said layer (11).
5. Heating apparatus as claimed in any preceding claim wherein said source or sources (5) of infra-red radiation are mounted above a generally circular tray member (1), within which a layer (2) of insulative material is deposited.
6. Heating apparatus as claimed in any preceding claim wherein each source (5) of infra-red radiation comprises a tungsten halogen lamp including a tungsten filament (7) supported within a quartz envelope (6).

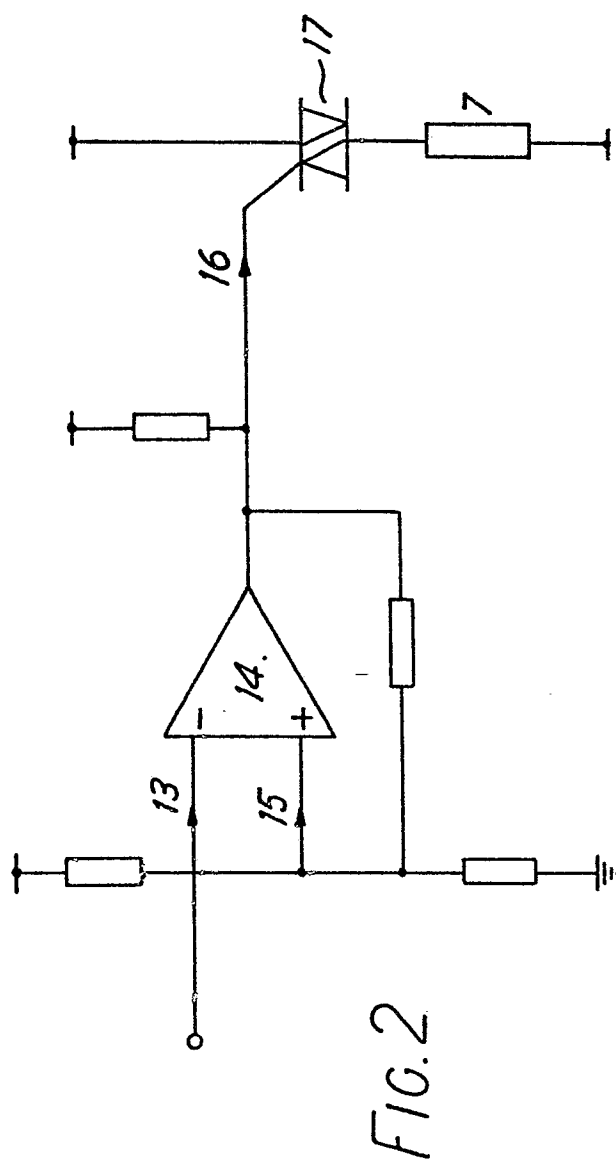
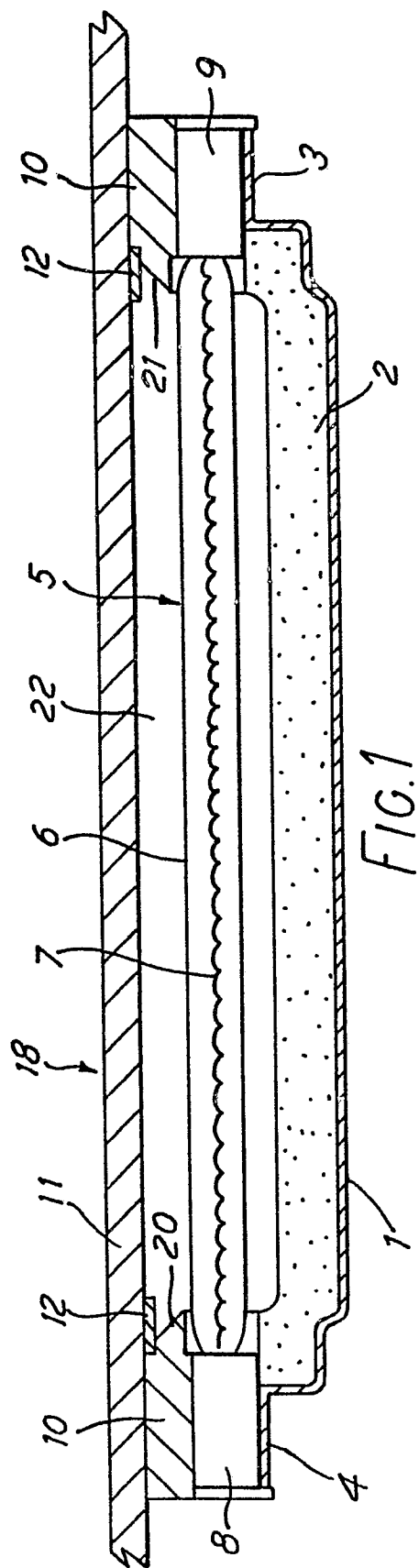


