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(54) FAN OVEN WITH ADDITIONAL SHROUD ELEMENT

(57) We propose a fan (1) oven, comprising: a circumferentially closed oven structure (2) with a top wall (2a), a bottom wall and two side walls (2c) for defining an oven cavity (3); a rear wall (2d) and a front door arranged at opposite ends of said oven structure (2) for closing said oven cavity (3); at least one heating resistance located inside said oven cavity (3) for heating said oven cavity (3); a fan (5) located in a vicinity of said rear wall (2d) for conveying hot air within said oven cavity (3); a fan shroud (6) located between said fan (5) and said oven cavity (3), thus defining a fan space (7) between said fan shroud (6) and said rear wall (2d), said fan shroud (6) comprising a number of openings (6a) for permitting an air stream from said fan (5) toward said oven cavity (3); wherein at least a first additional shroud element (1a) which is arranged inside said oven cavity (3) substantially in parallel with said top wall (2a) and at a certain distance (d) therefrom, thus defining a first airflow path between said first additional shroud element (10) and said top wall (2a), said first airflow path, at a first end (10a) thereof, being in fluid connection with said fan space (7), said first additional shroud element (10) comprising a plurality of openings (10c, 10d) toward said oven cavity (3).

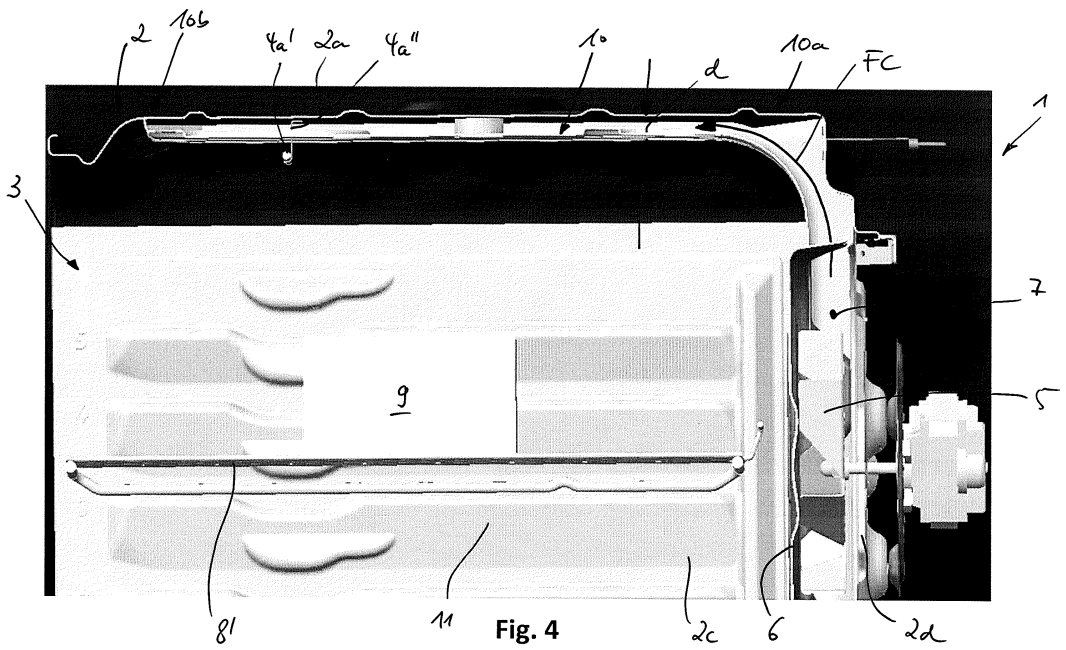

Fig. 4

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Description

[0001] The invention relates to a fan oven according to the preamble of claim 1, said oven comprising: a circumferentially closed oven structure with a top wall, a bottom wall and two side walls for defining an oven cavity; a rear wall and a front door arranged at opposite ends of said oven structure for closing said oven cavity; at least one heating resistance located inside said oven cavity for heating said oven cavity; a fan located in a vicinity of said rear wall for conveying hot air within said oven cavity; a fan shroud located between said fan and said oven cavity, thus defining a fan space between said fan shroud and said rear wall, said fan shroud comprising a number of openings for permitting an air stream from said fan toward said oven cavity.

[0002] Fan ovens of the above-defined type are known as such. However, they may suffer from the fact that heat generated by said at least one heating resistance is not evenly or homogeneously distributed inside the oven cavity. This may lead to situations where food to be prepared in the oven may not be heated properly in some places, while in other places the food is subjected to excess heat.

