

(19)



(11)

**EP 1 972 855 A1**

(12)

**EUROPEAN PATENT APPLICATION**

(43) Date of publication:  
**24.09.2008 Bulletin 2008/39**

(51) Int Cl.:  
**F24C 15/00<sup>(2006.01)</sup> F24C 15/04<sup>(2006.01)</sup>**

(21) Application number: **07005932.4**

(22) Date of filing: **22.03.2007**

(84) Designated Contracting States:  
**AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IS IT LI LT LU LV MC MT NL PL PT RO SE SI SK TR**  
 Designated Extension States:  
**AL BA HR MK RS**

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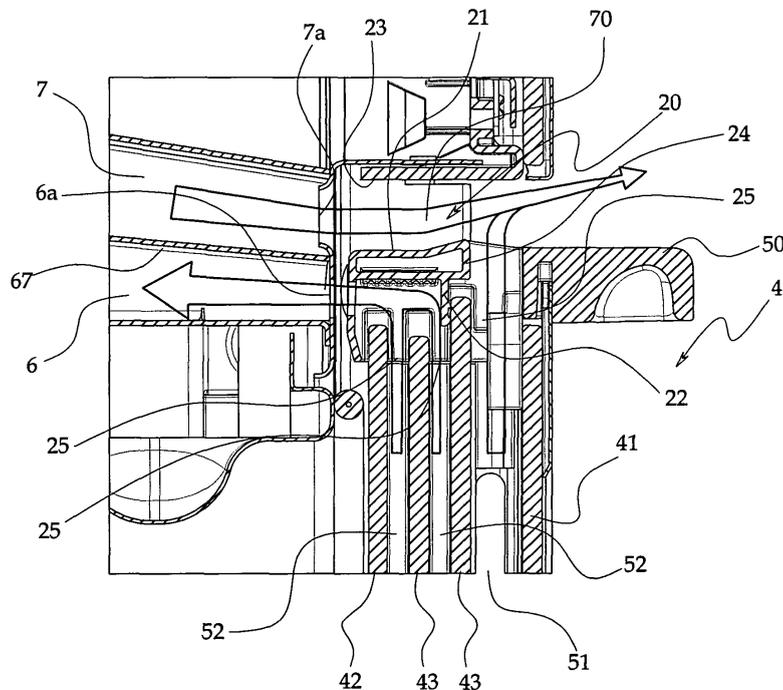
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**(54) Kitchen oven with air-cooled closing door**

(57) An oven (1) with a cooking chamber (2), comprising an air cooled door (4), with a plurality of plates, eg. window panes, wherein said door (4) comprises a first (51) and second (52) gap located between the window panes, which are positioned on the outer and inner side of door (4). Air moving means (5) draw a first air

flow, rising through said second gap (52) through a suction duct (6), and blow it to the outside through an expulsion duct (7). A second air flow rises through said first gap (51), unable to pass through said suction duct (6), and encounters said first air flow exiting from the expulsion duct (7), immediately after having left the first gap (51).



**FIG.5**

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## Description

**[0001]** The present invention refers to a kitchen oven with an air cooled closing door.

**[0002]** Kitchen ovens are known to have closing doors provided with parallel glass panes in order to form at least one gap through which air flows, and the continuous removal of said air during oven operation makes it possible to avoid heating of the external glass pane, so that users may not inadvertently get burned during oven operation when coming into contact with the external glass pane.

**[0003]** For this purpose fans are used, which generate an air flow which is tangential to the glass panes, in order to remove the air flowing out at the upper side of the gap.

**[0004]** Generally, the fan is placed on the inside of the oven and generates an air flow perpendicular to the plane of the door, when the door is closed. Such an air flow typically passes through a generally horizontal conduit with an outlet section positioned at the top of the gap.

**[0005]** The air flow generated by the fan passes along the upper end of said door in order to generate an a depression which draws a certain flow of air to pass through the same gap in a upwards direction.

**[0006]** Naturally, in this case, the gap communicates with the outside through a lower air inlet opening.

**[0007]** However, such ovens of the prior art, even if avoiding excessive heating of the outermost glass pane of the door, do not always avoid reaching temperatures, measured on the external glass pane of the door, sufficient to cause a slight contact burn.

**[0008]** This drawback occurs primarily when the oven operates at its maximum temperature for a long period of time.

**[0009]** Therefore, there is a need for an oven with an air cooled door which guarantees a more efficient and faster air replacement in the door gap, where, at the same time, the oven maintains a relatively low temperature, in order to avoid any type of burning to the user who touches the external face of the external pane of the door, during normal oven operation, using a simple and rational construction.

