(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 247 574 A1**

(12) EUROPEAN PATENT APPLICATION

(21) Application number: **87107640.2**

(22) Date of filing: **26.05.87**

(51) Int. Cl.[4]: **F24C 7/02** , H05B 3/44 , H05B 11/00 , H05B 6/64

(30) Priority: **28.05.86 DE 3618044**

(43) Date of publication of application: **02.12.87 Bulletin 87/49**

(84) Designated Contracting States: **DE ES FR GB IT SE**

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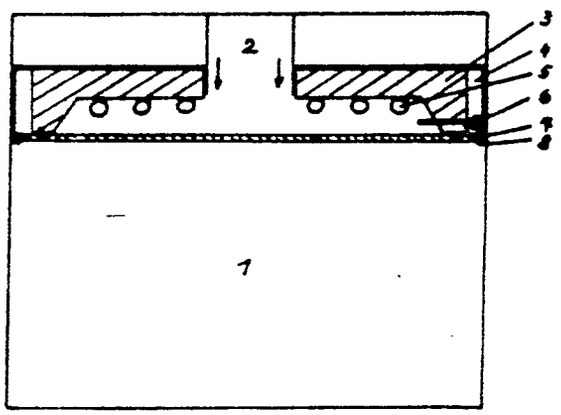
(54) Heating device for a microwave appliance.

(57) A heating device for combination microwave applicances contains a radiant heating element (5) with an operating temperature of at least 1150 K wherein this radiant heating element, which can comprise an electrically heated resistance wire, halogen lamps, or a quartz radiator, is covered by means of an at least partially infrared-transparent glass-ceramic (7) with low microwave energy absorption.

Figure 2



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HEATING DEVICE FOR A MICROWAVE APPLIANCE

BACKGROUND OF THE INVENTION

The present invention relates to a heating device for a microwave appliance.

Microwave appliances have become popular world-wide, and their share in the market increases constantly. In most recent times, so-called combination microwave appliances have gained increasing importance wherein, besides the microwave feature, a supplemental infrared heating unit is arranged in the cooking chamber for browning the roasting. In these combined appliances, browned and/or roasted food can be obtained just like in a baking oven, while the roasting process is simultaneously enhanced by the microwave energy. The customarily utilized supplemental infrared heating elements are radiant heating elements having an operating temperature of about 900 to 1000 K.

However, on account of infrared heating, the entire cooking chamber or at least the walls thereof become hotter than in case of mere microwave heating; in particular, the infrared heating element and the surfaces therebehind are soiled even if the operating temperature is reduced to below 800°C. While it has been possible, in principle, to install a cover to protect the radiant heating element from contamination, it was impossible with the presently existing covering materials to achieve a sufficient roasting and grilling result through this cover with an acceptable power of radiant heating.

SUMMARY OF THE INVENTION

It is an object of the present invention to avoid the drawback of inadequate roasting and grilling result while simultaneously protecting the radiant heating element and the surfaces of the cooking chamber located therebehind. Insofar as microwave feed-in usually takes place in microwave appliances from above, the zone of the microwave feed-in is simultaneously to be protected from soiling.

This object has been attained by means of a heating device in accordance with the claims.

By the use of a radiant heating element having the high operating temperature as stated, it is possible to pass a sufficiently high proportion of the heat generated by the radiant heating element through a cover of available glass ceramic to make the process economically and technically feasible, the glass-ceramic being selected to be sufficiently temperature-stable and transparent for radiant heat of the major wavelengths emitted by the radiant heating element. Thus, the invention makes possible to satisfactorily roast and grill the food and, in combination, have the radiant heating element protected by the cover against direct soiling.

It is essential to the invention that due to the high operating temperature of the radiant heating element, and thus emitting a higher proportion of the radiant heat with smaller wavelengths, it is made possible to select a glass-ceramic for the cover which does not absorb too high a proportion of the radiant heat emitted by the radiant heating element and, in combination, shows a low microwave energy absorption. Of the customary transparent glass-ceramics, most absorb microwave energy too strongly, and most of those which are substantially transparent to microwave energy show almost no transparency to infrared radiation.

Preferably, the glass-ceramic cover is made of a high-spodumene microcrystal-containing glass ceramic (h-spodumene-MK-containing glass-ceramic) having low microwave absorption and high infrared transmission.

The radiant heating element used can be any desired suitable infrared radiator, for example a resistance wire, halogen lamps, a quartz radiator, or a combination of differently suited radiators.

BRIEF DESCRIPTION OF THE DRAWINGS

The drawings show exemplary arrangements in accordance with the present invention.

Fig. 1 is a diagrammatic side elevation illustrating a first embodiment of the invention.

Fig. 2 is a diagrammatic side elevation illustrating a second embodiment of the invention.

