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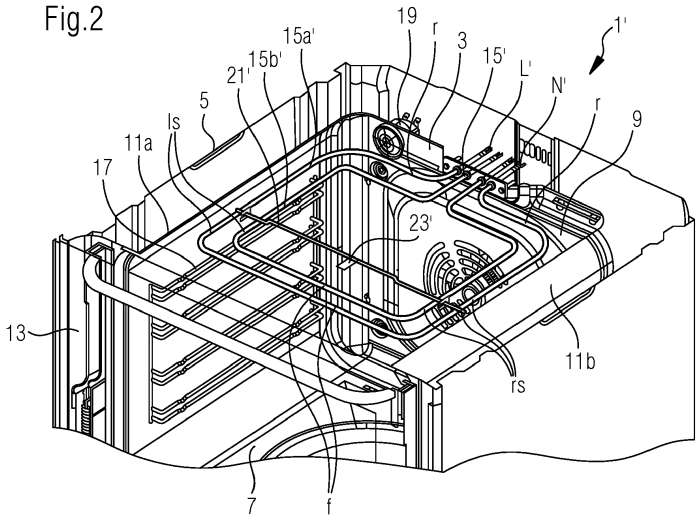
(54) BAKING OVEN

(57) The present invention relates to an oven, particularly a household baking oven, comprising an oven compartment (3), an oven door (13) closing the oven compartment (3) at a front opening and a heating element (15') arranged on a top side of the oven compartment (3) for top heat food preparation, in particular for baking, roasting, broiling, frying and/or for grilling. The oven compartment (3) is defined by a top wall, a bottom wall, a rear wall and side walls. The heating element (15') is particularly arranged in parallel to the top wall. The heating element (15') comprises at least a first loop-shaped heating rod (15a') or resistance heater and a second loop-shaped heating rod (15b') or resistance heater.

According to the invention, each of the first loop-shaped heating rod (15a') and the second loop-shaped heating rod (15b') is designed as a single-loop unit of at least essentially rectangular loop shape, the first loop-shaped heating rod (15a') framing an at least essentially rectangular first area and the second loop-shaped heating rod (15b') framing an at least essentially rectangular second area, wherein the at least essentially rectangular first area is larger than the at least essentially rectangular second area and wherein the at least essentially rectangular second area is preferably kept free from heating element sections or components.

The present invention further relates to a method for operating an oven.

Fig.2



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Description

[0001] The present invention relates to an oven, particularly a household baking oven, according to the preamble of claim 1. The present invention further relates to a method for operating an oven according to the preamble of claim 13.

[0002] Household baking ovens are usually equipped with several heating elements in order to provide the user the opportunity to run baking, roasting, broiling, frying or grilling oven programs for using a preparation process adapted to the respective food to be prepared. In general, there are ring-shaped heating elements known, which are operated in combination with a fan for oven programs using air recirculation for the distribution of heat within on oven compartment. Further, there are heating elements known for food treatment from above or from below, which are usually formed as tubular resistance heaters and which are operated, in that electric power being converted into heat energy. Said heating elements for heating from above or from below are individually designed, each one in a way that the heat emitted from said heating elements is intended to be evenly distributed over the entire horizontal cross-sectional area of the oven compartment, either top-down by the top heat heating element or bottom-up by the bottom heat heating element. In order to realize said even distribution, particularly the top heat heating element comprises an outer and an inner loop-shaped heating rod or resistance heater, usually designed as tubular heating element, wherein said outer and inner loops comprise both bordering and inscribed loop portions.

[0003] It is an object of the present invention to provide an oven, particularly a household baking oven as well as a method for operating an oven, particularly a household baking oven, with particularly even heat distribution, especially when operating the oven with a grilling program or function considering particularly high energy efficiency.

[0004] The object is achieved for an oven, particularly a household baking oven, according to the preamble of claim 1 by means of the characterizing features of claim 1.

