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(56) Documents Cited
GB 2160400 A **EP 0300548 A1** **US 4910387 A**

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(54) Abstract Title
IR heating lamp having different heating output zones

(57) An electric-heater for use beneath a glass-ceramic plate (4) of a cooking appliance to provide a heated zone (10) of the plate, the heater comprising a dish-like support (1) across which extends a substantially straight elongate lamp (5) emissive of infra-red radiation and comprising a tubular envelope (6) enclosing an elongate filament (7; 7A: 7B), the heater being adapted whereby infra-red radiation emission from the lamp impinging on the glass-ceramic plate is greater at a peripheral region (11) of the heated zone than at a central region (12) of the zone.

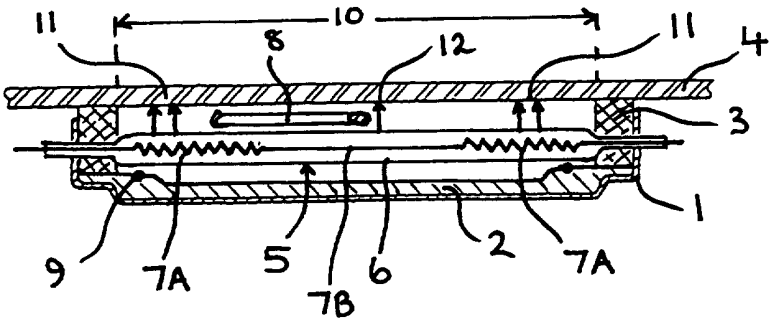

FIG. 2

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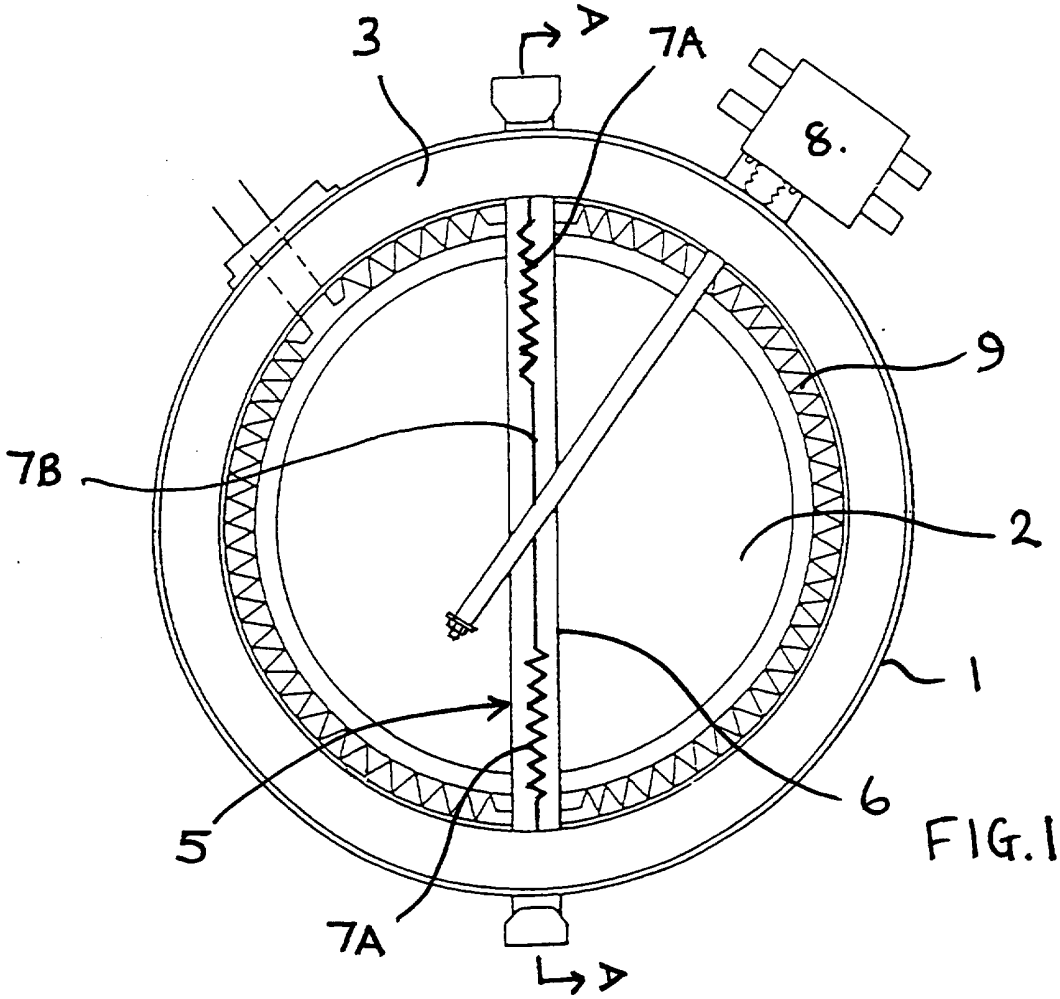