FIG. 3

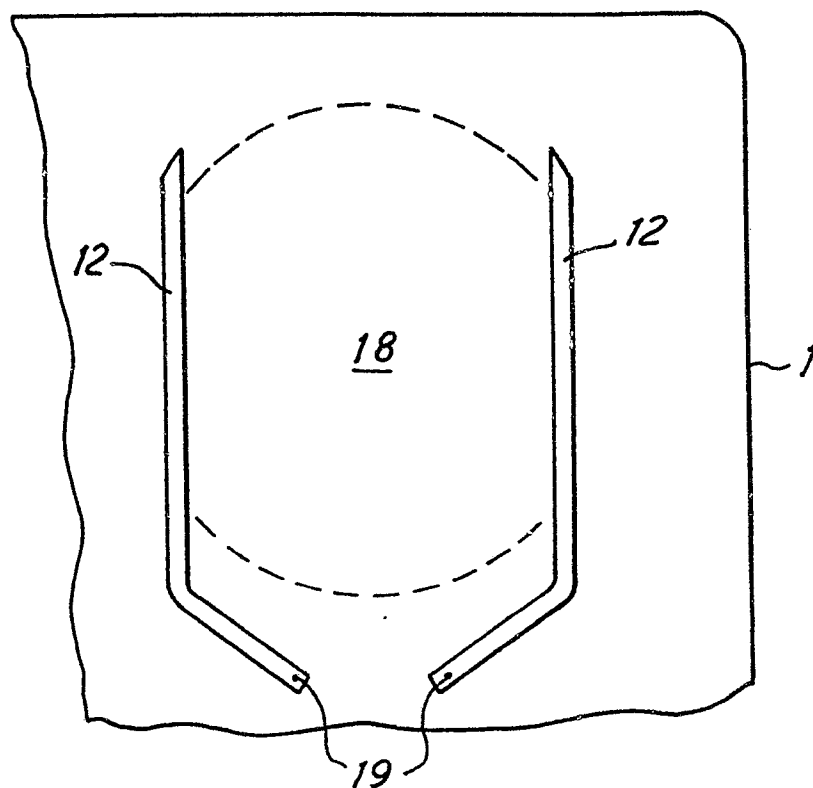
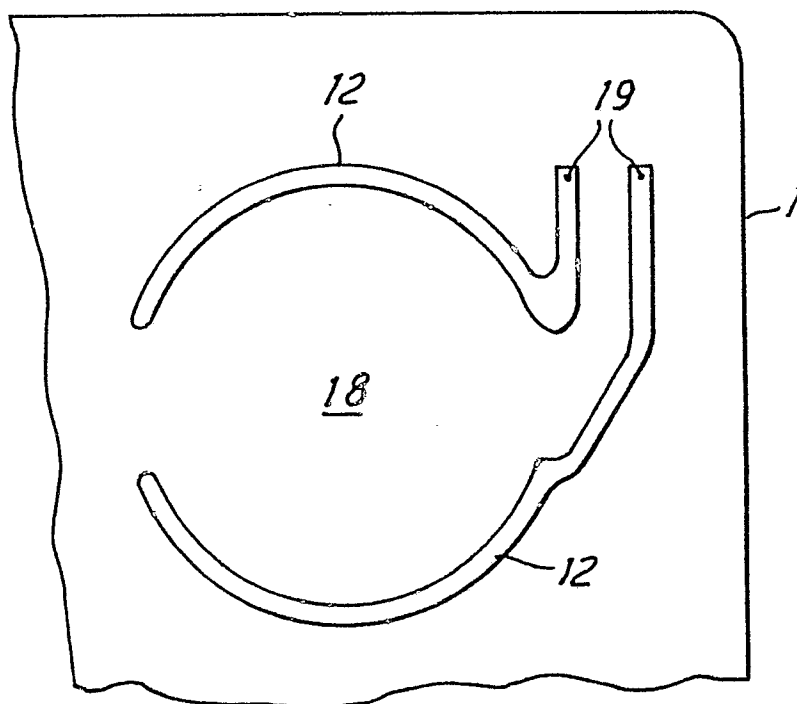


FIG. 4





European Patent
Office

EUROPEAN SEARCH REPORT

0147056

Application number

EP 84 30 8100

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)
X	US-A-4 237 368 (GENERAL ELECTRIC CO.) * Title; column 5, lines 53-68; column 6, lines 1-6, 36-38; column 8, lines 5-42, 68; column 9, lines 1-4, 31-33; column 13, lines 34-54; column 16, lines 39-68; column 17, lines 1-35; figures 1,3,6,7 *	1	H 05 B 3/74
A	* Title; column 5, lines 53-68; column 6, lines 1-6, 36-38; column 8, lines 5-42, 68; column 9, lines 1-4, 31-33; column 13, lines 34-54; column 16, lines 39-68; column 17, lines 1-35; figures 1,3,6,7 *	2-4	
Y	--- DE-A-2 203 661 (SIEMENS ELECTROGERÄTE GmbH) * Title; pages 1-2; figure 1 *	1	TECHNICAL FIELDS SEARCHED (Int. Cl.4) H 05 B 3/00 H 05 B 1/00
A	* Pages 1-2; figure 1 *	2-4	
Y	--- FR-A-2 138 464 (ETABLISSEMENTS EUGENE SCHOLTES) * Title; page 2, lines 35-39; page 4, lines 12-19, 31-33; page 5, lines 13-16; page 6, lines 7-13; figure 1 *	1	
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The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 08-03-1985	Examiner PIERRON P.A.
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 P : intermediate document 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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