[0005] According to an aspect of the invention, an oven, particularly a household baking oven, comprises an oven compartment, an oven door closing the oven compartment at a front opening and a heating element arranged on a top side of the oven compartment for top heat food preparation, in particular for baking, roasting, broiling, frying and/or for grilling. The oven compartment is defined by a top wall, a bottom wall, a rear wall and side walls. The heating element comprises at least a first loop-shaped heating rod or resistance heater, particularly of tubular design, which first loop-shaped heating rod or resistance heater is preferably arranged in parallel to the top wall, and a second loop-shaped heating rod or resistance heater, particularly of tubular design, which second loop-shaped heating rod or resistance heater is preferably arranged in parallel to the top wall. Each of the first loop-shaped heating rod and the second loop-shaped heating rod is designed as a single-loop unit of at least essentially rectangular loop shape. The first loop-shaped heating rod frames an at least essentially rectangular first area and the second loop-shaped heating rod frames an at least essentially rectangular second area. The at least essentially rectangular first area is larger than the at least essentially rectangular second area. Preferably, the at least essentially rectangular second area is kept free from heating element sections or components.

[0006] In particular, the first loop-shaped heating rod encompasses the second loop-shaped heating rod. Preferably, the first loop-shaped heating rod and the second loop-shaped heating rod are arranged in the same plane.

[0007] The first loop-shaped heating rod and the second loop-shaped heating rod (15b') may have different geometries, but preferably they are geometrically similar parts.

[0008] According to specific embodiments, the first loop-shaped heating rod and the second loop-shaped heating rod are shaped as rounded-corner rectangles.

[0009] The oven compartment is particularly of an at least approximately cuboid shape and preferably comprises rounded-corner vertical side edges.

[0010] Each of the first loop-shaped heating rod and the second loop-shaped heating rod may comprise

- a front bar portion or rod portion arranged at least approximately in parallel to the oven door,
- left and right bar portions or rod portions arranged at least approximately in parallel to the side walls of the oven compartment, and
- at least one rear bar portion or rod portion arranged at least approximately in parallel to the rear wall of the oven compartment.

[0011] Each one of the front, the left and right and of the rear bar portions or rod portions of the first loop-shaped heating rod may be at least approximately equally spaced from one of the oven door, the side walls and the rear wall at a first distance, and each one of the front, the left and right and of the rear bar portions or rod portions of the second loop-shaped heating rod may be at least approximately equally spaced from one of the oven door, the side walls and the rear wall at a second distance. With such equal spacings, the heat portions emitted into directions towards the surrounding walls (including the door wall) may be similarly reflected and an even heat distribution within the oven compartment can be supported.

[0012] In a specific embodiment, the first and second loop-shaped heating rods or resistance heaters are individually controllable.

[0013] In particular, the second loop-shaped heating rod or resistance heater is concentrically arranged to the first loop-shaped heating rod or resistance heater, particularly differing only in the dimensions.

[0014] As mentioned above, the second loop-shaped heating rod or resistance heater frames an at least approximately rectangular second area, which is preferably kept free from heating element sections or components. "Kept free" in this context not only means that the second loop-shaped heating rod or resistance heater no longer comprises any indentation or recess entering into the at least essentially rectangular second area, as known from the prior art solution, but there is also no further heating element part or component, such as a third heating rod or third resistance heater, implemented in said at least essentially rectangular second area. The inventor has surprisingly found that, contrary to a skilled person's expectations, said keeping the interior of the heating element free from sections or components rather improves the even heat distribution over the entire horizontal cross-sectional area of the oven compartment, which results in the specific geometric conditions inside and adjusted constructions of the oven compartment.

[0015] A specifically preferred embodiment is characterized in that the at least essentially rectangular second area covers the centre zone of a horizontal cross-sectional area of the oven compartment, the at least essentially rectangular second area framing a ratio of at least 30%, particularly at least 35%, more particularly at least 40% of the horizontal cross-sectional area.

[0016] In particular, the first loop-shaped heating rod or resistance heater is operable with an electrical power having a value of between 50% and 80%, preferably of between 55% and 70%, more preferably of about 60%, in relation to the second loop-shaped heating rod or resistance heater.

[0017] The oven may comprise a first loop-shaped heating rod or resistance heater, which is operable with an electrical power between 0.9 and 1.7 kW, preferably between 1.1 and 1.5 kW, more preferably of about 1.3 kW. The oven may further comprise a second loop-shaped heating rod or resistance heater, which is operable with an electrical power between 0.5 and 1.1 kW, preferably between 0.65 and 0.95 kW, more preferably of about 0.8 kW.

[0018] The object is achieved for a method for operating an oven, particularly a household baking oven, which oven is designed according to anyone of the above-described embodiments, by means of the characterizing feature of claim 13.

