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

(11) **EP 3 273 167 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
24.01.2018 Bulletin 2018/04

(51) Int Cl.:
F24C 15/32 *(2006.01)* ***F24C 15/36*** *(2006.01)*

(21) Application number: **16180688.0**

(22) Date of filing: **22.07.2016**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
MA MD

(71) Applicant: **Franke Technology and Trademark Ltd**
6052 Hergiswil (CH)

(72) Inventors:
- **The inventor has waived his right to be thus mentioned.**

(74) Representative: **Lemcke, Brommer & Partner**
Patentanwälte Partnerschaft mbB
Siegfried-Kühn-Straße 4
76135 Karlsruhe (DE)

(54) FAN OVEN COMPRISING PARTITION, SUPPORT PANEL AND REAR WALL

(57) We propose a fan oven (1) comprising: a cavity (2) to be heated; a partition (13) positioned at a predetermined distance from a rear wall (2e) of said cavity (2), said partition (13) having a central hole (13a); a fan (12) positioned in proximity of said central hole (13a), between said partition (13) and said rear wall (2e), said fan (12) adapted to collect air from said cavity (2) and convey a flow of said air behind said partition (13); and a plurality of heating elements (10a - 10c), positioned inside said cavity (2), in proximity of said fan (12) between said partition (13) and said rear wall (2e). Said oven (1) further comprises a support panel (6) positioned at a predetermined distance behind said partition (13), between said partition (13) and said rear wall (2e); wherein said fan (12) and said heating elements (10a - 10e) are located in a free space between said partition (13) and said support panel (6).

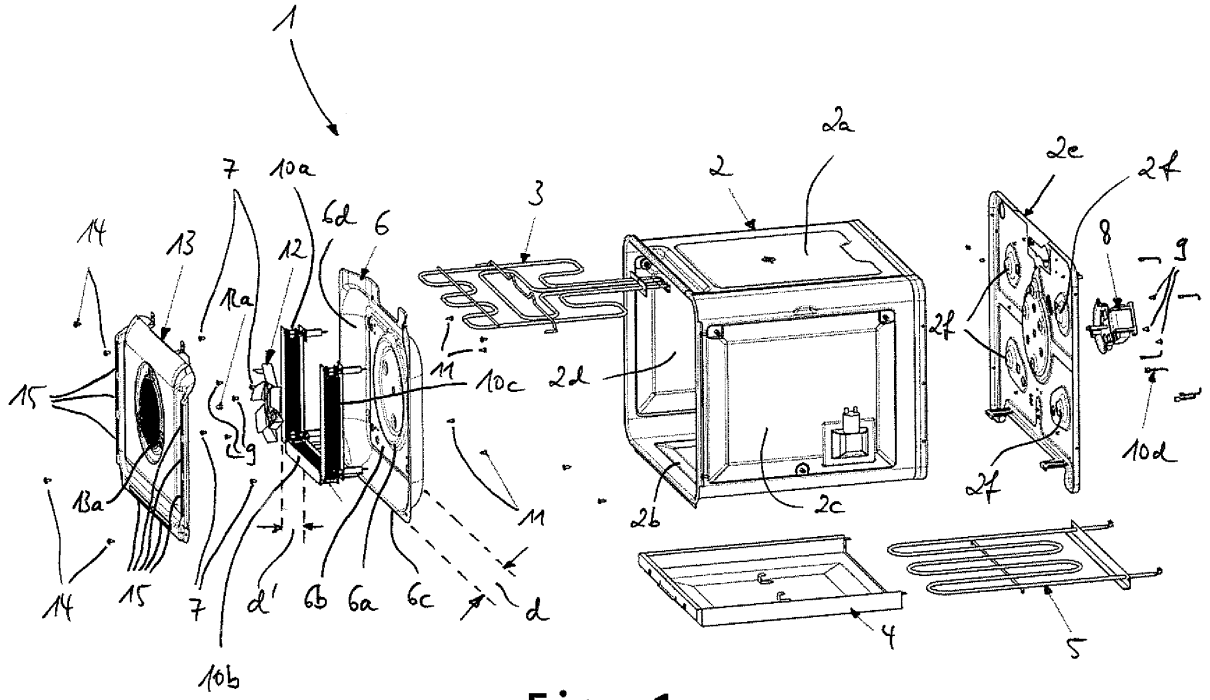


Fig. 1

EP 3 273 167 A1

Description

[0001] The invention relates to a fan oven, as defined in the preamble of claim 1, comprising: a cavity to be heated; a partition positioned at a predetermined distance from a rear wall of said cavity, said partition having a central hole; a fan positioned in proximity of said central hole, between said partition and said rear wall, said fan adapted to collect air from said cavity and convey a flow of said air behind said partition; and a plurality of heating elements positioned inside said cavity, in proximity of said fan between said partition and said rear wall.

