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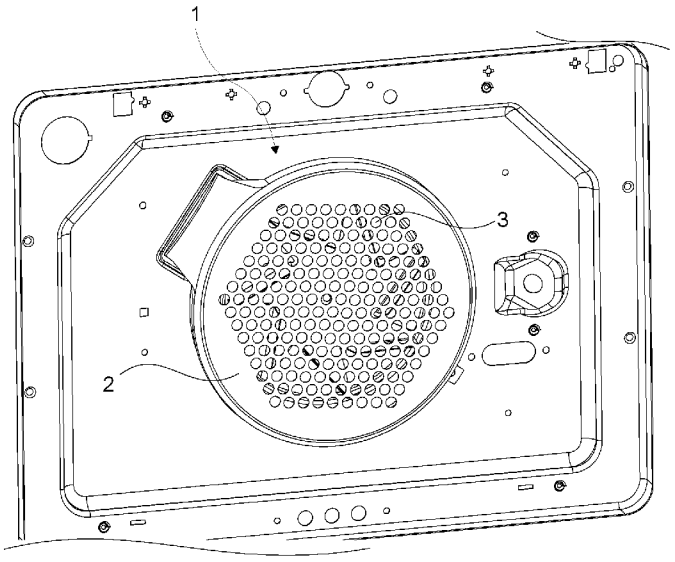
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(54) Title: ELECTRIC OVEN HAVING AN IMPROVED UNIFORM HEAT DISTRIBUTION PROFILE

Fig. 1



(57) Abstract: The present invention relates to an electric oven comprising an interior cooking chamber for cooking food, a door for allowing access into the cooking chamber and a fan assembly (1) on an inner wall portion of the cooking chamber, the fan assembly (1) having a circulation fan (4) drawing interior air through a plurality of intake holes (3) in a fan cover (2) and circulating the same into the cooking chamber through a heating element (5).

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Description

ELECTRIC OVEN HAVING AN IMPROVED UNIFORM HEAT DISTRIBUTION PROFILE

[0001] The present invention relates to an electric oven having a fan assembly directing the air to be exhausted so as to be circulating throughout the oven chamber in a uniform manner.

A conventional electric oven is a six-sided household appliance with an interior cooking chamber for cooking food. The body of the appliance typically has exterior side walls and rear and front walls, the front wall having a hinge connected door for allowing access into the cooking chamber. The electric oven may further have a control panel with various control knobs and buttons for setting operational parameters and a display for presenting the operational state of the appliance. Further, an oven may have an inner compartment containing electronic components such as magnetron and, high-voltage transformer.

[0002] In an electric oven, heated air is exhausted from a plurality of outlet openings of a fan cover so as to be circulated inside the cooking chamber to effect cooking of the food items. A heater associated with a circulation fan functions in the manner that, in order for heating the air in the oven, air drawn by the circulation fan through a plurality of intake holes is directed towards the heater and due to heat generated by the heater, heated air is circulated throughout the cooking chamber by passing through a plurality of outlet openings. Therefore a fan cover may have a plurality inlet holes as well as a plurality of outlet openings for circulating air through the heating air cycle.

[0003] A problem associated with the above-described system lies in that the food items placed in the cooking chamber may not be cooked thoroughly because the circulation of the heated air in the cooking chamber may not have a uniform heat distribution profile or, in other words, heat may not be evenly transferred throughout the cooking chamber.

[0004] In order for ensuring an evenly distributed thermal profile in the cooking chamber and to ensure that the food items are delicately and homogeneously cooked irrespective of their position therein, the present

invention proposes a fan cover along with a heating element effecting accelerated circulation of the heated air.

[0005] A prior art publication in the technical field of the present invention may be referred to as KR20090017299 among others, the document disclosing an electric oven with a convection cover including an air guide to discharge hot air horizontally via the air guide and thus to cook the food uniformly. The electric oven comprises a convection heater heating up the air in a cavity, a convection fan circulating the air via the convection heater to the cavity, and a convection cover installed in front of the convection fan and the convection heater. The convection cover includes an intake hole inhaling the air, an outlet discharging the inhaled air, and a plurality of air guides guiding the discharge direction of the air on the backside of the convection cover.