[0019] According to a further aspect of the invention, a method for operating an oven, particularly a household baking oven, which oven is designed according to anyone of the above-described embodiments, comprises a control unit, which operates the heating element during a top heat food preparation operating program, in particular a baking, a roasting, a broiling, a frying and/or a grilling operating program.

[0020] A specific embodiment of the method provides for at least one of the first and the second loop-shaped heating rods or resistance heaters, which is operated during said top heat food preparation operating program. At least one of the first and the second loop-shaped heating rods or resistance heaters is preferably operated during a top heat baking, roasting, broiling and/or frying operating program and both the first and the second loop-shaped heating rods or resistance heaters are preferably operated during a grilling operating program.

[0021] Novel and inventive features of the present invention are set forth in the appended claims.

[0022] The present invention will now be described in further detail with reference to the drawings, in which

Fig. 1 illustrates a perspective partial view of a built-in oven with both a casing top wall and an oven compartment top wall being cut-away according to a prior art solution; and

Fig. 2 illustrates a similar perspective partial view of a built-in oven according to the present invention.

[0023] In Fig. 1, an electric household built-in oven 1 of the prior art is partly shown in a perspective view. In order to better illustrate the interior of a compartment 3 of the oven 1, a top wall of the compartment 3 as well as a top wall of an oven casing 5 surrounding the compartment 3 are cut away.

[0024] The compartment 3 is of a cuboid shape, comprising the cut-away top wall, a bottom wall 7, a rear wall 9 and two side walls 11a, 11b. On its front side, the compartment 3 is open for providing a loading opening for the food to be prepared in the oven 1. However, said loading opening is closed by the user by means of an oven door 13, which is pivotally arranged at the bottom side of the loading opening, after the loading of food.

[0025] Due to the top walls of the casing 5 and the compartment 3 being cut away, a top heat heating element 15 is visible. Said top heat heating element 15 is arranged inside of the compartment 3 close to the top wall of the compartment 3 in a parallel alignment thereto.

[0026] In the interior of the compartment 3, the oven 1 further comprises insertion supports 17 attached at the side walls 11a, 11b (only insertion support 17 at left side wall 11a shown) for receiving baking trays and supporting them during the cooking process.

[0027] The top heat heating element 15 comprises an outer loop-shaped heating rod 15a and an inner loop-shaped heating rod 15b, which are individually operable for modifiable heat emission. Therefore, terminals L, N are provided in order to connect the heating rods 15a, 15b for supply of electrical energy. A controller of the oven 1 can operate either the outer heating rod 15a or the inner heating rod 15b or both of them in a joint operation, depending on the needed heat input.

[0028] Both inner and outer heating rods 15a, 15b comprise inner and outer heat portions hp_i, hp_o, wherein the inner heating portion hp_i is Ω-shaped and the outer heating portion hp_o surrounds the inner heating portion hp_i with rectangular shape. That way, a radiant panel heating

with uniform two-dimensional heat emission shall be simulated.

[0029] The top heat heating element 15 is supported by a supporting rod 21, which forms a horizontal support strut fixed between the side walls 11a, 11b and supporting the heating element 15 from below. Centrically, the supporting rod 21 comprises a fastening lug 23 for its further fixation at the top wall.

[0030] Finally, the oven 1 is also equipped with a temperature sensor 19 penetrating the compartment 3 at the upper left corner of the rear wall 9.

[0031] The oven 1' according to Fig. 2 is nearly identically constructed as the prior art oven 1. The two ovens 1, 1' illustrated in Figs. 1 and 2 only differ in the design of their heating elements 15, 15'. Also the heating element 15' of the oven 1' comprises an outer heating rod 15a' and an inner heating rod 15b'. However, according to the invention, both outer and inner heating rods 15a', 15b' are of a mere rectangular shape and do not comprise any inner heat portion.

[0032] The rectangular shapes of the outer and the inner heating rods 15a', 15b' are performed in a way that geometrical similarity is provided, so that the outer heating rod 15a' equidistantly surrounds the inner heating rod 15b'. More specifically, the outer and the inner heating rods 15a', 15b' comprise front, left side, right side and rear heating rod portions f, ls, rs, r, wherein the front heating rod portion f of the outer heating rod 15a' is arranged in parallel to the front heating rod portion f of the inner heating rod 15b' and both front heating rod portions f are spaced from each other in the same way as the left side heating rod portions ls as well as the right side heating rod portions rs of the outer heating rod 15a' and the inner heating rod 15b'. The same applies to the rear heating rod portions r, which, however, are divided in the middle for the branch of the terminals L', N'.