[0002] An oven of the above-defined type is known, e.g., from prior art document EP 2 336 650 A2. The known oven further comprises a number of deflectors of said air flow, which deflectors are positioned between said partition and said rear wall, in order to convey said air flow to several distinct areas of said cavity.

[0003] Applicant has found, however, that providing said deflectors may actually be detrimental to providing selective predetermined temperature distributions inside the cavity. Furthermore, in the known oven, the partition and further elements of the oven, e.g., the heating elements are directly attached to the cavity's rear wall, which is devised in the form of an enameled metal part so that the fixing conditions may be suboptimal.

[0004] It is the object of the present invention to provide a fan oven of the above-defined type which is advantageous in respect of achievable air flows and temperature distributions while optimizing the fixing conditions of various elements inside the oven cavity.

[0005] This object is achieved by means of a fan oven comprising the features of appended claim 1. Preferred further embodiments of the inventive oven are defined in the subclaims.

[0006] According to the present invention, a fan oven comprises: a cavity to be heated; a partition positioned at a predetermined distance from a rear wall of said cavity, said partition having a central hole; a fan positioned in proximity of said central hole, between said partition and said rear wall, said fan adapted to collect air from said cavity and convey a flow of said air behind said partition; and a plurality of heating elements, positioned inside said cavity, in proximity of said fan between said partition and said rear wall. It further comprises a support panel positioned at a predetermined distance behind said partition, between said partition and said rear wall; wherein said fan and said heating elements are located in a space between said partition and said support panel.

[0007] According to the present invention, the oven comprises said support panel as an additional element, which support panel is positioned between said partition and said rear wall, at a predetermined distance behind said partition, thus delimiting a free space between said support panel and said partition, which space is free of any deflecting elements. Said fan and said heating elements are located in said free space between said partition and said support element and can - at least as far as said heating elements are concerned - be fixed directly on said support panel, thus improving the above-mentioned fixing condition. Said support panel at least partly replaces said rear wall, thus providing, as far as fixing of elements is concerned, a solution for the above-mentioned object.

[0008] In a further embodiment of the oven according to the present invention, said support panel is made of steel, preferably stainless steel, essentially bare of any enamel coating. In this way, not only the fixing condition is improved, as stated earlier, but the heat reflection properties of the support panel can be improved with respect to the enameled cavity rear wall, thus providing an overall improved oven performance.

[0009] In yet another further embodiment of the oven according to the present invention, any walls of said cavity, in particular said rear wall, and said partition are made of enameled metal material, as it is known from prior art ovens of the above-mentioned type. However, the enamel coating especially of said rear wall is no longer detrimental to fixing of further oven elements, since fixing thereof can be achieved by using said support panel as fixing support, as has been explained earlier.

[0010] According to another further embodiment of the oven according to the present invention, said heating elements are arranged so that said fan conveys said air toward said heating elements. In this way, the heating elements can efficiently heat up the conveyed air for subsequently heating the oven cavity.

[0011] In yet another further embodiment of the oven according to the present invention, said fan is devised as a radial fan in order to convey said air in a radial manner or radial direction with a corresponding center of flow being located in proximity of said central hole. In other words: The fan can be devised to suck in air from said cavity through said central hole in the partition, and then convey said air radially outwards so that said central hole (or a fan axis) can be seen as a (virtual) center of the air flow.

[0012] Preferably, the heating elements are arranged around said fan so that said radial airflow passes through the heating elements.

[0013] In a preferred further embodiment of the oven according to the present invention, said heating elements are devised as naked wire heating elements as known, e.g., from prior art document EP 2 336 650 A2 (cf. Figs. 6 and 7 and corresponding description). Such heating elements, while being rather inexpensive, provide the further advantage of presenting only very limited thermal inertia.

[0014] In a preferred embodiment of the oven according to the present invention, said oven comprises two heating elements positioned one to the right of said central hole and one to the left of said central hole. In another preferred embodiment of the oven according to the present invention, said oven comprises three heating elements positioned one below said central hole, one to the right of said central hole and one to the left of said

central hole, without limitation.