[0006] The present invention proposes an electric oven having a fan assembly by which homogenous heating in the cooking chamber including the front region near the front door can be provided. The present invention also provides that a more compact and much smaller fan cover can be utilized such that manufacturing costs are saved without compromising on the quality and efficiency of the fan cover to obviate problems in association with insufficient heating of the front zone.

[0007] The present invention provides an electric oven circulation fan assembly which ensures uniform heat distribution in the oven chamber and provides a reduction in the size of the fan cover as defined by the characterizing features in Claim 1.

[0008] Primary object of the present invention is hence to provide an electric oven circulation fan assembly, which has a reduced size to provide cost saving without compromising uniform heat distribution within the oven chamber including the very front region near the front door of the electric oven.

[0009] The present invention proposes an electric oven having a circulation fan drawing interior air through a plurality of intake holes in a fan cover and circulating the same into the cooking chamber through a heating element. The heating element is designed in the form of two tubular circular extensions as a first and a second turn sections, these sections extending

in an adjacent manner with the exception of first outlet openings provided in between the two first and a second turn sections. The first outlet openings in between turn sections direct and accelerate the air flow such that a food item placed near the front door of the oven is also cooked in a satisfactory manner.

[0010] The heating element is radially disposed such that the two turn sections are equally-spaced relative to the circulation fan. Each first outlet opening is followed by a closed region where the two turn sections are adjacently juxtaposed. Two first outlet openings and two closed regions are subsequently distributed over the heating element. A closed region prevents the flow of air into the oven chamber.

[0011] In addition, second outlet openings are formed on a flanged skirt portion of the fan cover for allowing passage of the air coming from the first outlet openings. The second outlet openings coincide with the first outlet openings and an air path passing therethrough is obtained.

[0012] Accompanying drawings are given solely for the purpose of exemplifying an electric oven circulation fan assembly, whose advantages over prior art were outlined above and will be explained in brief hereinafter.

[0013] The drawings are not meant to delimit the scope of protection as identified in the claims nor should they be referred to alone in an effort to interpret the scope identified in said claims without recourse to the technical disclosure in the description of the present invention.

[0014] Fig. 1 demonstrates a front perspective view of a fan cover according to the present invention.

[0015] Fig. 2 demonstrates a side perspective view of a fan cover according to the present invention.

[0016] Fig. 3 demonstrates a side perspective view of a circulation fan with a heating element while the fan cover is removed according to the present invention.

[0017] Fig. 4 demonstrates a side perspective view of the heating element according to the present invention.

[0018] Fig. 5a and 5b respectively demonstrate 90-degrees rotated cross-sectional side views of the heating element according to the present

invention.

[0019] The following numerals are assigned to different parts demonstrated in the drawings:

1. Fan assembly
2. Fan cover
3. Intake hole
4. Circulation fan
5. Heating element
6. First turn section
7. Second turn section
8. First outlet opening
9. Second outlet opening
10. Skirt portion

[0020] The present invention proposes an electric oven having a body in the form of a six-sided household appliance with an interior cooking chamber for cooking food. The electric oven typically has exterior side walls and rear and front walls, the front wall having a hinge connected door for allowing access into the cooking chamber.

[0021] For effecting uniform circulation of heat throughout the cooking chamber, a fan assembly (1) is provided on an inner wall portion of the cooking chamber, said fan assembly (1) having a circulation fan (4) drawing interior air through a plurality of intake holes (3) in a fan cover (2) and directing the same radially in the direction of a first and second set of outlet openings (First outlet openings and second outlet openings; 8 and 9).

[0022] The air passing through the intake holes (3) by the drawing action of the circulation fan (4) is then heated while it is being circulated through a radially disposed peripheral heating element (5) to be delivered into the cooking chamber. The radially disposed peripheral heating element (5), and as well as the circulation fan (4) are covered by the fan cover (2) so that a user trying to reach for the circulation fan (4) will not be able to do so.

