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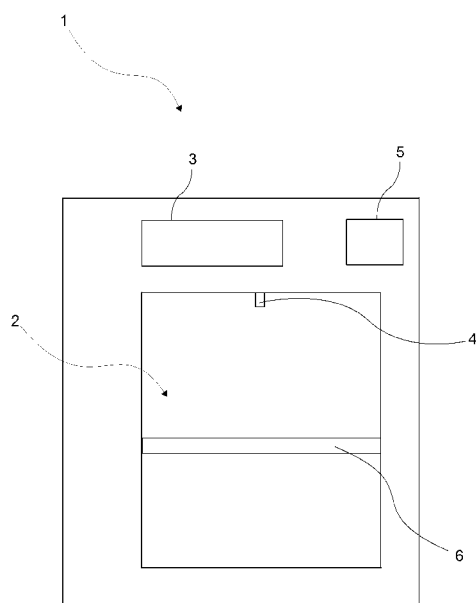
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(54) Title: A MICROWAVE OVEN COMPRISING AN OVEN TRAY

Figure 1



(57) Abstract: The present invention relates to a microwave oven (1) comprising an oven cavity (2) wherein the foodstuffs to be cooked are placed; a microwave generator (3) that generates microwaves; a temperature sensor (4) that is disposed in the oven cavity (2); a control unit (5) that controls the microwave generator (3) according to the data received from the temperature sensor (4), and a microwaveable oven tray (6) that is disposed into the oven cavity (2), that is produced from a refractory material and that has a support surface (S) whereon the foodstuff is placed.

Description**A MICROWAVE OVEN COMPRISING AN OVEN TRAY**

- [0001] The present invention relates to an microwave oven comprising an oven tray for microwave ovens in particular for cooking pizza and, more in general, for cooking pastry and bread products.
- [0002] Oven trays suitable for cooking pizza and pastry in particular in microwave ovens are available on the market. Generally the known oven trays are made of refractory materials, such as ceramic or stone, which have a good ability of storing heat and releasing it slowly over time, allowing to directly heat the base of the pastry which is in contact with the tray. In order to ensure an optimal cooking efficiency, such trays need to be preheated before placing the foodstuffs to be cooked thereon. The method for preheating such trays generally comprises keeping the same in a traditional oven cavity of an oven heated at a minimum temperature for a minimum interval of time.
- [0003] During the preheating process realized before the foodstuffs are placed into the microwave oven, heat leakage to the outer environment from the microwave oven increases in case of the absence of the oven tray, and malfunctions may occur in the microwave oven due to the increased back-reflection in the empty oven volume.
- [0004] In the state of the art United States patent Application No. US20140238250, a microwavable heating tray is disclosed, comprising a base provided with a central cavity, a heating element placed on the central cavity and a frame placed on the heating element for holding the same in place.
- [0005] The aim of the present invention is the realization of a microwave oven that can be used in a safe manner.
- [0006] The microwave oven realized in order to attain the aim of the present invention, explicated in the first claim and the respective claims thereof, comprises an oven cavity wherein the foodstuffs to be cooked are placed; a microwave generator that generates microwaves; a temperature sensor that is disposed in the oven cavity; a control unit that controls the microwave generator according to the data received from the temperature

sensor, and a microwaveable oven tray that is disposed into the oven cavity, that is produced from a refractory material and that has a support surface whereon the foodstuff is placed.

[0007] The microwave oven of the present invention comprises the control unit that compares the temperature values measured by the temperature sensor during a preheating period predetermined by the manufacturer after the microwave generator is activated with the limit temperature value predetermined by the manufacturer for the preheating period, and thus determines the presence of the oven tray in the oven cavity. The manufacturer predetermines the oven cavity temperature that is anticipated to be reached when the microwave oven is operated for certain time after the oven tray is placed into the oven cavity. The control unit compares the temperature detected by the temperature sensor with the temperature values determined by the manufacturer and decides whether the oven tray is placed in to the oven cavity.