[0015] In order to further reduce production costs by presenting highly acceptable results, applicant has found it advantageous to use heating elements that have an overall rectilinear form, according to another further embodiment of the invention.

[0016] Very good performance results have been achieved, according to another embodiment of the oven according to the present invention, when said heating elements are arranged tangentially in respect of said fan and orthogonally in respect of adjacent heating elements. For instance, in the case of three heating elements, as described above, the heating element being located below said central hole could be oriented horizontally, while the two other heating elements could be oriented vertically on opposite sides of said central hole.

[0017] In order to enhance conveyance of said air flow, according to yet another embodiment of the oven according to the present invention, said partition, which can have dimensions substantially the same as those of said rear wall, may comprise a plurality of slots, at least one slot being positioned in proximity of an edge of said partition in vicinity to a respective heating element. In this way, said air flow, having passed through or by said heating element, may pass through a slot of said partition, thus efficiently heating the oven cavity.

[0018] In order to further enhance air flow, according to a preferred embodiment of the oven according to the present invention, said support panel generally has the shape of a rectangular bowl or cup, while its overall dimensions can be substantially the same as those of said rear wall. Preferably, said support panel further has a central elevation of circular or ring-like shape, which can be located in a generally flat central section thereof, within which elevation can be located said fan. In this way, while conferring mechanical stability to said support panel, said circular elevation can serve to guide air flow from the fan toward the heating elements.

[0019] According to another preferred embodiment of the oven according to the present invention, a depth of said cup or bowl shape generally equals a corresponding extension of said heating elements. In this way, air flow can be effectively guided through said heating elements between said partition and said support panel.

[0020] In order to yet further enhance air flow, according to another preferred embodiment of the oven according to the present invention, said support panel has rounded transition regions between a generally flat central section and a peripheral flange, said rounded transition regions for guiding said air toward said partition, in particular toward and through the above-mentioned slots.

[0021] As stated farther up, according to a preferred embodiment of the oven according to the present invention, at least said heating elements and/or said partition are fixed directly on said support panel, rather than on said rear wall, by corresponding fixing means, preferably screws.

[0022] In another further embodiment thereof, the oven according to the present invention can be characterized in that each of said heating elements is individually controllable, preferably by means of a suitable control unit, at least in terms of heating power and/or heating duration. It is highly preferred that each of said heating elements is thus controllable in coordination with the other ones of said heating elements.

[0023] In this way, by controlling said heating elements individually, it becomes possible to achieve various temperature profiles and/or cooking/baking modes inside the oven cavity. Furthermore, it becomes possible to use the oven according to the present invention in different countries with different standards as far as mains power and electrical fusing are concerned.

[0024] Further advantages and characteristics of the present invention will now be explained with reference to the annexed drawings.

Fig. 1 shows an explosion view of a fan oven according to the present invention;

Fig. 2 shows a front view of the oven of Fig. 1, partially broken away;

Fig. 3 is a side view according to the line K-K in Fig. 2; and

Fig. 4 is an enlarged detail from Fig. 3.

[0025] In Fig. 1, the oven as such is denoted by reference numeral 1. It comprises a cavity 2 having a top wall 2a, a bottom wall 2b, and two side walls 2c, 2d, as well as a detachable rear wall 2e, which can also be referred to as back crosspiece. Elements 2a through 2e can be made of a sheet metal material, which is provided with an enamel coating.

[0026] On an interior side of said top wall 2a, there is located an upper heating element or grill 3. Underneath said bottom wall 2b, in a bottom heating element box 4, there is located a bottom heating element 5.

[0027] Said rear wall 2e or back crosspiece has a number of elevated regions or protrusions 2f which, in an assembled state of the oven 1, define contact regions or abutments for a support panel 6, which is placed inside the cavity 2 against said rear wall 2e. Support panel 6 is fixed on rear wall 2e by means of screws 7 at said elevations 2f. On an opposite side of back wall 2e will be fixed radial fan motor 8 by means of screws 9.

[0028] Oven 1 further comprises three rectilinear naked wire heating elements denoted by reference numerals 10a - 10c. They can be fixed directly to support panel 6 by means of screws 11. Support panel 6 is made of uncoated stainless steel so that the fixing condition is improved.

[0029] As can be gathered from Fig. 1, adjacent heating elements 10a and 10b, as well as adjacent heating elements 10b and 10c, respectively, are arranged orthog-

onally in a common plane. They can be located around a central circular elevation 6a provided on support panel 6 in a flat central section 6b thereof. Inside said circular elevation 6a will be located a radial fan 12, which can be attached to radial fan motor 8 by means of radial fan nut 12a.