[0033] Like the heating element 15 of the prior art oven 1, also the heating element 15' of the oven 1' according to the invention is supported by a supporting rod 21', which supporting rod 21' and its centric fastening lug 23' are also fixed to the side walls 11a, 11b and to the top wall as it is in the prior art oven 1.

[0034] The front, left side and right side heating rod portions are designed with a dimension of at least 220 mm and the outer heating rod 15a'is operable with a power of 0.8 kW and the inner heating rod 15b' is operable with a power of 1.3 kW.

[0035] Although an illustrative embodiment of the present invention has been described herein with reference to the accompanying drawing, it is to be understood that the present invention is not limited to that precise embodiment, and that various other changes and modifications may be affected therein by one skilled in the art without departing from the scope or spirit of the invention. All such changes and modifications are intended to be included within the scope of the invention as defined by the appended claims.

List of reference numerals

[0036]

1	oven
3	compartment
5	casing
7	bottom wall
9	rear wall
11a, 11b	side walls
13	door
15, 15'	heating element
15a, 15a'	outer heating rod
15b, 15b'	inner heating rod
17	insertion support
19	temperature sensor
21, 21'	supporting rod
23, 23'	fastening lug
hp_i	inner heater portion
hp_o	outer heater portion
L, L', N, N'	terminals
f, ls, rs, r	front, left side, right side and rear heating rod portions

Claims

1. An oven (1), particularly a household baking oven, comprising

- an oven compartment (3) defined by a top wall, a bottom wall (7), a rear wall (9) and side walls (11a, 11b),
- an oven door (13) closing the oven compartment (3) at a front opening, and
- a heating element (15') arranged on a top side of the oven compartment (3), preferably in parallel to the top wall, for top heat food preparation, in particular for baking, for roasting, for broiling, for frying and/or for grilling, the heating element (15') comprising at least a first loop-shaped heating rod (15a') or resistance heater, particularly of tubular design, and a second loop-shaped heating rod (15b') or resistance heater, particularly of tubular design,

characterized in that

each of the first loop-shaped heating rod (15a') and the second loop-shaped heating rod (15b') is designed as a single-loop unit of at least essentially rectangular loop shape, the first loop-shaped heating rod (15a') framing an at least essentially rectangular first area and the second loop-shaped heating rod (15b') framing an at least essentially rectangular second area, wherein the at least essentially rectangular first area is larger than the at least essentially rectangular second area and wherein the at least essentially rectangular second area is prefera-

bly kept free from heating element sections or components.

2. The oven (1) according to claim 1

characterized in that
the first loop-shaped heating rod (15a') encompasses the second loop-shaped heating rod (15b'), the first loop-shaped heating rod (15a') and the second loop-shaped heating rod (15b') preferably being arranged in the same plane.

3. The oven (1) according to claim 1 or 2,

characterized in that
the first loop-shaped heating rod (15a') and the second loop-shaped heating rod (15b') are geometrically similar parts.

4. The oven (1) according to anyone of the preceding claims,

characterized in that
the first loop-shaped heating rod (15a') and the second loop-shaped heating rod (15b') are shaped as rounded-corner rectangles.

5. The oven (1) according to anyone of the preceding claims,

characterized in that
the oven compartment (3) is of an at least approximately cuboid shape, preferably comprising rounded-corner vertical side edges.

6. The oven (1) according to anyone of the preceding claims,

characterized in that
each of the first loop-shaped heating rod (15a') and the second loop-shaped heating rod (15b') comprise

- a front bar portion or rod portion (f) arranged at least approximately in parallel to the oven door (13),
- left and right bar portions or rod portions (ls, rs) arranged at least approximately in parallel to the side walls (11a, 11b) of the oven compartment (3), and
- at least one rear bar portion or rod portion (r) arranged at least approximately in parallel to the rear wall (9) of the oven compartment (3).