[0008] In an embodiment of the present invention, the microwave oven comprises the control unit that compares the temperature value measured by the temperature sensor with the limit temperature value, that decides that the oven tray is in the oven cavity if the measured temperature value is equal to or higher than the limit temperature value, thus continuing the cooking process. If the microwave oven is operated when the oven tray is in the oven cavity, the temperature of the oven cavity increases as the oven tray heats up with microwaves. The control unit compares the temperature value measured by the temperature sensor with the limit temperature value determined by the manufacturer at certain intervals, and decides that the oven tray is in the oven cavity if the measured temperature value is equal to or higher than the limit temperature value. In this case, the control unit continues the cooking process since problems such as back-reflection of microwaves generated by the microwave generator or leakage to the outer environment cannot occur.

[0009] In another embodiment of the present invention, the microwave oven comprises the control unit that compares the temperature value measured by the temperature sensor with the limit temperature value, and that, if the

measured temperature value is lower than the limit temperature value, compares the measured temperature value with the initial temperature value measured when the microwave generator is operated. If the measured temperature value is lower than the limit temperature value, the control unit decides that the cooking process has not been properly performed, and determines the temperature change in the oven cavity by comparing the measured temperature value with the initial temperature value measured at the beginning of the cooking process.

[0010] In another embodiment of the present invention, the microwave oven comprises the control unit that decides that the oven tray is not in the oven cavity if the measured temperature value is not equal to the initial temperature value measured when the microwave generator is operated. If the measured temperature value is equal to the initial temperature value, the control unit decides that there is no microwaveable material in the cooking cavity that may cause increase in temperature, and thus determines that the oven tray is not in the oven cavity. In this case, the microwaves emitted by the microwave generator reflect from the surfaces of the oven cavity back to the microwave generator, and cause malfunction in the components of the microwave oven.

[0011] In another embodiment of the present invention, the microwave oven comprises the control unit that deactivates the microwave generator and ends the cooking process upon determining that the oven tray is not in the oven cavity. Upon determining that the oven tray is not in the oven cavity, the control unit turns off the microwave oven and prevents the microwave oven from being operated before the oven tray is placed. Thus, the components of the microwave oven are prevented from being damaged due to the microwaves reflecting from the oven cavity.

[0012] In another embodiment of the present invention, the microwave oven comprises the control unit that decides that the oven tray placed in the oven cavity or the microwave generator has malfunctioned if the measured temperature value is higher than the initial temperature value measured when the microwave generator is operated. If the temperature value measured by the temperature sensor is lower than the limit temperature

value and higher than the initial temperature value measured when the microwave generator is operated, the control unit determines that the interior of the microwave oven is heated to a level below the level determined by the manufacturer. Thus, the control unit decides that the temperature value anticipated by the manufacturer cannot be reached due to the malfunction of the oven tray or the microwave generator.

[0013] In another embodiment of the present invention, the microwave oven comprises the control unit that enables the user to be warned with a visual and/or audio warning upon detecting the malfunctioning of the oven tray or the microwave generator. The control unit enables the user to be informed by visual and/or audio warning.

[0014] In another embodiment of the present invention, the microwave oven comprises the oven tray comprising a plurality of housings and a plurality of blocks with microwaveable susceptor material, each placed into one housing. In this embodiment, composite materials comprising particles of a susceptor material, i.e. particles of a material having the capacity to absorb microwave radiation energy and to convert the same into thermal energy are placed into the oven tray housings. The composite material is arranged within the body in a plurality of distinct blocks of composite material spread beneath the support surface of the tray aimed to receive the food product to be cooked, parallel to the support surface. The blocks of composite material are designed to have a variable capacity of absorbing the microwave energy, so as to compensate the uneven distribution of microwave energy inside the oven cavities of the microwave ovens. To this aim, the blocks of composite material comprise a variable amount of susceptor material.

[0015] By means of the present invention, a microwave oven that can be used in a safe manner is realized.

[0016] The microwave oven realized in order to attain the aim of the present invention is illustrated in the attached figures, where:

[0017] Figure 1 - is the schematic view of a microwave oven.