[0030] In an alternative embodiment, oven 1 could comprise only two rectilinear naked wire heating elements, e.g., heating elements 10a and 10c.

[0031] During operation, radial fan 12 will suck in air essentially along its rotation axis and will convey said air radially outward so that it passes through heating elements 10a - 10c. Reference numeral 10d denotes an electrial connector for said heating elements 10a - 10c in exemplary fashion.

[0032] On an opposite side of support panel 6 in respect of rear wall 2e, there is located a partition 13, also referred to as fan bulk head. It has essentially the same overall dimensions as support panel 6 and rear wall 2e and presents a central opening or hole 13a, a location of which, in an assemble state of the oven 1, corresponds to a location of radial fan 12, so that fan 12 can suck in air through opening 13a from inside of cavity 2. Partition 13 can be fixed directly on support panel 6 by means of screws 14. This leads to improved fixing conditions. In the following, further details of support panel 6 and partition 13 will be described.

[0033] As can be seen from Fig. 1, support panel 6 is generally cup-shaped or bowl-shaped, while having an overall rectangular form. A depth d of said bowl or cup is devised so that it essentially corresponds to a dimension of heating elements 10a - 10c, denoted d' in Fig. 1. In this way, heating elements 10a - 10c can be arranged within the cup or bowl of support panel 6. As stated earlier, support panel 6 has an essentially flat or planar central section 6b, which is surrounded by a peripheral flange 6c, which flange 6c serves for fixing partition 13, as described earlier. Between central section 6b and peripheral flange 6c, there is arranged a transition region 6d, which transition region 6d is of rounded configuration, thus achieving the transition from central section 6b to peripheral flange 6c. In this way, air passing through heating elements 10a - 10c is then directed toward partition 13. Partition 13 comprises a number of slots 15 along three of its edges, which slots 15 correspond - as far their respective locations are concerned - to the locations of heating elements 10a - 10c. In this way, air flow directed by said transition regions 6d of support panel 6, having passed through heating elements 10a - 10c, then enters cavity 2 through slots 15.

[0034] By providing an individual control for heating elements 10a - 10c, at least in terms of heating power and/or heating duration, differential heat can be supplied to cavity 2 through respective slots 15, thus achieving different cooking/baking modes and/or various temperature distributions inside cavity 2.

[0035] By providing support panel 6 of uncoated stainless steel material, not only the fixing conditions but also a thermal reflectivity can be optimized, thus achieving improved oven performance.

[0036] Fig. 2 shows a partially broken away frontal view of oven 1 according to Fig. 1. As can be gathered from Fig. 2, central hole 13a of partition 13 can be covered by a grid 13b in order to protect the fan 12. Please note that not all reference numerals are shown in Fig. 2 in order to increase intelligibility thereof.

[0037] Fig. 3 shows oven 1 along line K-K in Fig. 2. For further details, please refer to the magnification of area A in Fig. 4.

[0038] One can easily gather from Fig. 4 how support panel 6 is fixed to back wall/crosspiece 2e by means of screws 7 at said elevations or protrusions 2f. For a detailed description of the other elements depicted in Fig. 4, please refer to the description of Fig. 1.

[0039] The heating elements 10a - 10c as shown, e.g., in Fig. 1 can be devised according to Fig. 6 or Fig. 7 of EP 2 336 650 A2, and the corresponding description thereof, which is herewith incorporated by reference in the present description.

List of reference numerals

[0040]

1	fan oven
2	cavity
2a	top wall
2b	bottom wall
2c, d	side walls
2e	rear wall
2f	elevations/protrusions
3	upper heating element/grill
4	bottom heating element box
5	bottom heating element
6	support panel
6a	circular elevation
6b	central section
6c	peripheral flange
6d	rounded transition regions
7	screws (for support panel 6)
8	radial fan motor
9	screws (for radial fan motor 8)
10a, b, c	heating elements
11	screws (for heating elements 10a - 10c)
12	radial fan
12a	radial fan nut
13	partition
13a	central opening
13b	grid
14	screws (for partition 13)
15	slots
d	depth (of cup or bowl shape)
d'	extension (of heating elements 10a - 10c)

Claims

1. A fan oven (1) comprising:

   a cavity (2) to be heated;
   a partition (13) positioned at a predetermined distance from a rear wall (2e) of said cavity (2), said partition (13) having a central hole (13a);
   a fan (12) positioned in proximity of said central hole (13a), between said partition (13) and said rear wall (2e), said fan (12) adapted to collect air from said cavity (2) and convey a flow of said air behind said partition (13); and
   a plurality of heating elements (10a - 10c), positioned inside said cavity (2), in proximity of said fan (12) between said partition (13) and said rear wall (2e);

   characterized in that
   it comprises a support panel (6) positioned at a predetermined distance behind said partition (13), between said partition (13) and said rear wall (2e);
   wherein said fan (12) and said heating elements (10a - 10c) are located in a space between said partition (13) and said support panel (6).