[0003] Appended Fig. 1 shows an oven of the above-mentioned type, which oven is denoted by reference numeral 1, comprising a circumferentially closed oven structure 2 with a top wall 2a, a bottom wall 2b and two side walls 2c for defining an oven cavity 3. A rear wall 2d and a front door 2e are arranged with opposite sides of said oven structure 2 for closing said oven cavity 3. According to Fig. 1, the oven 1 comprises three heating resistances denoted 4a, 4b, 4c which are located inside said oven cavity 3 for heating said oven cavity. Heating resistance 4a is devised in the form of an upper heating resistance or grille located in a vicinity of said top wall 2a. Heating resistance 4b is devised in the form of a bottom resistance, located in a vicinity of said bottom wall 2b. Heating resistance 4c is devised in the form of a coil and located in a vicinity of said rear wall 2d. Within a space circumscribed by heating resistance 4c there is located a fan 5, said fan 5 for conveying hot air (e.g., from heating resistance 4c) within said oven cavity 3. Between said fan 5 and said oven cavity 3, there is located a fan shroud 6. In this way, fan shroud 6 defines a fan space 7 between said fan shroud 6 and said rear wall 2d. Said fan shroud 6 comprises a number of openings 6a in the form of slits or slots for permitting an air stream from said fan 5 toward said oven cavity 3.

[0004] Further depicted in Fig. 1 are two drip pans 8 on which food (e.g., cakes 9) is placed for preparation inside the oven 1.

[0005] Fig. 2 shows the oven 1 according to Fig. 1 together with a graphical representation of an airflow inside the oven cavity 3, wherein dark lines show relatively hot air while lighter coloured lines represent relatively cooler air. As can be gathered from the graphical representation in Fig. 2, the airflow and/or temperature inside the oven cavity 3 is not distributed evenly or homogeneously.

[0006] It is the object of the present invention to modify a fan oven of the above-defined type in such a way that an improved homogeneity of hot airflow inside the oven cavity can be achieved.

[0007] This subject is achieved by means of a fan oven with the features of appended claim 1. Advantageous further embodiments of the oven according to the present invention are defined in the subclaims.

[0008] According to the present invention, a fan oven, comprising: a circumferentially closed oven structure with a top wall, a bottom wall and two side walls for defining an oven cavity; a rear wall and a front door arranged at opposite ends of said oven structure for closing said oven cavity; at least one heating resistance located inside said oven cavity for heating said oven cavity; a fan located in a vicinity of said rear wall for conveying hot air within said oven cavity; a fan shroud located between said fan and said oven cavity, thus defining a fan space between said fan shroud and said rear wall, said fan shroud comprising a number of openings for permitting an air stream from said fan toward said oven cavity; is characterized by at least a first additional shroud element which is arranged inside said oven cavity substantially in parallel with said top wall and at a certain distance therefrom, thus defining a first air flow path between said first additional shroud element and said top wall, said first air flow path, at a first end thereof, being in fluid connection with said fan space, said first additional shroud element comprising a plurality of openings toward said oven cavity.

[0009] Applicant has found that by adding at least one first additional shroud element, the distribution of hot air inside the oven cavity can be influenced in positive fashion in order to achieve the above-defined object. To this end, said first additional shroud element is arranged inside said oven cavity, substantially in parallel with said top wall and a certain distance therefrom. However, said distance need not be uniform but can slightly vary along said additional shroud element, e.g., by mounting it in a slightly oblique fashion and/or by providing recessed and/or protruding structures on said first additional shroud element.

[0010] In this way, said additional shroud element defines a first airflow path between said first additional shroud element and said top wall. Said first airflow path, at a first end thereof, is in fluid connection with said fan space. In this context, "fluid connection" means that a fluid, e.g., hot air, can pass from said fan space in or through said first airflow path. Furthermore, the first additional shroud element comprises a plurality of openings towards said oven cavity, through which openings hot air flowing along said first airflow path can pass into said oven cavity, thus rendering heat distribution in said oven cavity more homogeneous.

[0011] Accordingly, in a further embodiment of the oven according to the present invention said plurality of openings and said first additional shroud element are arranged for providing a homogeneous airflow toward said

oven cavity and inside said oven cavity, respectively, e.g., by providing a homogeneous distribution of said openings in said first additional shroud element.

[0012] In another embodiment of the oven according to the present invention said at least one heating resistance is located in a vicinity of said fan, preferably circumferentially around said fan. In this way, an airflow generated by said fan passes directly along said heating element for providing a flow of hot air inside the oven cavity, in part via said first airflow path.

[0013] In order to further increase homogeneity of said airflow inside the oven cavity, also as far as a flow velocity is concerned, according to yet another embodiment of the oven according to the present invention, a number per unit area of openings in said first additional shroud element and/or a size of said openings in said first additional shroud element increases in a direction toward said front door, i.e., away from said fan. More and/or larger openings may result in a decrease in pressure drop which compensates a higher flow path resistance for openings which are located farther away from the fan.

[0014] In order to even further increase homogeneity of hot airflow inside the oven cavity, a preferred further embodiment of the oven according to the present invention comprises that at least some of said plurality of openings in said first additional shroud element are arranged in a portion of said additional shroud element, which portion is located along a contour of an upper heating resistance comprised inside said oven cavity. In this way, said upper heating resistance is effectively "washed" by an airflow coming from said openings in said first additional shroud element, thus effectively distributing heat generated by said upper heating resistance evenly within the oven cavity. Preferably, said upper heating resistance serves as said at least one heating resistance defined earlier, or said upper heating resistance can be present in addition to said heating resistance located in vicinity of said fan. Furthermore, the oven according to the present invention may comprise a bottom heating resistance, as mentioned.