7. The oven (1) according to claim 6,

characterized in that
each one of the front (f), the left (ls) and right (rs) and the rear (r) bar portions or rod portions of the first loop-shaped heating rod (15a') is at least approximately equally spaced from one of the oven door (13), the side walls (11a, 11b) and the rear wall (9) at a first distance, and
each one of the front (f), the left (ls) and right (rs) and the rear (r) bar portions or rod portions of the second loop-shaped heating rod (15b') is at least approximately equally spaced from one of the oven door (13), the side walls (11a, 11b) and the rear wall (9) at a second distance.

8. The oven (1) according to anyone of the preceding claims,

characterized in that
the first and second loop-shaped heating rods (15a', 15b') or resistance heaters are individually controllable.

9. The oven (1) according to anyone of the preceding claims,

characterized in that
the second loop-shaped heating rod (15b') or resistance heater is concentrically arranged to the first loop-shaped heating rod (15a') or resistance heater.

10. The oven (1) according to anyone of the preceding claims,

characterized in that
the at least essentially rectangular second area covers the centre zone of a horizontal cross-sectional area of the oven compartment (3), the at least essentially rectangular second area framing a ratio of at least 30%, particularly at least 35%, more particularly at least 40% of the horizontal cross-sectional area.

11. The oven (1) according to anyone of the preceding claims,

characterized in that
the first loop-shaped heating rod (15a') or resistance heater is operable with an electrical power having a value of between 50% to 80%, preferably of between 55% and 70%, more preferably of about 60%, in relation to the second loop-shaped heating rod (15b') or resistance heater.

12. The oven (1) according to anyone of the preceding claims,

characterized in that
the first loop-shaped heating rod (15a') or resist-

ance heater is operable with an electrical power between 0.5 and 1.1 kW, preferably between 0.65 and 0.95 kW, more preferably of about 0.8 kW, and the second loop-shaped heating rod (15b') or resistance heater is operable with an electrical power between 0.9 and 1.7 kW, preferably between 1.1 and 1.5 kW, more preferably of about 1.3 kW.

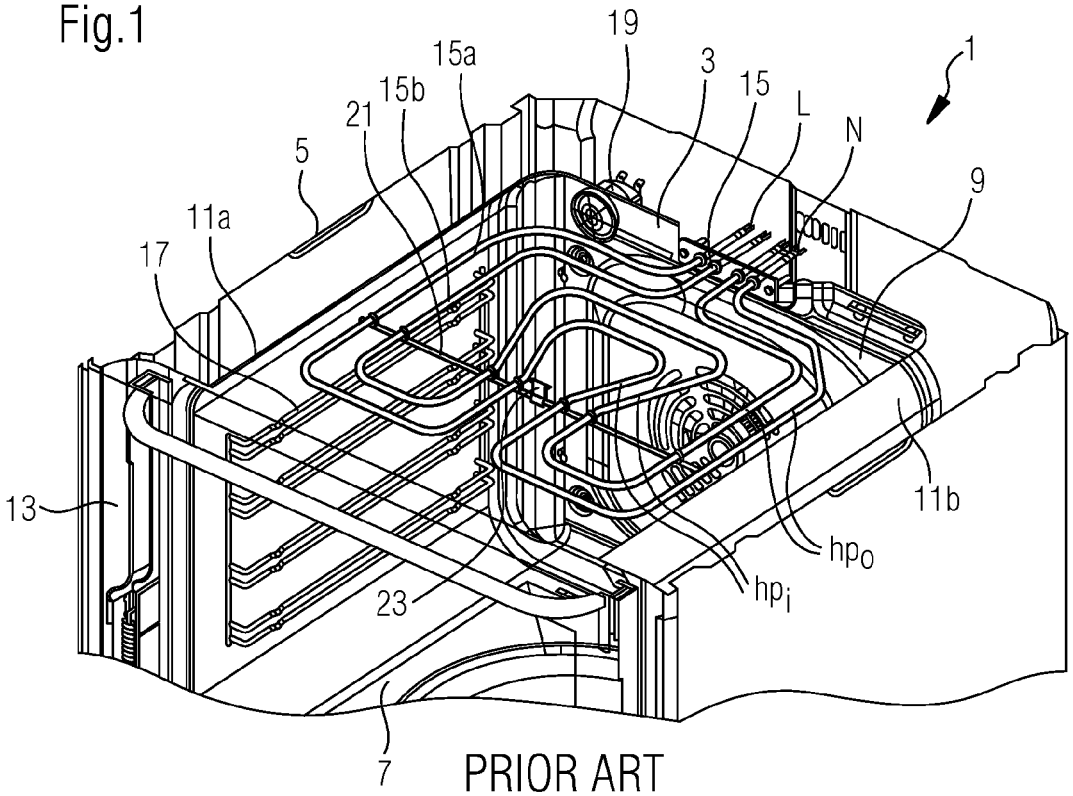
13. A method for operating an oven (1), particularly a household baking oven, according to anyone of the preceding claims,