2. The oven (1) according to claim 1, **characterized in that**
   said support panel (6) is made of steel, preferably stainless steel, essentially bare of any enamel coating.

3. The oven (1) according to claim 1 or 2, **characterized in that**
   walls (2a - 2e) of said cavity (2), in particular said rear wall (2e), and said partition (13) are made of enameled metal material.

4. The oven (1) according to any one of claims 1 through 3, **characterized in that**
   said heating elements (10a - 10c) are arranged so that said fan (12) conveys said air toward said heating elements (10a - 10c).

5. The oven (1) according to any one of claims 1 through 4, **characterized in that**
   said fan (12) is devised as a radial fan to convey said air in a radial manner with a corresponding center of flow in proximity of said central hole (13a).

6. The oven (1) according to any one of claims 1 through 5, **characterized in that**
   it comprises two heating elements, one of which is positioned to the right of said central hole (13a) and one to the left of said central hole (13a), or three heating elements (10a - 10c), one of which is positioned below said central hole (13a), one to the right of said central hole (13a) and one to the left of said central hole (13a).

7. The oven (1) according to any one of claims 1 through 6, **characterized in that**
   said heating elements (10a - 10c) are devised as naked wire heating elements.

8. The oven (1) according to any one of claims 1 through 7, **characterized in that**
   said heating elements (10a - 10c) have an overall rectilinear form.

9. The oven (1) according to any one of claims 1 through 8, **characterized in that**
   said heating elements (10a- 10c) are arranged tangentially in respect of said fan (12) and orthogonally in respect of adjacent heating elements.

10. The oven (1) according to any one of claims 1 through 9, **characterized in that**
    said partition (13), having dimensions substantially the same as those of said rear wall (2e), comprises a plurality of slots (15), at least one slot positioned in proximity of an edge of said partition in vicinity to a respective heating element (10a - 10c).

11. The oven (1) according to any one of claims 1 through 10, **characterized in that**
    said support panel (6) generally has the shape of a rectangular bowl or cup, having dimensions substantially the same as those of said rear wall (2e), preferably with a central circular or ring-shaped elevation (6a), within which elevation (6a) is located said fan (12).

12. The oven (1) according to claim 11, **characterized in that**
    a depth (d) of said cup or bowl shape generally equals a corresponding extension (d') of said heating elements (10a - 10c).

13. The oven (1) according to claim 11 or 12, **characterized in that**
    said support panel (6) has rounded transition regions (6d) between a generally flat central section (6b) and a peripheral flange (6c), said rounded transition regions (6d) for guiding said air toward said partition (13), in particular toward and through the slots (15) according to claim 10.

14. The oven (1) according to any one of claims 1 through 13, **characterized in that**
    at least said heating elements (10a - 10c) and/or said partition (13) are fixed on said support panel (6), rather than on said rear wall (2e), by corresponding fixing means, preferably screws (11, 14).

15. The oven (1) according to any one of claims 1

through 14, **characterized in that**
each of said heating elements (10a - 10c) is individually controllable at least in terms of heating power and/or duration, preferably in coordination with the other ones of said heating elements (10a - 10c).