[0015] Preferably, according to another embodiment of the oven according to the present invention, said first airflow path is closed at a second end thereof, said second end being located opposite said first end. In this way, air flowing along said first airflow path is forced through said openings and inside the oven cavity.

[0016] According to a highly preferred further embodiment of the oven according to the present invention, at least one second additional shroud element is arranged inside said oven cavity, substantially in parallel with one of said side walls and at a certain distance therefrom. The terms "in parallel" and "certain distance" are used in the same way as defined earlier.

[0017] In this way, said at least one second additional shroud element defines a second airflow path between said second additional shroud element and said one side wall. Analogue to said first airflow path, said second airflow path is in fluid connection with said fan space and comprises a plurality of openings toward said oven cavity. In this way, distribution of heat and/or airflow inside the oven cavity is made even more homogeneous, since the at least one second additional shroud element is arranged for providing additional airflow from the side of said oven cavity.

[0018] In yet another embodiment of the oven according to the present invention, said second airflow path is closed at a second end thereof, said second end being located opposite said first end. In this way, air flowing along said second airflow path is forced out of the openings in said at least one second additional shroud element inside the oven cavity which renders heat distribution inside the oven cavity even more homogeneous.

[0019] Preferably, a second additional shroud element is arranged at each side wall, which even further increases homogeneity of heat distribution. Preferably, said second additional shroud elements are fixed (directly) to said oven structure, in particular to the side wall in question.

[0020] In another embodiment of the oven according to the present invention, the first additional shroud element is directly fixed to the oven structure, preferably to said top wall thereof.

[0021] However, in another embodiment of the oven according to the present invention, the first additional shroud element can be indirectly fixed to the oven structure via an upper heating resistance or via a fixation element of said upper heating resistance. As described earlier, said upper heating resistance can be arranged on said top wall. In this way, the number of fixation elements can be reduced since the first additional shroud element and the upper heating resistance can be fixed by means of the same fixation elements.

[0022] In order to further improve homogeneity of airflow inside the oven cavity, according to another embodiment of the oven according to the present invention, at least some of said openings in said first additional shroud element can be devised in the form of holes, slits or slots, preferably comprising slats or louvres for guiding an airflow.

[0023] In analogue fashion, at least some of said openings in said second additional shroud element can be devised in form of holes, slits or slots, preferably comprising slats or louvres for guiding an airflow.

[0024] Further characteristics and advantages of the present invention can be gathered from the following description of preferred embodiments thereof with reference to the drawings.

Fig. 1 shows a prior art fan oven;

Fig. 2 shows airflow within the oven of Fig. 1;

Fig. 3 shows a detailed, partly broken away view of a fan oven according to the present invention;

Fig. 4 shows another view of the oven according to Fig. 3; and

Fig. 5 shows yet another view of the oven according to Fig. 3.

[0025] In all drawing figures, the same reference numerals are used to denote identical or similar features.

[0026] According to Fig. 3, food to be prepared in the oven 1 is denoted by reference numeral 9 and placed on a metal grate 8' instead of a pan.

[0027] Reference numeral 10 denotes a first additional shroud element which is arranged inside oven cavity 3 substantially in parallel with top wall 2a of oven structure 2. Said first additional shroud element 10 is placed at a certain distance from top wall 2a, which distance has been denoted by reference numeral d in Fig. 3. In this way, a first airflow path is defined between first additional shroud element 10 and top wall 2a. This first airflow path is in fluid connection, at a first end thereof, with fan space 7, as can best be gathered from Fig. 4. In Fig. 4, said fluid connection is denoted by reference numeral FC. In this way, (hot) air conveyed by fan 5 can pass in the space between top wall 2a and first additional shroud element 10 along arrow FC. Reference numeral 10a denotes a first end of said first airflow path, while reference numeral 10b denotes a second end thereof, said second end 10b being located opposite from said first end 10a. At said second end 10b, the first airflow path is closed (blocked).

[0028] As can be gathered in particular from Figs. 3 and 5, said first additional shroud element 10 comprises a plurality of openings, some of which are denoted by reference numerals 10c, 10d in Figs. 3 and 5. These openings 10 c, 10d allow passage of (hot) air from said first airflow path above first additional shroud element 10 into oven cavity 3 in order to achieve a more homogeneous heat (flow) distribution inside the oven cavity 3.

[0029] As can be gathered from Figs. 3 and 5, openings 10d located toward the front of the oven 1, i.e., farther away from fan 5, can be made larger than openings 10c located farther toward fan 5. This can compensate for flow (velocity) losses due to longer flow paths.