FIG. 1

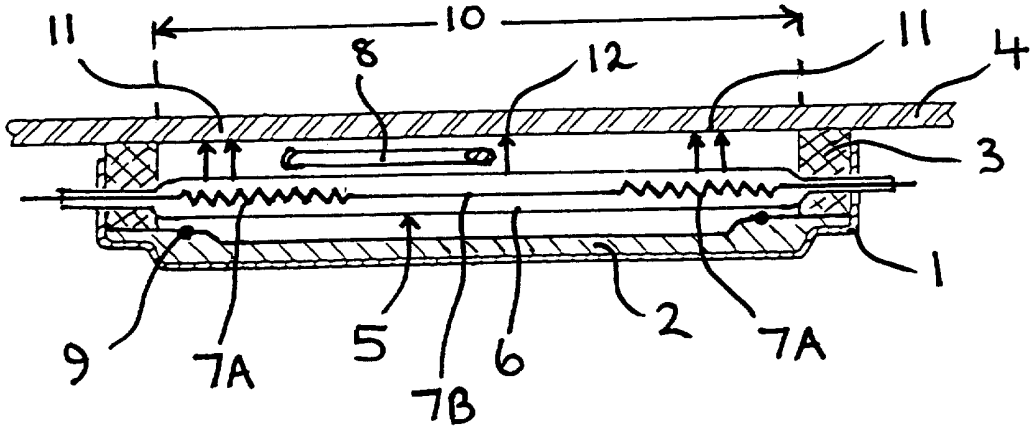


FIG. 2

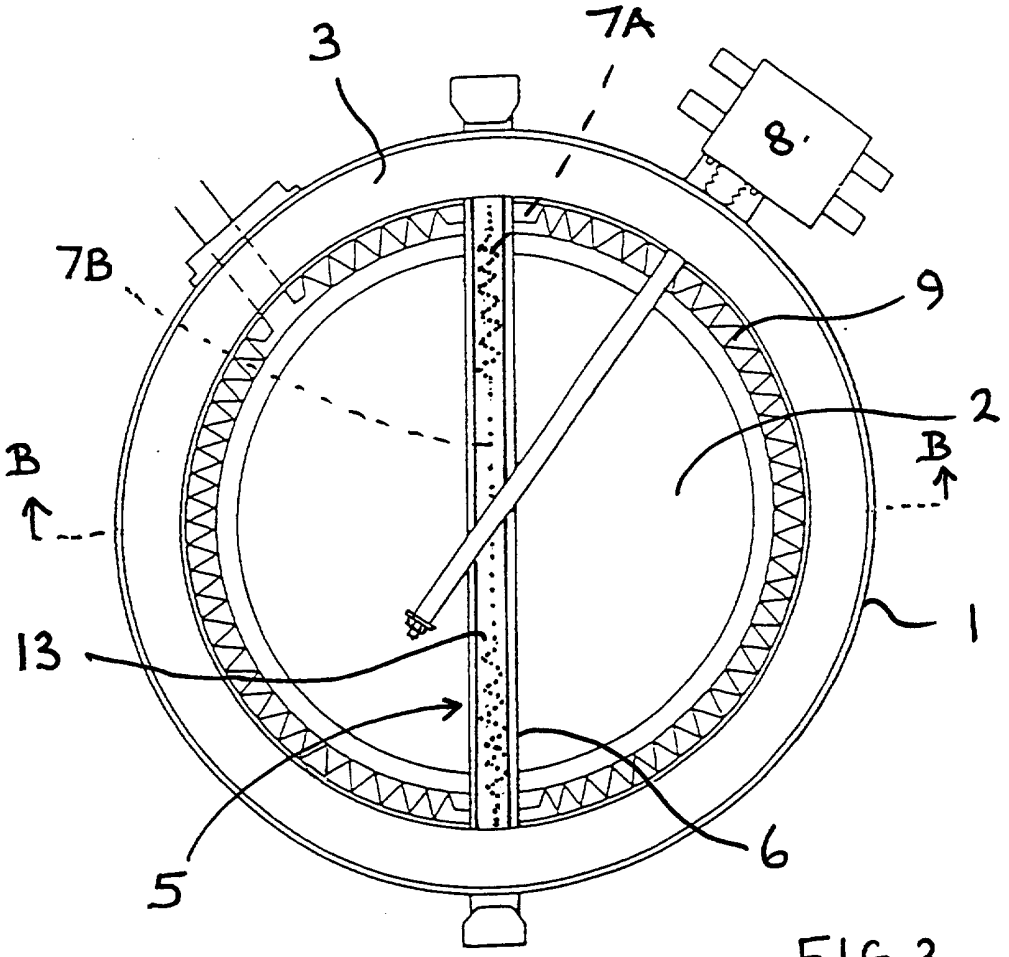


FIG. 3

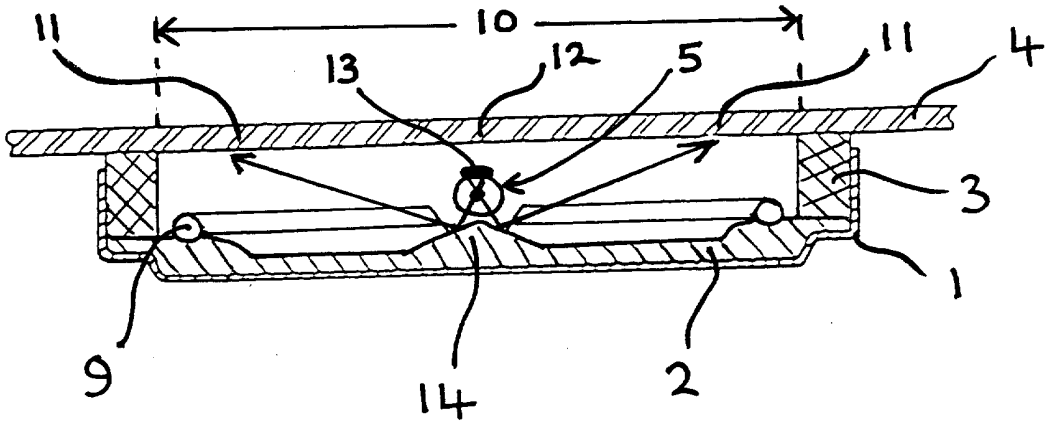


FIG. 4

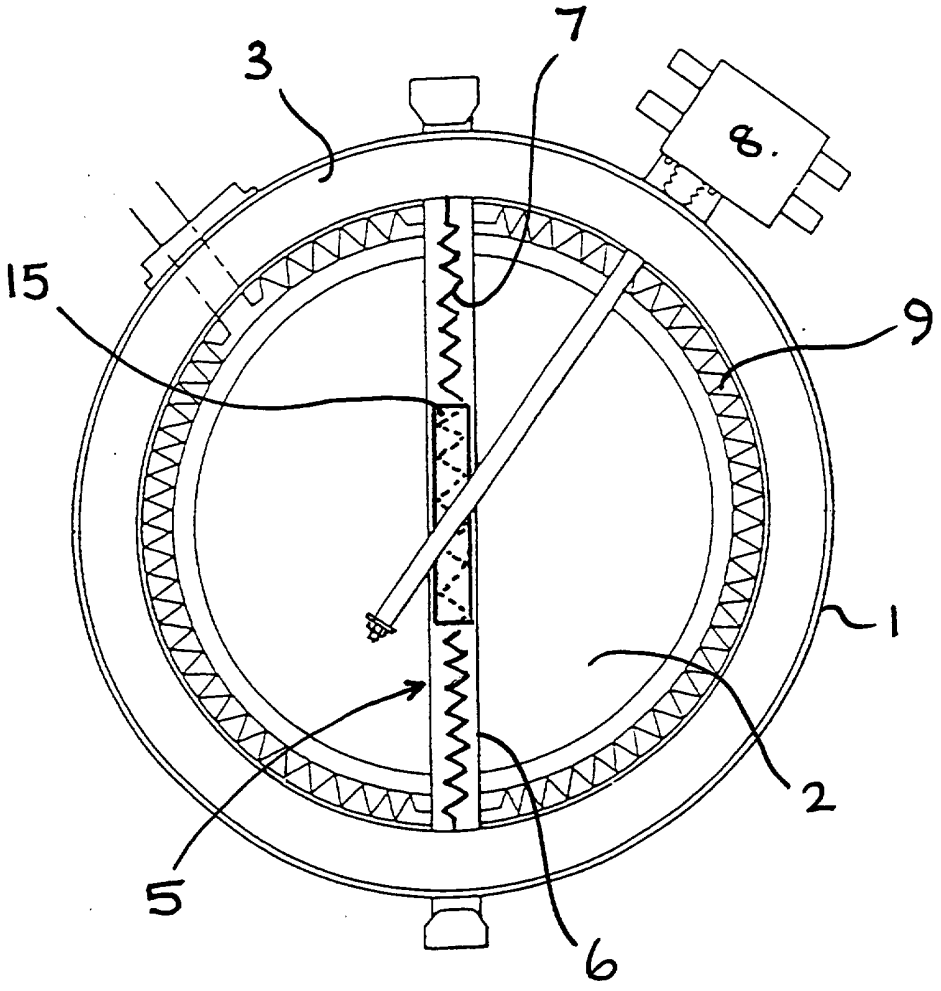


FIG. 5

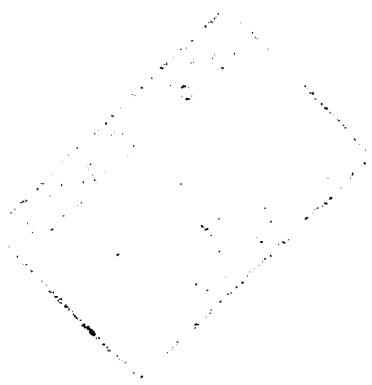
Electric Heater

This invention relates to electric heaters for use beneath glass-ceramic plates of cooking appliances and which heaters incorporate lamps emissive of infra-red radiation.

Such heaters are very well known, incorporating a plurality of elongate straight lamps or one or more circular lamps, the lamps generally comprising a tungsten filament supported in a sealed quartz envelope containing halogenated gas. Such lamps are expensive, particularly in circular form and it is an object of the present invention to provide a heater of economical manufacture which offers an advantageous heat distribution with minimal infra-red lamp source provision, being implementable with as little as one elongate straight lamp.