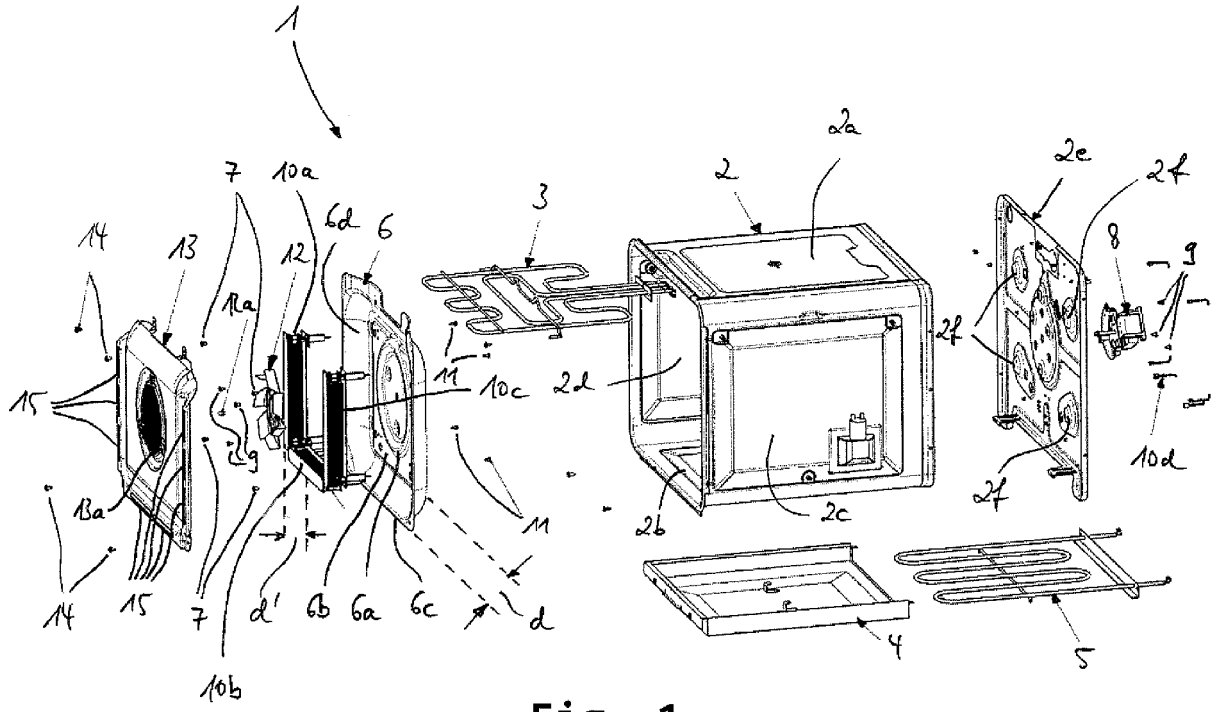

1
7
10a
6d
6
3
2
2a
2e
2f
14
13
12
8
9
15
1a
10c
2d
11
10d
1g
1b
2b
2c
4
5
d'
6b
6a
6c
d
10b