[0023] According to the present invention, a more compact reduced size fan cover is provided resulting in that manufacturing costs can be saved. To

ensure efficiency of the fan cover to obviate problems in association with insufficient heating of the front zone, a heating element (5) is provided in the form of a first turn section (6) and a second turn section (7), the heating element (5) comprising a resistance wire typically suspended inside a tubular hard metal alloy bent into a circular shape as in the case of the first and second turn sections (6, 7). The heating element (5) in accordance with the present invention therefore comprises a first turn section (6) neighboring a second turn section (7), both having an equal distance to the circulation fan (4) in the radial directions. To this end, the air directed by the circulation fan (4) towards the heating element (5) hits the first and second turn sections (6, 7) at the radial periphery of the circulation fan (4).

[0024] According to the present invention, the first and second turn sections (6, 7) at the radial periphery of the circulation fan (4) are designed such that a first outlet opening (8) is provided in between the first and second turn sections (6, 7) of the heating element (5) so that the air is allowed to pass therethrough. First outlet openings (8) are longitudinal openings formed between the two elongated first and second turn sections (6, 7), each being disposed in an equally-spaced relationship throughout the first outlet openings (8). First outlet openings (8) are discontinuous in the sense that the space between the first and second turn sections (6, 7) is discontinued at peripheral sections subsequent to the first outlet openings (8). In this regard, the circular extension of the heating element (5) is divided into four sections with two first outlet openings (8) being separated by closed sections, i.e. sections where the first and second turn sections (6, 7) are adjacently juxtaposed between two first outlet opening (8) sections. Closed sections, where the first and second turn sections (6, 7) are adjacently juxtaposed do not allow inflow of the discharged air into the cooking chamber.

[0025] Further, according to the present invention, second outlet openings (9) are provided, these outlets being formed on the flanged skirt portions (10) of the fan cover (2) for allowing air passage. The second outlet openings (9) of the fan cover (2) coincide with the first outlet openings (8) of the heating

element (5) such that the air can only be circulated along a path simultaneously passing through the first and second outlet openings (8, 9). The first and second outlet openings (8, 9) forming an air passageway provides that the fan cover can have a reduced size and can only be comprised of a flat surface having a plurality of the intake holes (3) and a flanged skirt portion (10) having discontinued second outlet openings (9). In other words, as the air is circulated through the first outlet openings (8) in a directed and accelerated manner, no air deflectors to direct the circulation fan (4) flow is included in the fan cover (2) and an accordingly reduced size fan cover is obtained.

[0026] In a nutshell, the present invention proposes an electric oven comprising an interior cooking chamber for cooking food, a door for allowing access into the cooking chamber and a fan assembly (1) on an inner wall portion of the cooking chamber, the fan assembly (1) having a circulation fan (4) drawing interior air through a plurality of intake holes (3) in a fan cover (2) and circulating the same into the cooking chamber through a heating element (5).

[0027] The heating element (5) comprises a first and a second turn sections (6, 7) between which a first outlet opening (8) is provided such that the air is selectively allowed to pass therethrough.

[0028] In an embodiment of the invention, the heating element (5) is a radially disposed peripheral element in relation to the circulation fan (4). In a further embodiment of the invention, the first turn section (6) and the second turn section (7) have an equal distance to the circulation fan (4) in the radial directions. In a still further embodiment of the invention, the first turn section (6) and the second turn section (7) are circular shape tubular extensions.

[0029] In a yet still further embodiment of the invention, the first outlet opening (8) is a longitudinal opening formed between two elongated first and the second turn sections (6, 7), each being disposed in an equally-spaced relationship along the first outlet opening (8).

[0030] In a yet still further embodiment of the invention, the first outlet opening (8) is discontinuous in the sense that the space between the first and second

turn sections (6, 7) is discontinued at peripheral sections subsequent to the first outlet opening (8).