The present invention provides an electric heater for use beneath a glass-ceramic plate of a cooking appliance to provide a heated zone of the plate, the heater comprising a dish-like support across which extends at least one substantially straight elongate lamp emissive of infra-red radiation and comprising a tubular envelope enclosing an elongate filament, the heater being adapted whereby infra-red radiation emission from the lamp impinging on the glass ceramic plate is greater at a peripheral region of the heated zone than at a central region of the zone.

The dish-like support may include a base of microporous thermal insulation material beneath the at least one lamp.



The at least one lamp may be adapted whereby infra-red radiation emission therefrom towards the plate is greater from end portions of the lamp than from a central portion thereof.

In a first embodiment of the invention the elongate filament of the at least one lamp has opposite end portions thereof adapted to provide greater emission of infra-red radiation than a portion thereof intermediate the end portions. In this regard, the end portions of the filament may be of single-coiled or coiled-coiled form and the intermediate portion of less-coiled or substantially uncoiled or single-coiled form respectively.

In a second embodiment of the invention, a region of a central portion of the lamp envelope facing the glass-ceramic plate is provided with a heat resistant coating of a material which operates to reduce impingement of infra-red radiation from the lamp onto the central region of the heated zone of the glass ceramic plate. In this embodiment, the filament may be arranged to provide substantially uniform emission of radiation along its length or alternatively may be arranged as with the first embodiment whereby the emitted radiation is greater at opposite end portions of the filament than at a central portion thereof.