DETAILED DESCRIPTION

Embodiment 1

Figure 1 shows an example, in principle, according to claim 6 of the application. The microwave energy is fed into the microwave cooking chamber 1 through the bottom 2. A heating device designed as a module 4 is attached at the overhead wall of the cooking chamber. A resistor 5 of this heating module forms a radiant heating element which radiates on the food to be grilled from above. Toward the rear and toward the directly adjoining sides, the walls of the cooking chamber are protected from overheating by means of an insulation molding 3 which also supports the heating resistor 5. Toward the bottom, i.e. toward the

cooking chamber, the heating resistor is covered by means of a glass-ceramic plate 7. The glass-ceramic is mounted by means of a suitable mounting to the housing 8 of the heating module 4. A temperature protector 6 integrated into the heating module 4 serves for temperature regulation and/or temperature limiting of the heating module 4.

Embodiment 2

Figure 2 shows another embodiment, in principle, according to claim 7 of this application. In this arrangement, the microwave energy is fed into the microwave cooking chamber 1 in the direction 2 from above. A heating device designed as a module 4 with an insulation body 3, a radiant heating element formed by a heating resistor 5, a glass-ceramic cover 7, and a temperature limiter 6 is in this case attached underneath the overhead wall of the cooking chamber. Thereby, the heating module radiates on the food to be grilled from above. A glass-ceramic cover 7 protects, in this arrangement, not only the heating module from soiling, but also serves simultaneously for covering the microwave feed-in into the cooking chamber of the microwave appliance. Yet, on account of the low microwave absorption of the glass-ceramic 7, the microwave energy can enter the cooking chamber 1 with low losses.

The glass-ceramic cover can be fashioned as a plate, as illustrated in Figures 1 and 2; however, it is just as readily possible to provide a cover with pressed or blown molded components.

In both embodiments illustrated, the radiant heating element is designed for an operating temperature of at least 1150 K.

From the foregoing description, one skilled in the art can easily ascertain the essential characteristics of this invention, and without departing from the spirit and scope thereon, can make various changes and modifications of the invention to adapt it to various usages and conditions.

Claims

1. Heating device for a microwave appliance having a cooking chamber adapted to receive food to be heated, characterized in that the heating device comprises a radiant heating element, e.g. an electrical resistance heater, designed for an operating temperature of at least 1150 K, and that the radiant heating element is covered by a glass-ceramic cover having a low microwave energy absorption and being transparent for a major portion of the infrared radiation emitted by the radiant heating element.

2. Heating device according to claim 1, characterized in that the radiant heating element comprises an electrically heated resistance wire affixed in a suitable way in or on a highly insulating support material and constituting together therewith the heating element.

3. Heating device according to claim 1, characterized in that the radiant heating element comprises at least one halogen lamp.

4. Heating device according to claim 1, characterized in that the radiant heating element comprises a quartz radiator.

5. Heating device according to claim 1, characterized in that it comprises a combination of heating coils and heating lamps.

6. Heating device according to claim 1, characterized in that it is fashioned as a heating module comprising the radiant heating element, the glass-ceramic cover, and optionally a temperature protector and/or controller; and that this module is affixed in the microwave appliance as a complete unit.

7. Heating device according to claim 1, characterized in that the glass-ceramic cover is designed and arranged to form a protective cover for means for feeding microwave energy into the cooking chamber.

8. Heating device according to claims 6 and 7, characterized in that the heating module is fashioned so that it can be mounted directly above the means for feeding microwave energy.

9. Heating device according to claim 1, characterized in that the glass-ceramic employed is an h-spodumene-MK-containing glass-ceramic having low microwave absorption.