Fig. 1

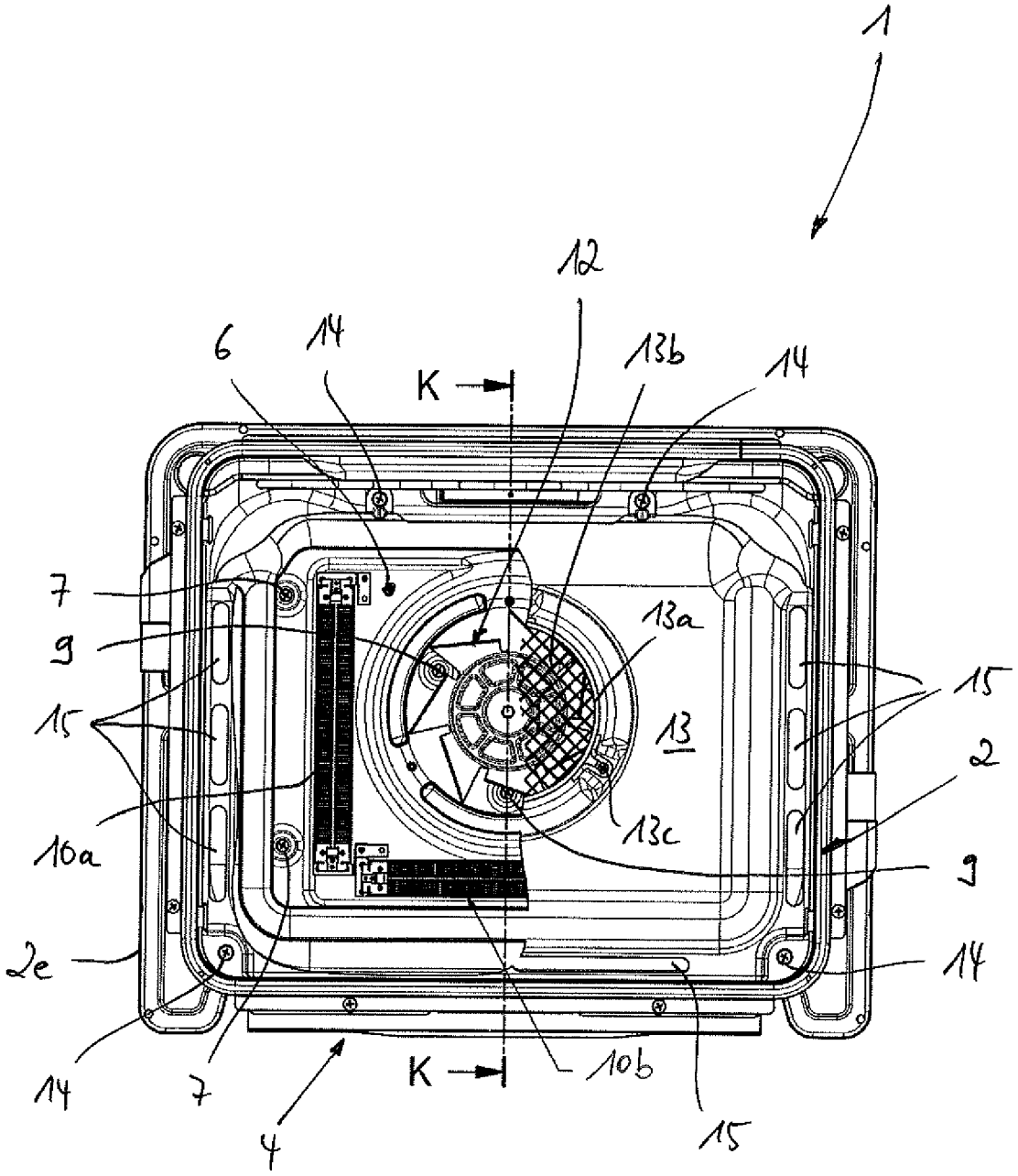


Fig. 2

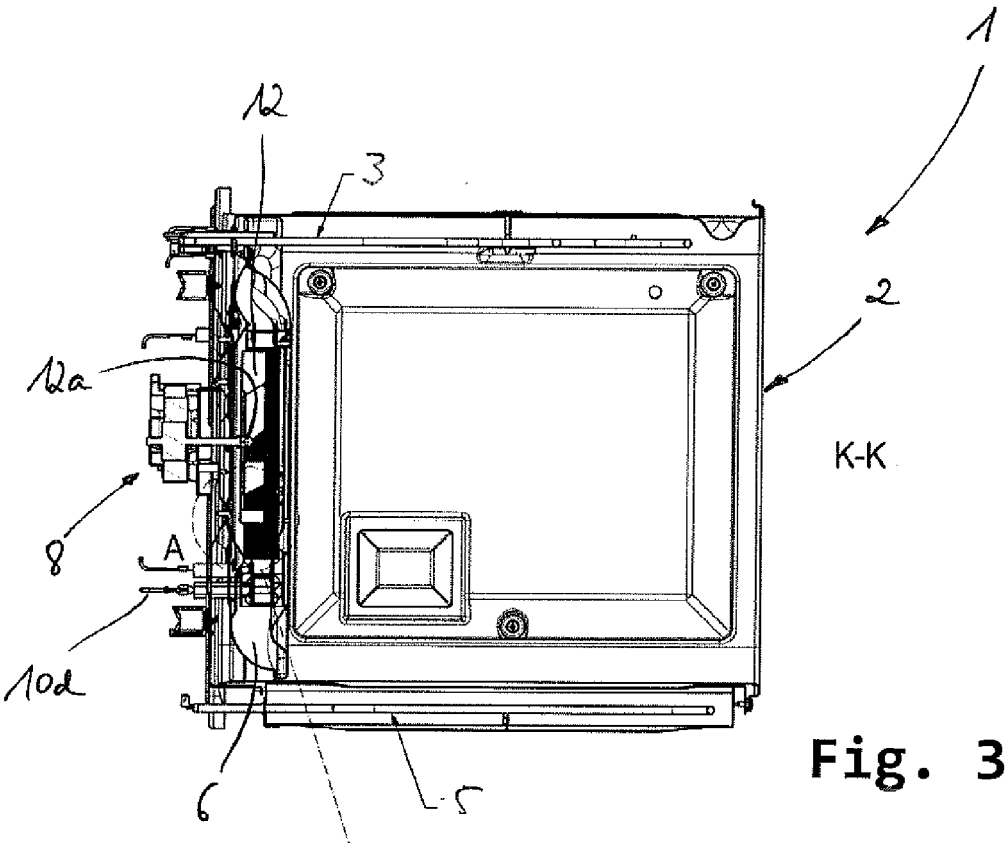
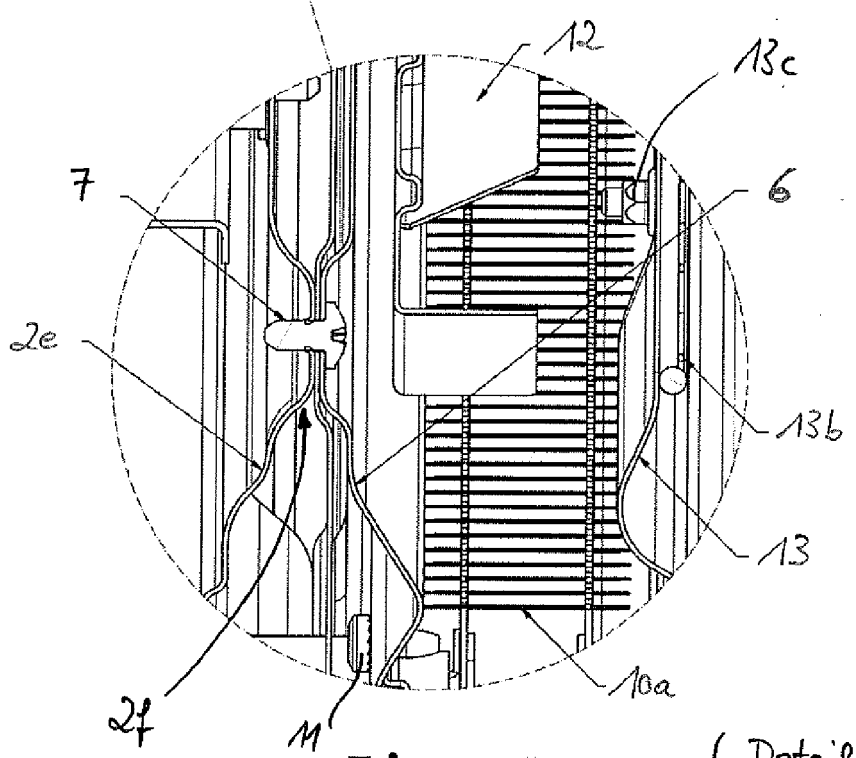