[0018] Figure 2 - is the perspective view of the oven tray in an embodiment of the present invention.

[0019] Figure 3 – is the partial schematic view of the oven tray in another embodiment of the present invention.

[0020] The elements in the figures are numbered as follows:

1. Microwave oven
2. Oven cavity
3. Microwave generator
4. Temperature sensor
5. Control unit
6. Oven tray
7. Housing
8. Block

[0021] S. Support Surface

[0022] The microwave oven (1) comprises an oven cavity (2) wherein the foodstuffs to be cooked are placed; a microwave generator (3) that generates microwaves; a temperature sensor (4) that is disposed in the oven cavity (2); a control unit (5) that controls the microwave generator (3) according to the data received from the temperature sensor (4), and a microwaveable oven tray (6) that is disposed into the oven cavity (2), that is produced from a refractory material and that has a support surface (S) whereon the foodstuff is placed.

[0023] The microwave oven (1) of the present invention comprises the control unit (5) that compares the temperature values (T) measured by the temperature sensor (4) during a preheating period (T) predetermined by the manufacturer after the microwave generator (3) is activated with the limit temperature value (T_{lim}) predetermined by the manufacturer for the preheating period (T), and thus determines the presence of the oven tray (6) in the oven cavity (2).

[0024] In an embodiment of the present invention, the microwave oven (1) comprises the control unit (5)

[0025] - that compares the temperature value (T) measured by the temperature sensor (4) with the limit temperature value (T_{lim}), and

[0026] - that decides that the oven tray (6) is in the oven cavity (2) and continues the cooking process if the measured temperature value (T) is equal to or

higher than the limit temperature value (T_{lim}).

- [0027] The limit temperature value (T_{lim}) determined by manufacturer shows the temperature value that is anticipated to be reached in the oven cavity (2) at the end of the preheating period (T) after the microwave generator (3) is operated when the oven tray (6) is in the oven cavity (2). If the measured temperature value (T) is equal to or higher than the limit temperature value (T_{lim}), the control unit (5) decides that the oven tray (6) is properly placed into the oven cavity (2) and continues the cooking process.
- [0028] In another embodiment of the present invention, the microwave oven (1) comprises the control unit (5)
- [0029] - that compares the temperature value (T) measured by the temperature sensor (4) with the limit temperature value (T_{lim}), and
- [0030] - that compares the measured temperature value (T) with the initial temperature value (T_1) measured when the microwave generator (3) is operated if the measured temperature value (T) is lower than the limit temperature value (T_{lim}).
- [0031] If the measured temperature value (T) is lower than the limit temperature value (T_{lim}), the control unit (5) decides that the cooking process has not been properly performed, and determines the temperature change in the oven cavity (2) by comparing the measured temperature value (T) with the initial temperature value (T_1) measured at the beginning of the cooking process.
- [0032] In another embodiment of the present invention, the microwave oven (1) comprises the control unit (5)
- [0033] - that decides that the oven tray (6) is not in the oven cavity (2) if the measured temperature value (T) is equal to the initial temperature value (T_1) measured when the microwave generator (3) is operated.
- [0034] If the measured temperature value (T) is equal to the initial temperature value (T_1), the control unit (5) decides that there is no microwaveable material in the cooking cavity (2) that may cause increase in temperature, and thus determines that the oven tray (6) is not in the oven cavity (2).
- [0035] In another embodiment of the present invention, the microwave oven (1) comprises the control unit (5) that deactivates the microwave generator (3)

and ends the cooking process upon determining that the oven tray (6) is not in the oven cavity (2). If the microwave oven (1) is operated before the oven tray (6) is placed, the microwaves sent by the microwave generator (3) into the oven cavity (2) reflect back to the microwave generator (3) and cause malfunction in the microwave oven (1). Upon determining that the oven tray (6) is not in the oven cavity (2), the control unit (5) deactivates the microwave generator (3) and prevents the microwave oven (1) from being operated before the oven tray (6) is placed. Thus, the lifetime of the microwave oven (1) is increased.