[0030] As can further be gathered from Figs. 3 and 5, the openings 10c, 10d in said first additional shroud element 10 can be arranged in a contoured pattern, which pattern may retrace a contour of an upper heating element not shown in Figs. 3 through 5, but, for instance, in Fig. 1. Such upper heating element 4a can also be used with the oven 1 according to Figs. 3 and 5 with its contour fitting said contoured pattern of openings 10c, 10d. In this way, said upper heating resistance could be efficiently "washed" by an airflow leaving said openings 10c, 10d, for to achieve an even more homogeneous heat (flow) distribution inside oven cavity 3.

[0031] First additional shroud element 10 can be directly fixed to top wall 2a of oven structure 2, e.g., at said second end 10b, for instance by welding or the like. It can further be attached to rear wall 2d and/or fan shroud 6, e.g., by welding or screwing, or it could even be devised in integral fashion with one of elements 2d or 6.

[0032] Furthermore, it is possible to fix said first additional shroud element 10 indirectly to top wall 2a and/or oven structure 2 via a fixation of upper heating element 4a. In Figs. 3 through 5, reference numeral 4a' denotes a modified upper heating resistance, and reference numeral 4a" denotes a fixing element for fixing said modified upper heating resistance 4a' to top wall 2a, as can best be gathered from Fig. 4. In this way, said first additional shroud element 10 could also be fixed to top wall 2a by using said fixing element 4a".

[0033] Although not shown in Figs. 3 through 5, in the context of the present invention it is also possible to arrange further (second) additional shroud elements along side walls 2c of oven structure 2. These further additional shroud elements could be devised essentially as first additional shroud element 10. However, the distribution of openings could be different (more uniform) since there are usually no heating resistances located on said side walls 2c.

[0034] As denoted in Fig. 4, the further additional shroud elements could comprise protruding structures 11 for placing a metal grate 8' or a pan 8 (of Fig. 1) thereon.

[0035] In analogy to first additional shroud element 10, said further additional shroud elements would define an airflow path in fluid connection with fan space 7, while preferably closed toward a front side of oven 1, as explained earlier.

Claims

1. A fan (1) oven, comprising:

a circumferentially closed oven structure (2) with a top wall (2a), a bottom wall (2b) and two side walls (2c) for defining an oven cavity (3);

a rear wall (2d) and a front door (2e) arranged at opposite ends of said oven structure (2) for closing said oven cavity (3);

at least one heating resistance (4a - 4c) located inside said oven cavity (3) for heating said oven cavity (3);

a fan (5) located in a vicinity of said rear wall (2d) for conveying hot air within said oven cavity (3);

a fan shroud (6) located between said fan (5) and said oven cavity (3), thus defining a fan space (7) between said fan shroud (6) and said rear wall (2d), said fan shroud (6) comprising a number of openings (6a) for permitting an air stream from said fan (5) toward said oven cavity (3);

characterized by

at least a first additional shroud element (10) which is arranged inside said oven cavity (3) substantially in parallel with said top wall (2a) and at a certain distance (d) therefrom, thus de-

fining a first air flow path between said first additional shroud element (10) and said top wall (2a), said first air flow path, at a first end (10a) thereof, being in fluid connection (FC) with said fan space (7), said first additional shroud element (10) comprising a plurality of openings (10c, 10d) toward said oven cavity (3).

2. The fan oven (1) of claim 1, wherein said plurality of openings (10c, 10d) in said first additional shroud element (10) are arranged for providing a homogenous air flow toward said oven cavity (3).

3. The fan oven (1) of claim 1, wherein said at least one heating resistance (4c) is located in a vicinity of said fan (5), preferably around said fan (5).

4. The fan oven (1) of claim 1, wherein a number per unit area of said plurality of openings (10c, 10d) in said first additional shroud element (10) and/or a size of said openings (10c, 10d) in said first additional shroud element (10) increases in a direction toward said front door (2e).

5. The fan oven (1) of claim 1, wherein at least some of said plurality of openings (10c, 10d) in said first additional shroud element (10) are arranged in a portion of said first additional shroud element (10) located along a contour of an upper heating resistance (4a) comprised inside said oven cavity (3), preferably said upper heating resistance (4a) being said at least one heating resistance or said upper heating resistance (4a) being present in addition to the heating resistance (4c) of claim 3.

6. The fan oven (1) of claim 1, wherein said first air flow path is closed at a second end (10b) thereof, said second end (10b) being located opposite said first end (10a).

7. The fan oven (1) of claim 1, wherein at least a second additional shroud element is arranged inside said oven cavity (3) substantially in parallel with one of said side walls (2c) and at a certain distance therefrom, thus defining a second airflow path between said second additional shroud element and said one side wall (2c), said second airflow path, at a first end thereof, being in fluid connection with said fan space (7), said second additional shroud element comprising a plurality of openings toward said oven cavity (3).

8. The fan oven (1) of claim 7, wherein said second air flow path is closed at a second end thereof, said second end being located opposite said first end.