Fig. 3



(Detail A)

Fig. 4

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 16 18 0688

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	EP 2 799 782 A2 (DONGBU DAEWOO ELECTRONICS CORP [KR]) 5 November 2014 (2014-11-05) * paragraph [0102] * * paragraph [0103] * * paragraph [0104] * * paragraph [0108] * * figures 6, 7, 14 * * paragraph [0002] * -----	1,2,4-15	INV. F24C15/32 F24C15/36
X	FR 2 446 993 A1 (RAYTHEON CO [US]) 14 August 1980 (1980-08-14) * page 1, line 19 - page 1, line 21 * * page 1, line 34 - page 1, line 38 * * page 4, line 17 - page 4, line 18 * -----	1,3-6,8, 11,12, 14,15	
X	EP 1 732 359 A2 (SAMSUNG ELECTRONICS CO LTD [KR]) 13 December 2006 (2006-12-13) * paragraph [0001] * * paragraph [0015] * * paragraph [0019] * * paragraph [0020] * * figure 2 * * paragraph [0017] * -----	1,4-7,9, 11-15	
			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	28 November 2016	Jalal, Rashwan

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 16 18 0688

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
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

28-11-2016

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 2799782 A2	05-11-2014	CN 104138218 A	12-11-2014
		EP 2799782 A2	05-11-2014
		JP 5723954 B2	27-05-2015
		JP 2014219188 A	20-11-2014
		KR 20140129536 A	07-11-2014
		US 2014318388 A1	30-10-2014
FR 2446993 A1	14-08-1980	AU 5440680 A	24-07-1980
		BE 881143 A1	02-05-1980
		CA 1114262 A	15-12-1981
		DE 3001221 A1	24-07-1980
		FR 2446993 A1	14-08-1980
		GB 2043237 A	01-10-1980
		IT 1144029 B	29-10-1986
		JP S55110836 A	26-08-1980
		ZA 8000087 B	31-12-1980
EP 1732359 A2	13-12-2006	EP 1732359 A2	13-12-2006
		KR 20060128372 A	14-12-2006
		RU 2311001 C2	20-11-2007
		US 2006289435 A1	28-12-2006

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- EP 2336650 A2 **[0002] [0013] [0039]**