[0036] In another embodiment of the present invention, the microwave oven (1) comprises the control unit (5)

[0037] - that decides that the oven tray (6) placed in the oven cavity (2) or the microwave generator (3) has malfunctioned if the measured temperature value (T) is higher than the initial temperature value (T_1) measured when the microwave generator (3) is operated.

[0038] The susceptor material in the oven tray (6) enables the oven tray (6) to be heated with microwaves. When the susceptor material loses its capacity in time, the microwaveability performance of the oven tray (6) decreases. Therefore, the interior of the oven cavity (2) cannot reach the temperatures determined by the manufacturer. Moreover, in case of a malfunction in the microwave generator (3), the interior of the oven cavity (2) cannot reach the temperatures determined by the manufacturer.

[0039] In another embodiment of the present invention, the microwave oven (1) comprises the control unit (5) that enables the user to be warned with a visual and/or audio warning upon detecting the malfunctioning of the oven tray (6) or the microwave generator (3). The control unit (5) enables the user to be informed by visual and/or audio warning.

[0040] In another embodiment of the present invention, the microwave oven (1) comprises the oven tray (6) having a plurality of housings (7) and a plurality of blocks (8) containing microwaveable susceptor material therein, each placed into one housing (7). The susceptor material is for instance a metal, a metal oxide or a metal based material. In an embodiment of the present invention, the susceptor material is an iron compound such as

magnetite (Fe_3O_4) or hematite (Fe_2O_3) (Figure 2 and Figure 3).

[0041] In the microwave oven (1) of the present invention, the presence of the oven tray (6) in the oven cavity (2) is enabled to be detected by means of the temperature sensor (4). Thus, the microwave oven (1) is prevented from being operated before the oven tray (6) is placed.

Claims

1. A microwave oven (1) **comprising** an oven cavity (2) wherein the foodstuffs to be cooked are placed; a microwave generator (3) that generates microwaves; a temperature sensor (4) that is disposed in the oven cavity (2); a control unit (5) that controls the microwave generator (3) according to the data received from the temperature sensor (4), and a microwaveable oven tray (6) that is disposed into the oven cavity (2), that is produced from a refractory material and that has a support surface (S) whereon the foodstuff is placed, **characterized by** the control unit (5) that compares the temperature values (T) measured by the temperature sensor (4) during a preheating period (T) predetermined by the manufacturer after the microwave generator (3) is activated with the limit temperature value (T_{lim}) predetermined by the manufacturer for the preheating period (T), and thus determines the presence of the oven tray (6) in the oven cavity (2).
2. A microwave oven (1) as in Claim 1, **characterized by** the control unit (5)
 - that compares the temperature value (T) measured by the temperature sensor (4) with the limit temperature value (T_{lim}), and
 - that decides that the oven tray (6) is in the oven cavity (2) and continues the cooking process if the measured temperature value (T) is equal to or higher than the limit temperature value (T_{lim}).
3. A microwave oven (1) as in Claim 1 or 2, **characterized by** the control unit (5)
 - that compares the temperature value (T) measured by the temperature sensor (4) with the limit temperature value (T_{lim}), and
 - that compares the measured temperature value (T) with the initial temperature value (T_1) measured when the microwave generator (3) is operated if the measured temperature value (T) is lower than the limit temperature value (T_{lim}).
4. A microwave oven (1) as in Claim 3, **characterized by** the control unit (5)
 - that decides that the oven tray (6) is not in the oven cavity (2) if the measured temperature value (T) is equal to the initial temperature value (T_1) measured when the microwave generator (3) is operated.
5. A microwave oven (1) as in Claim 4, **characterized by** the control unit (5) that deactivates the microwave generator (3) and ends the cooking process upon

determining that the oven tray (6) is not in the oven cavity (2).