characterized in that
a control unit of the oven (1) operates the heating element (15') during a top heat food preparation operating program, in particular a baking, a roasting, a broiling, a frying and/or a grilling operating program.

14. The method according to claim 13,

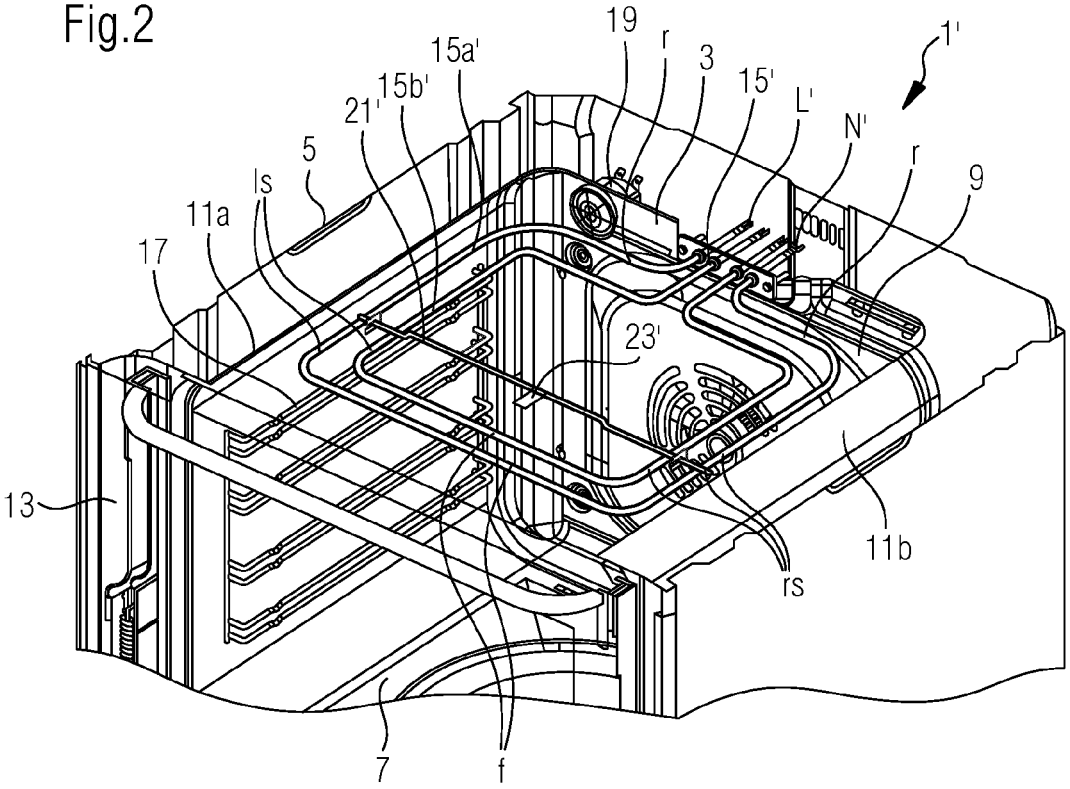
characterized in that
at least one of the first and the second loop-shaped heating rods (15a', 15b') or resistance heaters is operated during the top heat food preparation operating program, preferably at least one of the first and the second loop-shaped heating rods (15a', 15b') or resistance heaters is operated during a top heat baking, roasting, broiling and/or frying operating program and both the first and the second loop-shaped heating rods (15a', 15b') or resistance heaters are operated during a grilling operating program.

Fig.1



PRIOR ART

Fig.2



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EUROPEAN SEARCH REPORT

Application Number
EP 20 16 5504

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TECHNICAL FIELDS SEARCHED (IPC)
F24C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	30 October 2020	Jalal, Rashwan

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 20 16 5504

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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