The coating on the region of the central portion of the lamp envelope may be in the form of a strip having a length and width selected to provide a desired heat distribution across the central and peripheral regions of the heated zone of the glass-ceramic plate.

The coating may comprise a material which provides reduced permeability to the radiation. It may suitably comprise a material which has reflecting properties, particularly diffuse reflecting properties, in respect of the radiation, such as fine particulate alumina. When a base of

microporous insulation material is provided beneath the at least one lamp, this may include an infra-red reflecting material, particularly a diffuse reflecting material, such as titanium dioxide. The surface of the base of insulation material may be contoured such that radiation reflected by the coating on the region of the central portion of the lamp envelope is further reflected by the base of insulation material preferentially towards the peripheral region of the heated zone of the glass-ceramic plate.

In a third embodiment of the invention, which is a modification of the first embodiment, the elongate filament of the at least one lamp has opposite end portions thereof adapted to provide greater emission of infra-red radiation than a portion thereof intermediate the end portions and the envelope of the lamp is coated with a heat resistant strip of infra-red radiation reflecting material substantially along the length of the envelope, on that part of the envelope facing the glass-ceramic plate, a base of microporous insulation material being provided beneath the at least one lamp and which includes an infra-red reflecting material, particularly a diffuse reflecting material, such as titanium dioxide, the surface of the base being contoured such that infra-red radiation from the filament is reflected by the strip of reflecting material towards the base and then by the base preferentially towards the peripheral region of the heated zone of the glass-ceramic plate.

The strip of heat-resistant reflecting material is suitably a diffuse reflecting material, such as fine particulate alumina.

The at least one lamp may comprise a tungsten filament supported in a sealed quartz envelope containing halogenated gas.

A single lamp may be provided.

The heater may be of substantially circular shape and a single lamp may be provided extending substantially diametrically thereacross.

A ballast resistance element, such as of ribbon or wire form, may be provided in the heater for connection in series with the at least one lamp, to damp inrush current on energising the at least one lamp. Such ballast resistance element may be suitably arranged peripherally in the heater.

By means of the invention a heater may be economically manufactured such that the number of infra-red lamps is minimised (a single straight lamp being possible) and with the particularly advantageous property of what is known as edge weighting, namely that the infra-red radiation from the lamp impinging on the glass-ceramic cooking plate is more concentrated at the periphery of a heated zone of the plate than at the centre of the plate, thereby providing more efficient heating of a cooking utensil located on the plate.

The invention is now described by way of example with reference to the accompanying drawings, in which:

Figure 1 is a top plan view of an electric heater according to the invention;

Figure 2 is a section along A-A of the heater of Figure 1;

Figure 3 is a top plan view of a further electric heater according to the invention;

Figure 4 is a section along B-B of the heater of Figure 3; and

Figure 5 is a top plan view of a still further electric heater according to the invention.

Referring to Figures 1 and 2, an electric heater is constructed comprising a circular metal support dish 1 having thereon a base 2 of compacted microporous thermal insulation material.

A peripheral wall 3 of thermal insulation material is provided in well known manner and has a top surface arranged to contact the underneath of a glass-ceramic cook top 4.

An infra-red radiation source is provided in the heater in the form of a straight elongate lamp 5. The lamp 5 is arranged diagonally across the dish 1 and comprises a sealed tubular envelope 6 of quartz containing halogenated gas.

An elongate tungsten filament is provided in the envelope 6 and comprises end portions 7A and an intermediate portion 7B.

A thermal limiter 8, of well known form is provided extending at least partly across the heater.

A ballast resistance element 9, of well known form, comprising coiled wire or corrugated metal ribbon, is provided, connected in series with the lamp 5. The ballast resistance element 9 operates in well known form to damp inrush current through the tungsten filament 7A, 7B when the heater is energised by connection to a voltage supply (not shown). The ballast resistance element is conveniently disposed at the periphery of the heater, but other locations within the heater can be considered.