[0031] In a yet still further embodiment of the invention, the heating element (5) is divided into four sections with each of the two first outlet openings (8) being separated by sections where the first and second turn sections (6, 7) are adjacently juxtaposed.

[0032] In a yet still further embodiment of the invention, sections where the first and second turn sections (6, 7) are adjacently juxtaposed provides a barrier against the flow of air exhausted by the circulation fan (4).

[0033] In a yet still further embodiment of the invention, a flanged skirt portion (10) of the fan cover (2) comprises a second outlet opening (9) for allowing passage of the air coming from the first outlet opening (8).

[0034] In a yet still further embodiment of the invention, the second outlet openings (9) of the fan cover (2) coincide with the first outlet openings (8) of the heating element (5) such that air is circulated along an air path simultaneously passing through the first and second outlet openings (8, 9).

[0035] In a yet still further embodiment of the invention, the fan cover (2) covers the circulation fan (4) such that the latter is in air communication with the cooking chamber only through the intake holes (3) and the air path passing through the first and second outlet openings (8, 9).

[0036] Therefore, an electric oven having a fan assembly (1) is provided, by which homogenous heating in the cooking chamber is ensured, which also overcomes insufficient heating in the front zone of the cooking chamber. A more compact and much smaller fan cover (2) is utilized whereby manufacturing costs are saved without compromising on the efficiency of the fan cover (2).

CLAIMS

1) An electric oven comprising an interior cooking chamber for cooking food, a door for allowing access into the cooking chamber and a fan assembly (1) on an inner wall portion of the cooking chamber, the fan assembly (1) having a circulation fan (4) drawing interior air through a plurality of intake holes (3) in a fan cover (2) and circulating the same into the cooking chamber through a heating element (5) **characterized in that;**

the heating element (5) comprises a first and a second turn sections (6, 7) between which a first outlet opening (8) is provided such that the air is selectively allowed to pass therethrough.

2) An electric oven as in Claim 1, **characterized in that** the heating element (5) is a radially disposed peripheral element in relation to the circulation fan (4).

3) An electric oven as in Claim 1 or 2, **characterized in that** the first turn section (6) and the second turn section (7) have an equal distance to the circulation fan (4) in the radial directions.

4) An electric oven as in Claim 3, **characterized in that** the first turn section (6) and the second turn section (7) are circular shape tubular extensions.

5) An electric oven as in Claim 1, 2 or 3, **characterized in that** the first outlet opening (8) is a longitudinal opening formed between two elongated first and the second turn sections (6, 7), each being disposed in an equally-spaced relationship along the first outlet opening (8).

6) An electric oven as in Claim 1, 2 or 5, **characterized in that** the first outlet opening (8) is discontinuous in the sense that space between the first and the second turn sections (6, 7) is discontinued at sections subsequent to the first outlet opening (8).

7) An electric oven as in Claim 6, **characterized in that** the heating element (5) is divided into four sections with each of the two first outlet openings (8) being separated by sections where the first and second turn sections (6, 7) are adjacently juxtaposed.

8) An electric oven as in Claim 7, **characterized in that** sections where the first and second turn sections (6, 7) are adjacently juxtaposed provides a barrier against the flow of air exhausted by the circulation fan (4).

9) An electric oven as in Claim 1, 2 or 5, **characterized in that** a flanged skirt portion (10) of the fan cover (2) comprises a second outlet opening (9) for allowing passage of the air coming from the first outlet opening (8).

10) An electric oven as in Claim 9, **characterized in that** second outlet openings (9) of the fan cover (2) coincide with first outlet openings (8) of the heating element (5) such that air is circulated along an air path simultaneously passing through the first and second outlet openings (8, 9).

11) An electric oven as in Claim 10, **characterized in that** the fan cover (2) covers the circulation fan (4) such that the latter is in air communication with the cooking chamber only through the intake holes (3) and the air path passing through the first and second outlet openings (8, 9).