9. The fan oven (1) of claim 7, wherein a second additional shroud element is arranged at each side wall (2c), and is preferably fixed to said oven structure (2), in particular to said side wall (2c).

10. The fan oven (1) of claim 1, wherein the first additional shroud element (10) is directly fixed to the oven structure (2), preferably to said top wall (2a).

11. The fan oven (1) of claim 1, wherein the first additional shroud element (10) is indirectly fixed to the oven structure (2) via an upper heating resistance (4a) or via a fixation (4a") of said upper heating resistance (4a, 4a'), said upper heating resistance (4a, 4a') being arranged on said top wall (2a).

12. The fan oven (1) of claim 1, wherein at least some of said openings (10c, 10d) in said first additional shroud element (10) are devised in the form of holes, slits or slots, preferably comprising slats or louvres for guiding an air flow.

13. The fan oven (1) of claim 7, wherein at least some of said openings in said second additional shroud element are devised in the form of holes, slits or slots, preferably comprising slats or louvres for guiding an air flow.

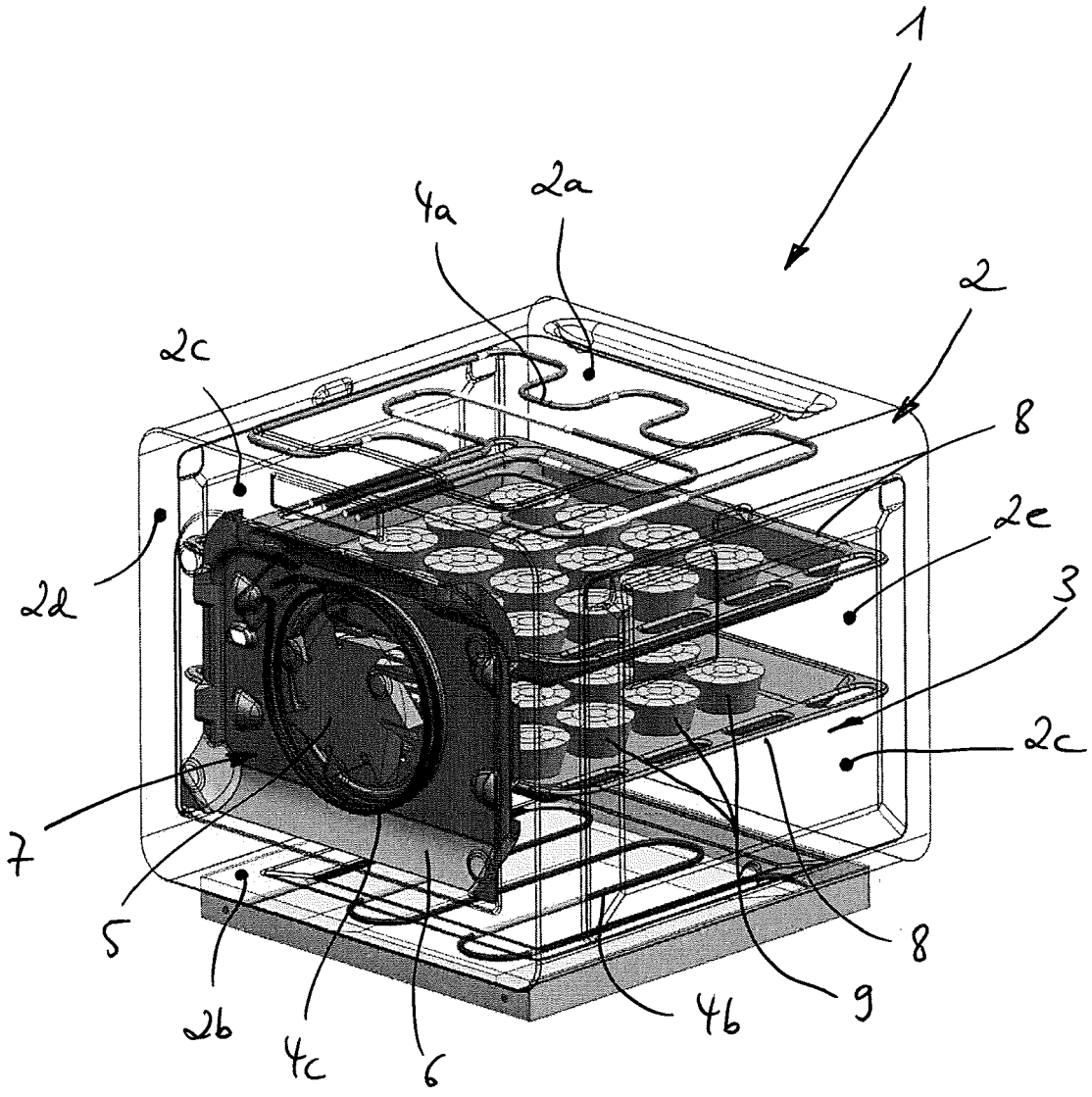

Fig. 1

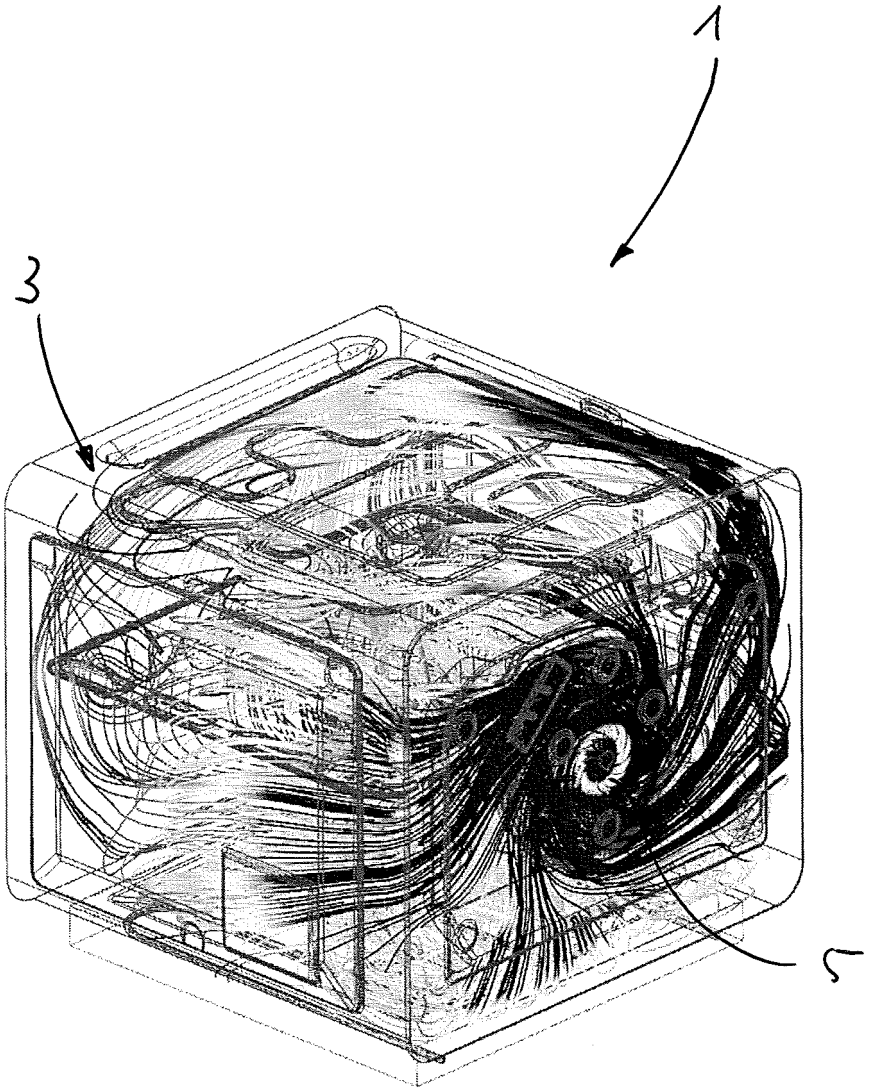

Fig. 2

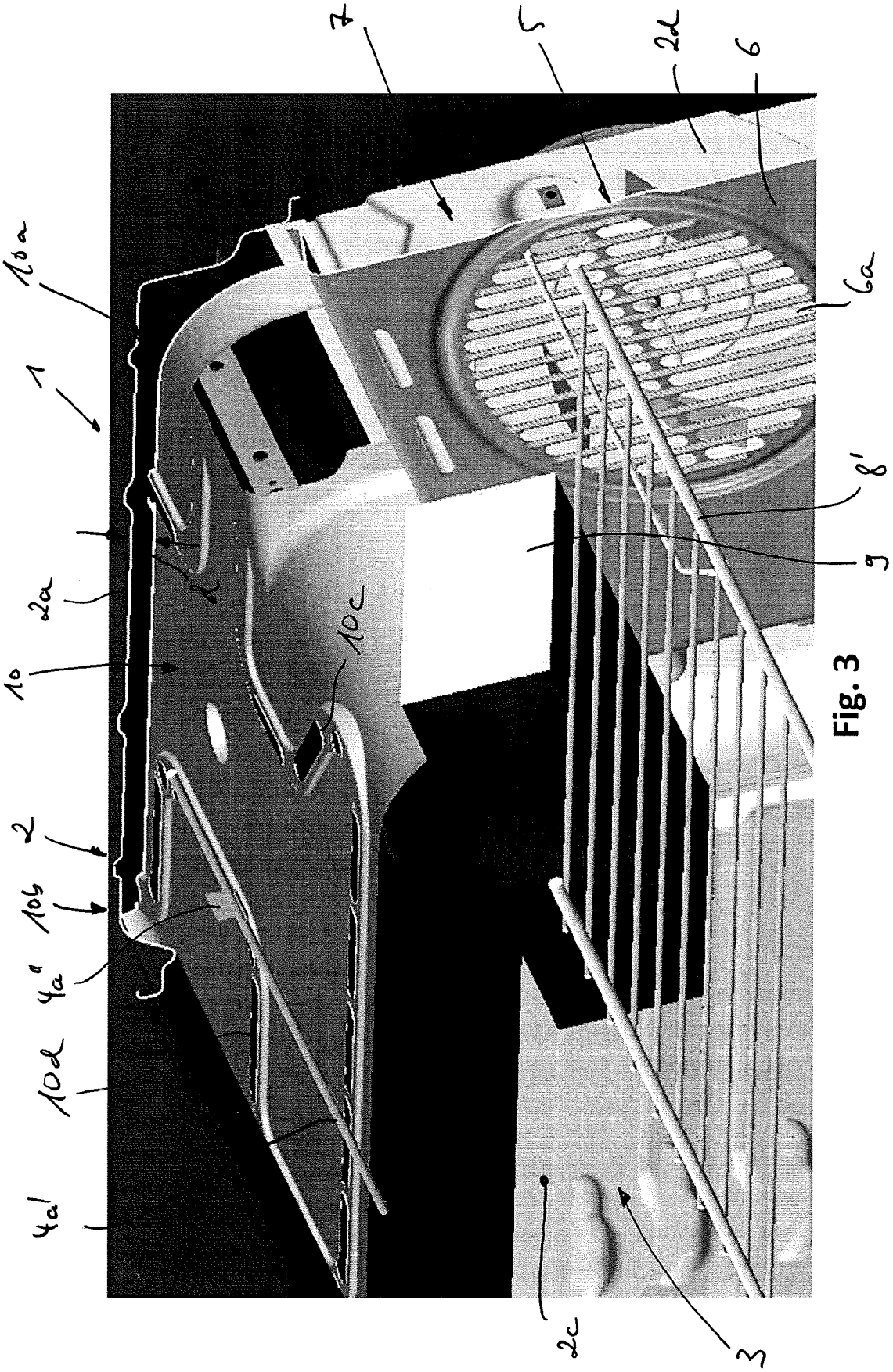

Fig. 3