6. A microwave oven (1) as in Claim 3, **characterized by** the control unit (5)
- that decides that the oven tray (6) placed in the oven cavity (2) or the microwave generator (3) has malfunctioned if the measured temperature value (T) is higher than the initial temperature value (T_1) measured when the microwave generator (3) is operated.
7. A microwave oven (1) as in Claim 6, **characterized by** the control unit (5) that enables the user to be warned with a visual and/or audio warning upon detecting the malfunctioning of the oven tray (6) or the microwave generator (3).
8. A microwave oven (1) as in any one of the above claims, **characterized by** the oven tray (6) having a plurality of housings (7) and a plurality of blocks (8) containing microwaveable susceptor material therein, each placed into one housing (7).

Figure 1

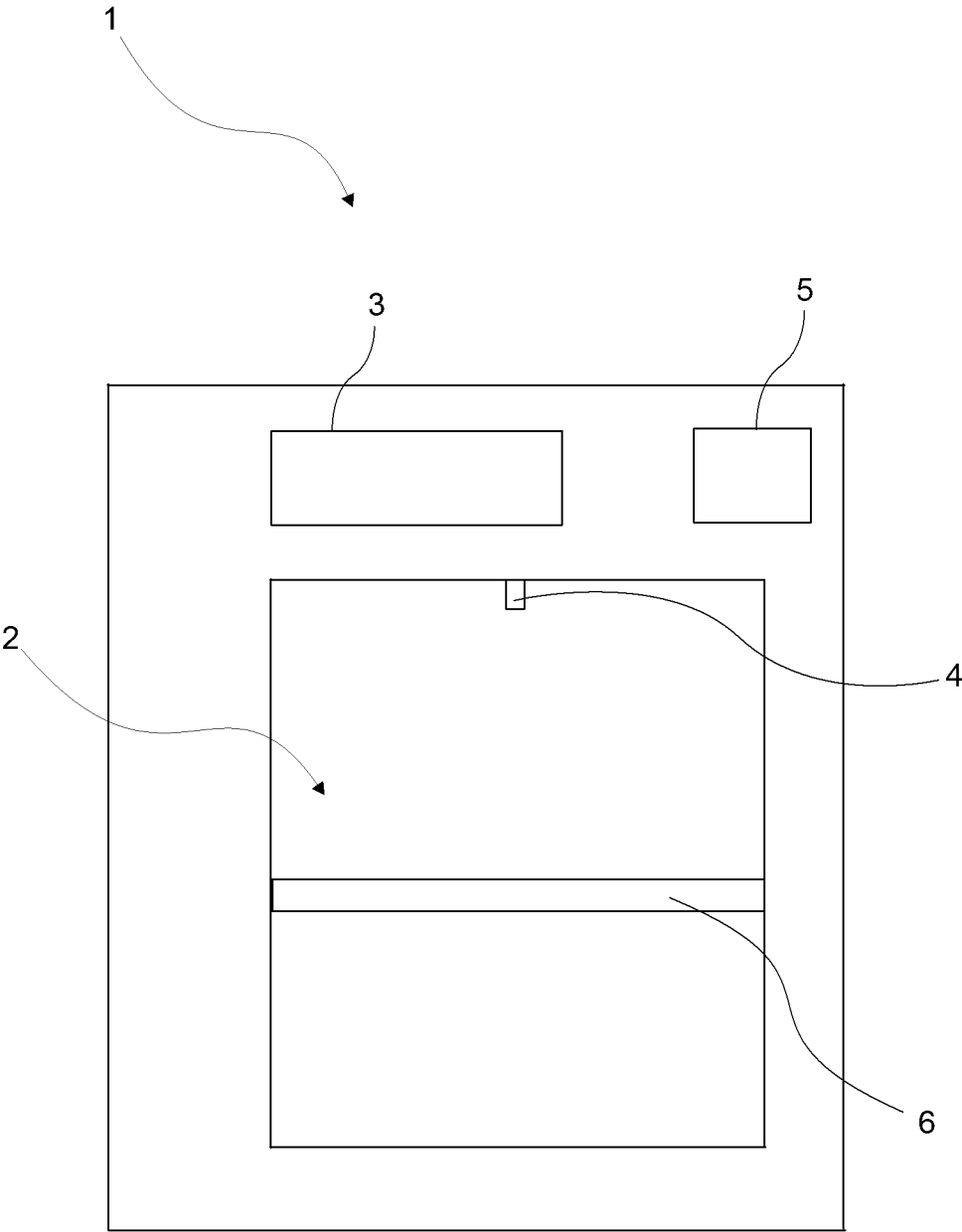


Figure 2

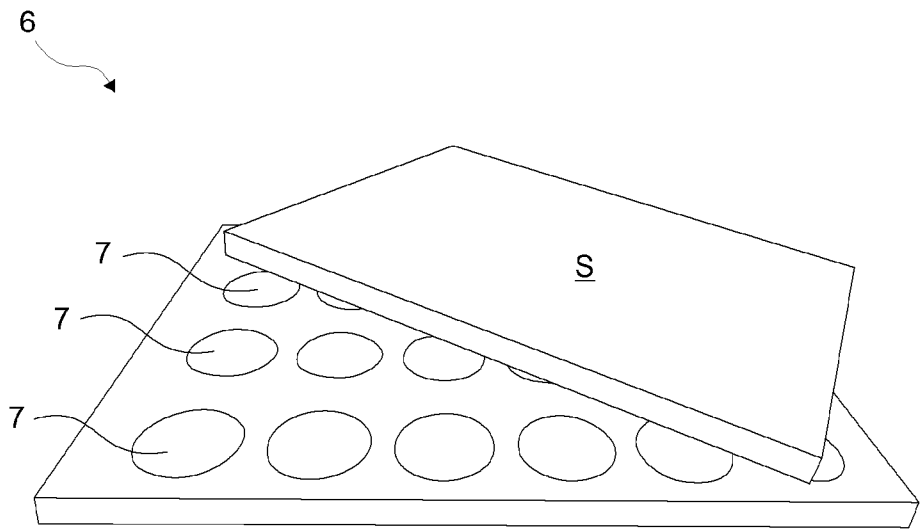