Fig. 1

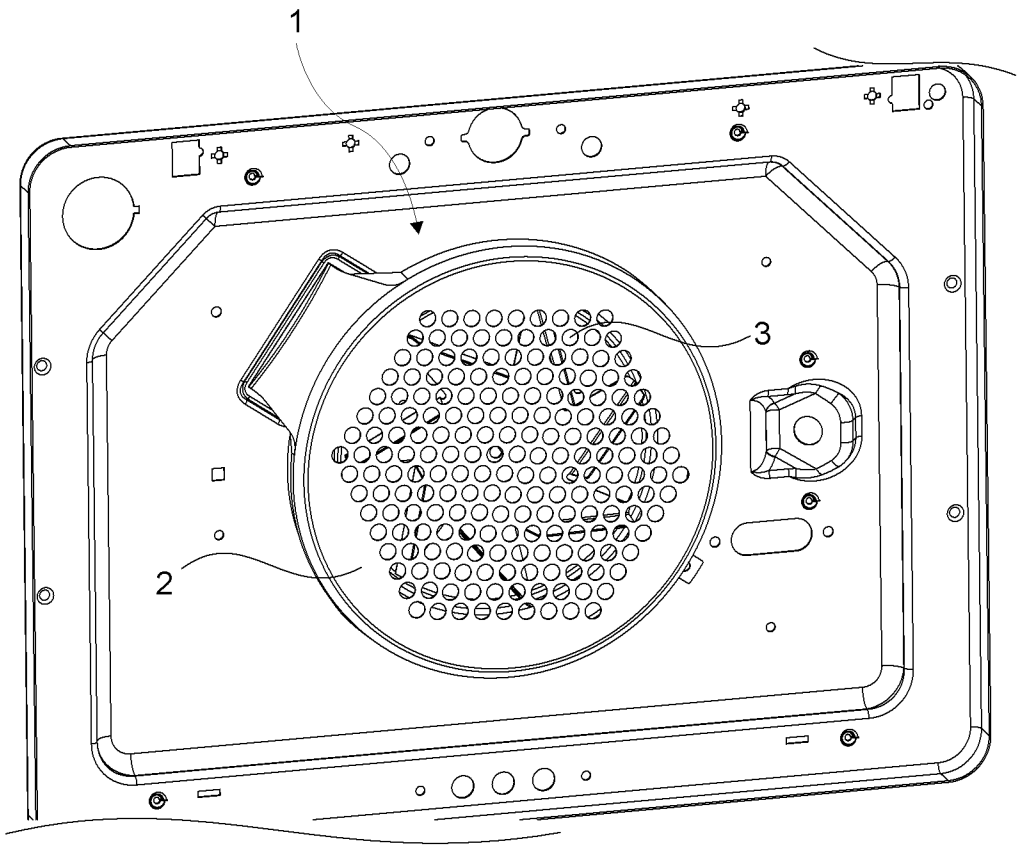


Fig. 2

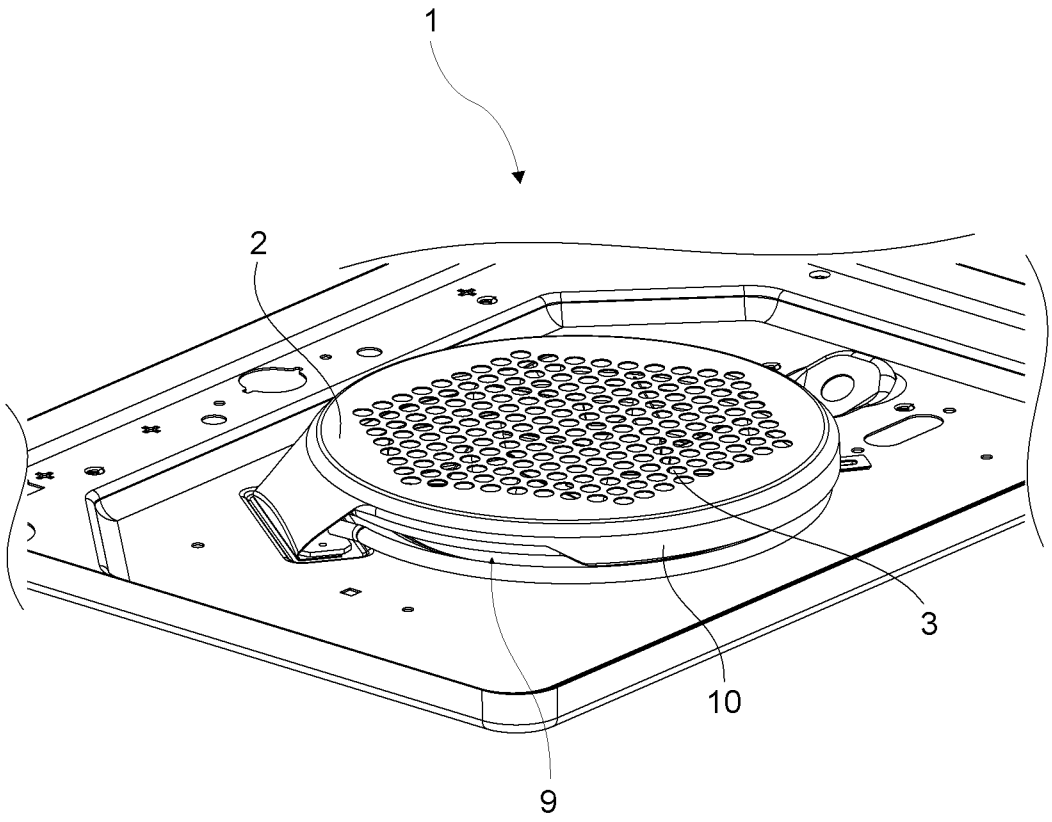


Fig. 3

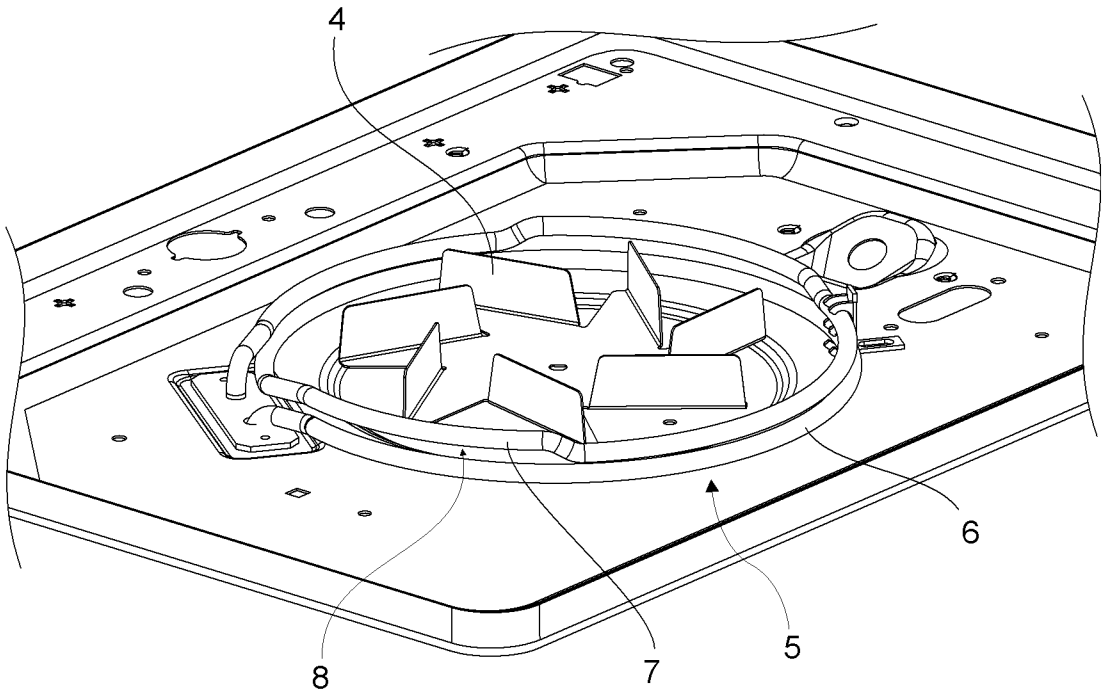


Fig. 4

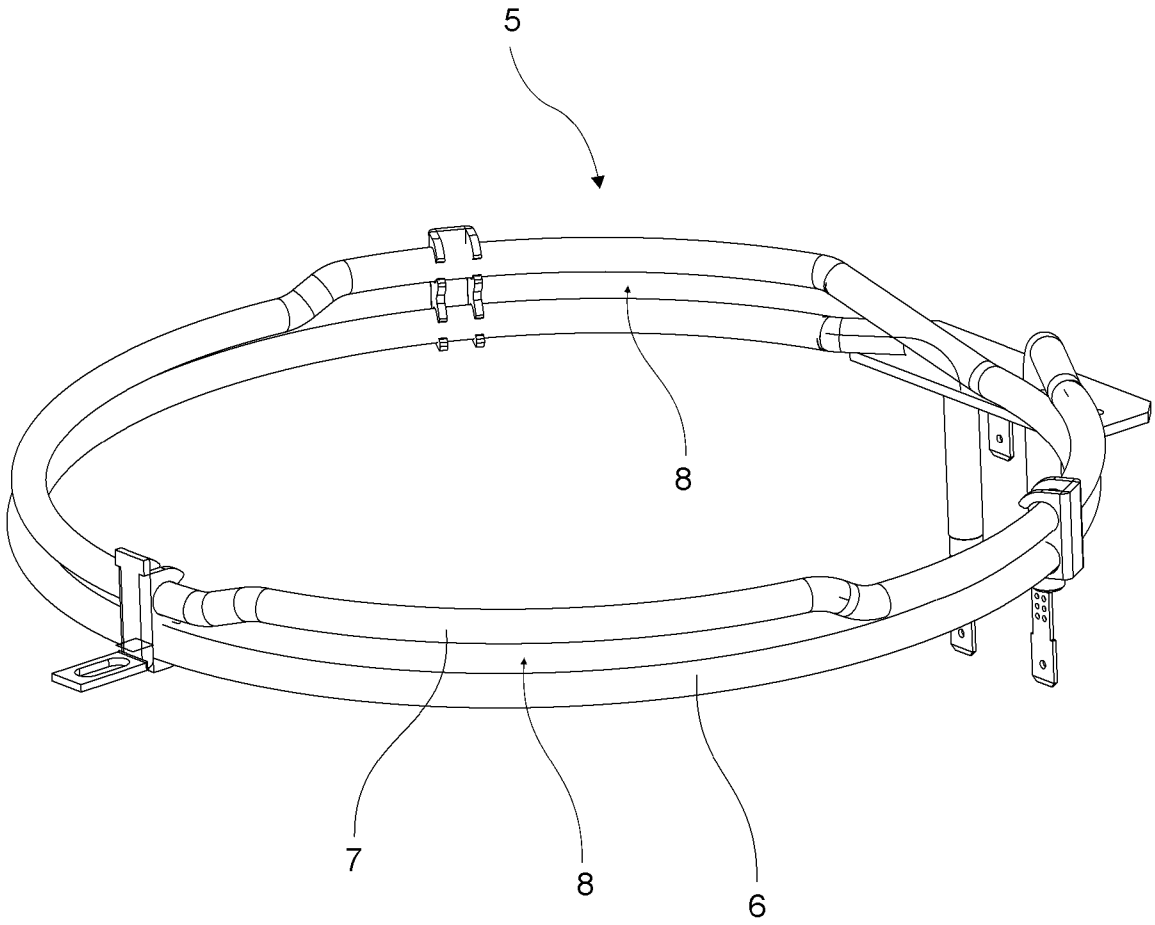


Fig. 5a

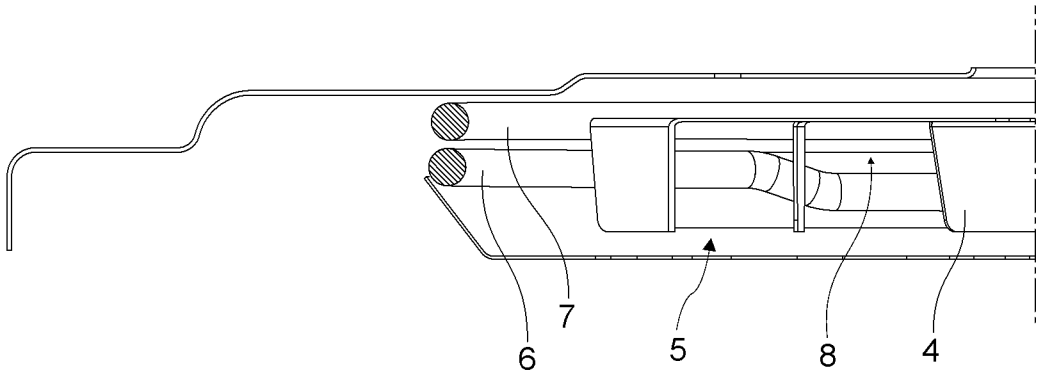
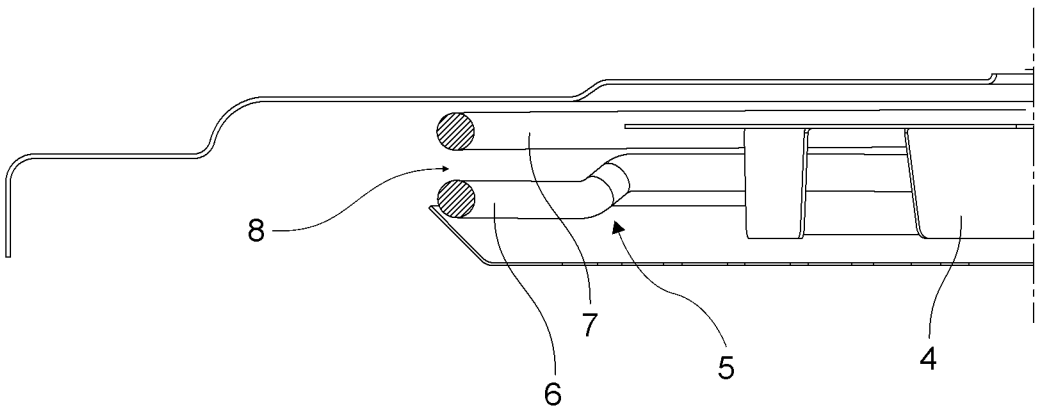


Fig. 5b



INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2014/058646

A. CLASSIFICATION OF SUBJECT MATTER
INV. F24C15/32
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)
F24C

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.
X A	EP 0 319 373 A1 (SEB SA [FR]) 7 June 1989 (1989-06-07) column 2, line 24 - column 3, line 64; figures 1-4	1-5,9-11 6-8
X	WO 93/03309 A1 (MICROWAVE OVENS LTD [GB]) 18 February 1993 (1993-02-18) page 2 - page 5; figures 1,2	1-5
X	DE 10 2007 026218 A1 (BSH BOSCH SIEMENS HAUSGERAETE [DE]) 11 December 2008 (2008-12-11) paragraph [0016] - paragraph [0018]; figures 1,2	1-6

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[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

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"P" document published prior to the international filing date but later than the priority date claimed

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
4 March 2015	13/03/2015

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INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2014/058646

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 02/39021 A1 (WILSON RON [AU]) 16 May 2002 (2002-05-16) page 8, line 19 - page 10, line 5; figures 1-5	1-5

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2

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/EP2014/058646

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