Figure 1

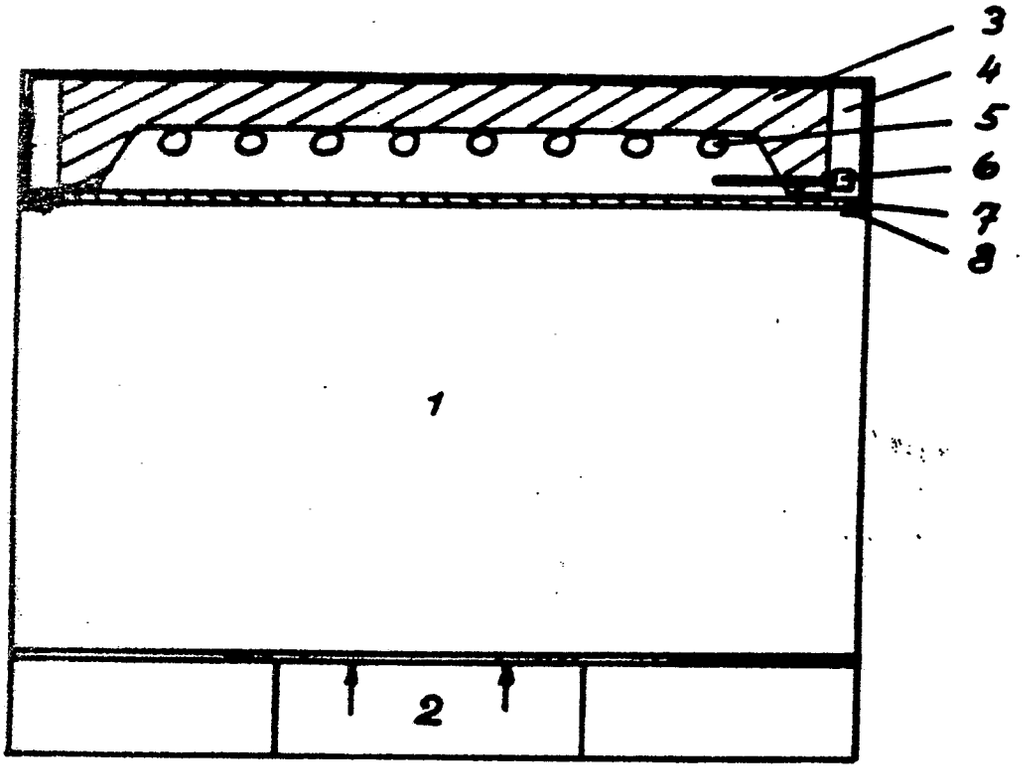
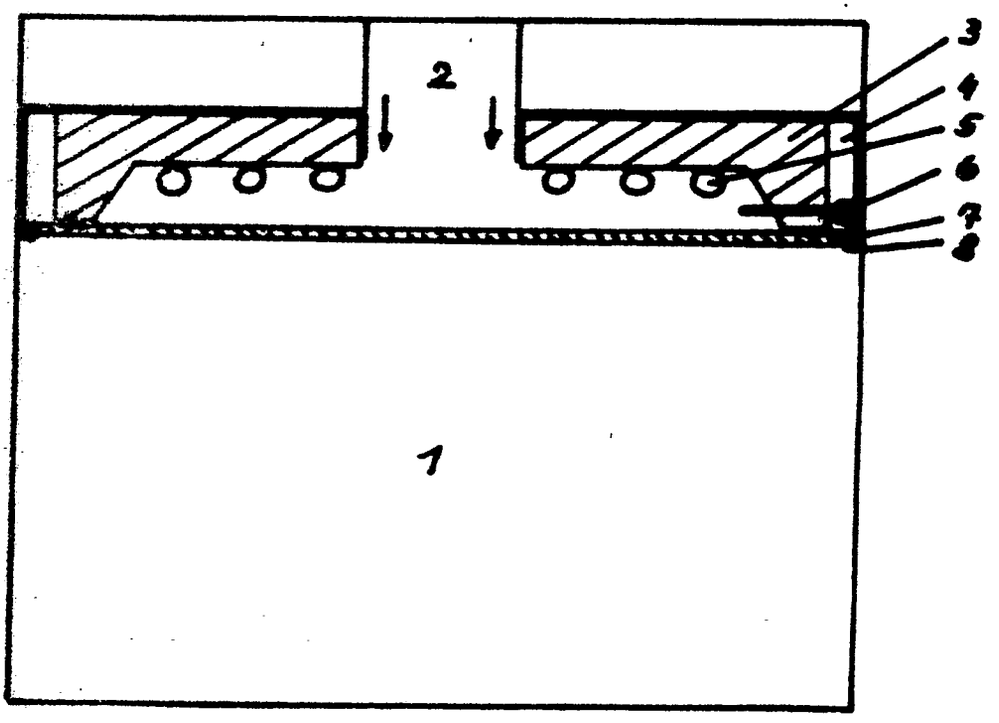


Figure 2



European Patent Office

EUROPEAN SEARCH REPORT

Application number

DOCUMENTS CONSIDERED TO BE RELEVANT

EP 87107640.2

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
Y A	PATENTS ABSTRACTS OF JAPAN, unexamined application, M section, vol. 2, no. 80, June 24, 1978 THE PATENT OFFICE JAPANESE GOVERNMENT page 2126 M 78 * Kokai-no. 53-49 351 (MATSUSHITA) * --	1-4,7 6,8,9	F 24 C 7/02 H 05 B 3/44 H 05 B 11/00 H 05 B 6/64
P,Y	EP - A1 - 0 215 617 (THORN EMI) * Abstract; page 3, lines 3-39; fig. 1,2 * --	1-4,7	
A	PATENTS ABSTRACTS OF JAPAN, unexamined application, M section, vol 2, no. 87, July 15, 1978 THE PATENT OFFICE JAPANESE GOVERNMENT page 2506 M 78 * Kokai-no. 53-57 542 (MATSUSHITA) * --	1-4	TECHNICAL FIELDS SEARCHED (Int. Cl.4) F 24 C 7/00 H 05 B 3/00 H 05 B 6/00 H 05 B 11/00
A	US - A - 4 477 706 (MITTELSTEADT) * Abstract; fig. 1 * --	1,2,4	
A	DE - A1 - 2 921 266 (GENERAL ELECTRIC) * Page 13, last paragraph - page 16, first paragraph; fig. 2 * ----	1,2,4	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
VIENNA	04-09-1987	TSILIDIS

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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A : technological background
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