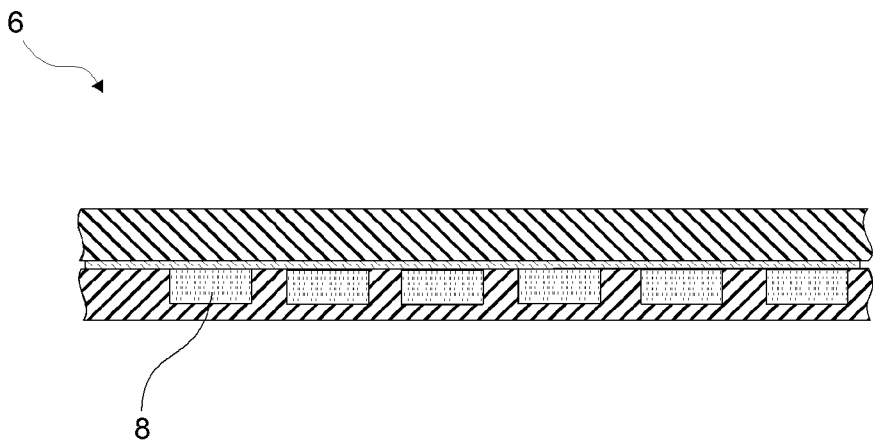


Figure 3



INTERNATIONAL SEARCH REPORT

International application No

PCT/EP2018/058333

A. CLASSIFICATION OF SUBJECT MATTER

INV. H05B6/64 H05B6/66
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
H05B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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A	JP 2006 288778 A (MATSUSHITA ELECTRIC IND CO LTD) 26 October 2006 (2006-10-26) abstract; figures 1-9 -----	1-8
A	WO 2016/192802 A1 (ARCELIK AS [TR]) 8 December 2016 (2016-12-08) abstract; figures 1-6 -----	1-8
A	WO 2012/152692 A1 (ARCELIK AS [TR]; GUR METIN [TR]; BABA SINAN [TR]) 15 November 2012 (2012-11-15) abstract; figures 1-10 -----	1-8



Further documents are listed in the continuation of Box C.



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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2018/058333

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