The heater is arranged such that when the lamp 5 is energised infra-red radiation emission therefrom impinges on the glass-ceramic plate over a heated zone 10 of the plate and the impinging radiation is greater at a peripheral region 11 of the heated zone 10 than at a central region 12 of the heated zone 10. This is achieved by forming the filament of the lamp such that the end portions 7A thereof provide greater emission of infra-red radiation towards the plate 4 than the intermediate portion 7B. The end portions 7A of the filament may be of single-coiled or coiled-coiled form and the intermediate portion of less-coiled or substantially uncoiled, or single-coiled form respectively.

The resulting heater has what is known as edge weighting as a consequence of the greater impinging of infra-red radiation on the peripheral region 11 of the heated zone 10 of the glass-ceramic plate 4, compared with that on the central region 12 of the plate 4 and this leads to faster heating of the contents of a cooking utensil when placed on the plate 4.

Figures 3 and 4 show a modification to the heater of Figures 1 and 2. The heater in Figures 3 and 4 differs from that of Figures 1 and 2 as follows. The lamp 5 is coated with a heat-resistant strip 13 of infra-red radiation reflecting material, substantially along the length of the envelope 6, on that part of the envelope facing the glass-ceramic plate 4. The strip 13 suitably comprises a diffuse reflecting material such as fine particulate alumina.

The base 2 of microporous insulation material provided beneath the lamp 5, and which includes a diffuse infra-red reflecting material in the form of titanium dioxide (Rutile), cooperates with the reflecting strip 13. Infra-red radiation from the lamp 5 is reflected by the strip 13 towards the base 2 and then by the base 2 towards the heated zone 10 of the glass-

ceramic plate 4. The base 2 is contoured as shown in Figure 4 to provide a ridge 14 running lengthwise beneath the lamp. The infra-red radiation from the lamp reflected towards the base 2 by the reflecting strip 13 is reflected by the ridge 14 towards the peripheral region of the heated zone 10, particularly to the peripheral region remote from the lamp.

A further embodiment of the invention is shown in Figure 5. This differs from that shown in Figure 1 in that a region of the central portion of the lamp envelope facing the glass-ceramic plate 4 is provided with a heat resistant coating 15 of a material which operates to reduce impingement of infra-red radiation from the lamp 5 onto the central region of the heated zone of the glass-ceramic plate, whilst allowing unrestricted impingement of radiation onto the peripheral region of the heated zone of the plate. In this embodiment, the filament 7 in the lamp may be arranged to provide substantially uniform emission of radiation along its length or, alternatively, may be arranged as in Figures 1 and 2 whereby the radiation is greater at opposite ends of the filament than at the central portion thereof.

The coating 15 is provided as a strip having a length and width selected to provide a desired heat distribution across the central and peripheral regions of the heated zone of the glass-ceramic plate.

The coating 15 may comprise a material which provides reduced permeability to the radiation. It may suitably comprise a material which has reflecting properties, particularly diffuse reflecting properties, in respect of the radiation, such as fine particulate alumina. The base 2 of microporous insulation material provided beneath the lamp includes an infra-red reflecting material, particularly a diffuse reflecting material, such as titanium dioxide (Rutile). The surface of the base 2 of insulation material may be contoured, at least in the central region

thereof such that radiation reflected by the coating 15 on the region of the central portion of the lamp envelope is further reflected by the base 2 of insulation material preferentially towards the peripheral region of the heated zone of the glass-ceramic plate. Such contouring of the base 2 may be in the form of a ridge beneath the lamp 5, similar to the ridge 14 shown in and previously described with reference to Figure 4.

Claims

1. An electric heater for use beneath a glass-ceramic plate of a cooking appliance to provide a heated zone of the plate, the heater comprising a dish-like support across which extends at least one substantially straight elongate lamp emissive of infra-red radiation and comprising a tubular envelope enclosing an elongate filament, the heater being adapted whereby infra-red radiation emission from the lamp impinging on the glass-ceramic plate is greater at a peripheral region of the heated zone than at a central region of the zone.

2. A heater according to claim 1, in which the dish-like support includes a base of microporous thermal insulation material beneath the at least one lamp.

3. A heater according to claim 1 or 2, in which the lamp is adapted whereby infra-red emission therefrom towards the plate is greater from end portions of the lamp than from a central portion thereof.

4. A heater according to claim 3, in which the elongate filament of the at least one lamp has opposite end portions thereof adapted to provide greater emission of infra-red radiation than a portion thereof intermediate the end portions.