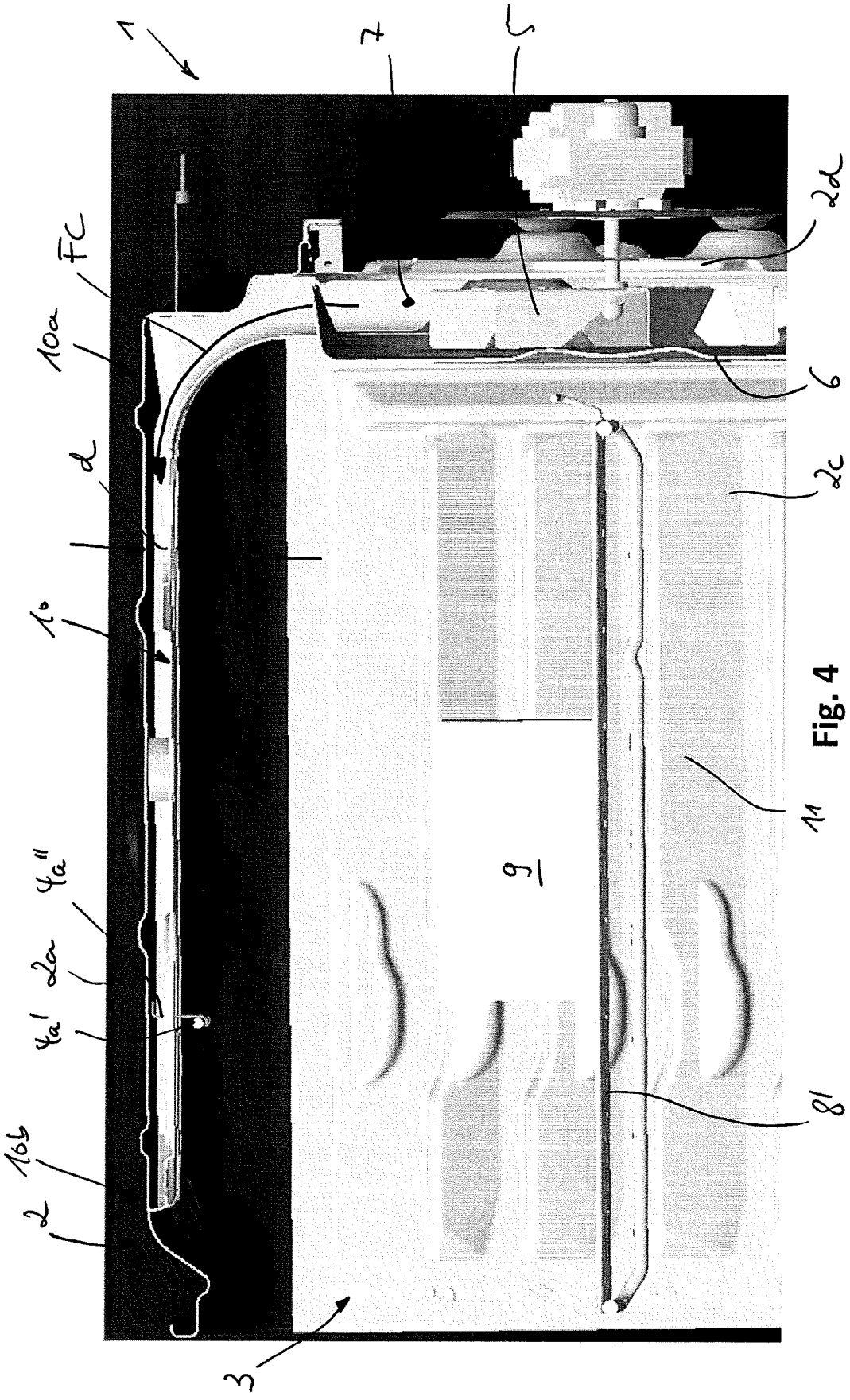

Fig. 4

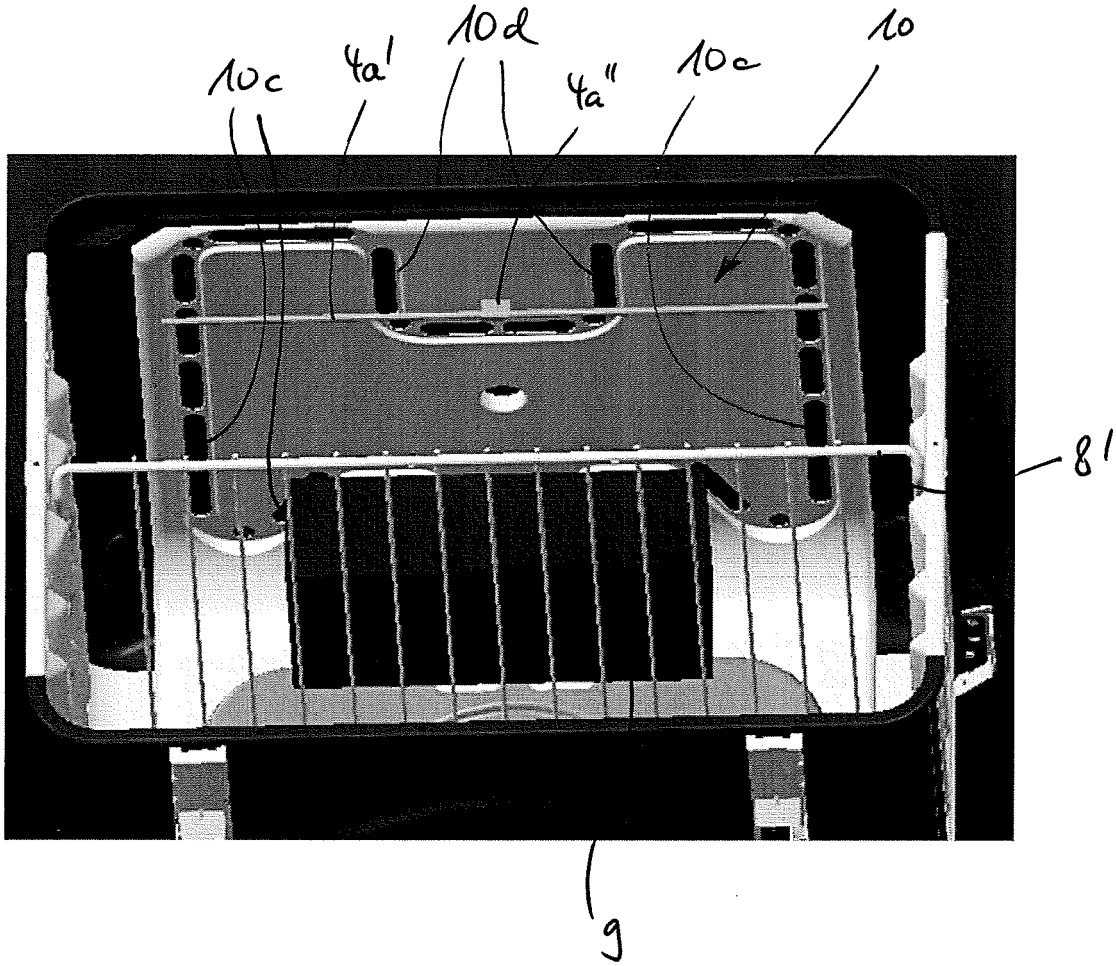

Fig. 5

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EUROPEAN SEARCH REPORT

Application Number
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	14 March 2018	Jalal, Rashwan

CATEGORY OF CITED DOCUMENTS

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EUROPEAN SEARCH REPORT

Application Number
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