5. A heater according to claim 4, in which the end portions of the filament are of single-coiled or coiled-coiled form and the intermediate portion is of less-coiled or substantially uncoiled or single-coiled form respectively.

6. A heater according to claim 1, 2 or 3, in which a region of a central portion of the lamp envelope facing the glass-ceramic plate is provided with a heat-resistant coating of a material which operates to reduce impingement of infra-red radiation from the lamp onto the central region of the heated zone of the glass-ceramic plate.

7. A heater according to claim 6, in which the filament is arranged to provide substantially uniform emission of radiation along its length or alternatively is arranged whereby the emitted radiation is greater at opposite end portions of the filament than at a central portion thereof.

8. A heater according to claim 6 or 7, in which the coating on the region of the central portion of the lamp envelope is in the form of a strip having a length and width selected to provide a desired heat distribution across the central and peripheral regions of the heated zone of the glass-ceramic plate.

9. A heater according to claim 6, 7 or 8, in which the coating comprises a material which provides reduced permeability to the radiation.

10. A heater according to claim 9, in which the coating comprises a material which has reflecting properties in respect of the radiation.

11. A heater according to claim 10, in which the reflecting properties of the material are diffuse reflecting properties.

12. A heater according to claim 11, in which the material comprises fine particulate alumina.

13. A heater according to any one of claims 10 to 12, as dependant upon claim 2, in which a base of microporous insulation material provided beneath the at least one lamp includes an infra-red reflecting material.

14. A heater according to claim 13, in which the infra-red reflecting material is a diffuse reflecting material.

15. A heater according to claim 14, in which the diffuse reflecting material comprises titanium dioxide.

16. A heater according to any one of claims 13 to 15, in which the surface of the base of insulation material is contoured such that radiation reflected by the coating on the region of the central portion of the lamp envelope is reflected by the base of insulation material preferentially towards the peripheral region of the heated zone of the glass-ceramic plate.

17. A heater according to claim 3, 4 or 5, as dependant upon claim 2, in which the envelope of the at least one lamp is coated with a strip of heat-resistant infra-red radiation reflecting material substantially along the length of the envelope, on that part of the envelope facing the glass-ceramic plate, the base of microporous insulation material beneath the at least one lamp including an infra-red reflecting material, the surface of the base being contoured such that infra-red radiation from the filament is reflected by the strip of reflecting material towards the base and then by the base preferentially towards the peripheral region of the heated zone of the glass-ceramic plate.

18. A heater according to claim 17, in which the strip of radiation .flecting material is a diffuse reflecting material.

19. A heater according to claim 18, in which the reflecting material comprises fine particulate alumina.

20. A heater according to any one of claims 17 to 19, in which the infra-red reflecting material in the base is a diffuse reflecting material.

21. A heater according to claim 20, in which the reflecting material comprises titanium dioxide.

22. A heater according to any one of the preceding claims, in which the at least one lamp comprises a tungsten filament supported in a sealed quartz envelope containing halogenated gas.

23. A heater according to any one of the preceding claims in which a single lamp is provided.

24. A heater according to any one of the preceding claims, provided of substantially circular shape.

25. A heater according to claim 24, as dependant upon claim 23, in which a single lamp is provided extending substantially diametrically thereacross.

26. A heater according to any one of the preceding claims, provided therein with a ballast resistance element for connection in series with the at least one lamp to damp inrush current on energising the at least one lamp.

27. A heater according to claim 26, in which the ballast resistance element is of ribbon or wire form.

28. An electric heater constructed and arranged substantially as hereinbefore described with reference to the accompanying drawings.

29. A cooking appliance with a glass-ceramic plate provided with an electric heater according to any one of the preceding claims.

The Patent Office

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Application No: GB 9706511.4
Claims searched: 1-29

Examiner: John Cockitt
Date of search: 25 June 1997

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.O): H5H [HAA5, HAA7, HAA9, HAH]

Int Cl (Ed.6): H05B [03/74]; F24C [07/04, 07/06, 15/22]

Other:

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
X	GB2160400A	MICROPORE - see prior art figs 3,4	1 at least
X	EP0300548A1	BAUKNECHT - see fig 3	1 at least
X	US4910387A	MICROPORE - see ballast resistance	26,27

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.