**[0010]** The object of the present invention consists in providing an oven with an air cooled door, having structural and functional characteristics which meet the above said need, at the same time avoiding the disadvantages cited with reference to the prior art.

**[0011]** This object is achieved by an oven with an air cooled door according to claim 1.

**[0012]** The dependent claims comprise preferred and especially advantageous embodiments of the oven according to the invention.

**[0013]** Further characteristics and advantages of the invention will become apparent from the following description, which is intended to be only illustrative and non limitative, in connection with the attached figures, in which:

Fig. 1 shows a front view of an oven according to the

present invention,

Fig. 2 shows a view along line II-II of fig. 1,

Fig. 3 shows a view along line III-III of fig. 1,

Fig. 4 shows part of a view along line IV-IV of fig. 1,

Fig. 5 and 6 show a respective enlarged detail of fig. 2.

**[0014]** With reference to figs. 1-3, 1 generally indicates an oven according to the present invention.

**[0015]** In the example shown, the oven 1 is a built-in oven mounted inside a cupboard.

**[0016]** As can easily be seen in fig. 2, the oven 1 comprises, generally, a support structure which defines a cooking chamber 2, known as a muffle, provided with an opening on one side, for accessing a cooking cavity 3 inside, a door 4 for closing the chamber 2, means for moving air, which will be described in greater detail later, and means for heating the inside of the cavity 3.

**[0017]** In particular the closing door 4 is hinged by means of two invisible struts to the chamber 2, so that it can be rotated between a closed position, in which the door 4 is disposed in a substantially vertical plane in order to close the opening and avoid access to the cavity 3, and an open position in which said door 4 is, for instance, inclined with respect to the vertical plane, in order to allow access to the cooking cavity 3 through said opening.

**[0018]** In the example shown, the means for heating the inside of the cavity 3 comprise a pair of electric resistors 10, one of which is placed inside the cavity 3 near the upper wall and the other is positioned in a slot 11 adjacent to the lower wall of chamber 2.

**[0019]** The air moving means comprise a blower 5, mounted above chamber 2, and positioned on the side opposite to where the door 4 is mounted, in order to generate an air flow perpendicular to the plane of door 4 when in the closed position.

**[0020]** In particular, the blower 5 communicates with a suction duct 6, through which a first air flow is drawn, in a way which will be described later, and with an expulsion duct 7, through which said first air flow, drawn through the suction duct 6, is expelled.

**[0021]** The suction duct 6 and the expulsion duct 7 are overlapping and separated by a common separation wall 67 and are formed by a respective flared conduit, which is substantially horizontal.

**[0022]** In particular, the conduit in the suction duct 6 has an inlet section 6a, positioned above the opening of chamber 2 and which preferably spans the whole width of door 4. The conduit of expulsion duct 7 has an outlet section 7a positioned above the inlet section 6a of the suction duct 6 and preferably spans the whole width of door 4.

**[0023]** The cross-section of the suction duct 6 increases starting from the inlet section 6a, towards the bottom

where the blower 5 is positioned, whereas the cross-section of expulsion duct 7, in the upper position, decreases starting from blower 5 up to the outlet section 7a.

**[0024]** In the example shown, the cross-section measured at the inlet section 6a is smaller than the outlet cross-section 7a.

**[0025]** According to the present invention, the door 4 comprises an external plate 41, an internal plate 42 and two further plate-like elements, reference numeral 43, all of which are opposed and parallel to each other in order to form three gaps, wherein the outermost is indicated by 51 and the other two internal gaps are indicated by 52.

**[0026]** The plates 41, 42 and the plate-like elements 43 are held together to form the door 4, by a support frame comprising a pair of lateral struts 8 formed by a hollow profile. On each strut 8 a shaped element is attached, in order to form guiding channels 8a (fig. 4) in which the plate-like elements 43 may slide.

**[0027]** In particular, the guiding channels 8a are formed in a direction generally parallel to the longitudinal extension of struts 8.

**[0028]** Plates 41 and 42 are mounted on two opposed faces of the struts 8. In particular, the outermost plate 41 is supported on the lower side by a pair of small brackets 12 (fig. 6) which are fixed to the lower ends of the two struts 8 by means of screws, whereas the innermost plate 42 is supported by a profile 9 (fig. 6), which is laterally fixed to the two brackets 12 by means of screws.

**[0029]** The two brackets 12 isolate the outermost plate 41 from the two struts, avoiding direct heat transfer between the strut and the respective plate.

**[0030]** The profile 9 has three seats 9a at its ends for holding the lower edges of the innermost plate 42 and the edges of the two plate-like elements 43.

**[0031]** On the external face of the outermost plate 41 a gripping handle 50 is attached, which extends along the whole width of door 4 near its upper edge.

**[0032]** According to the present invention, the supporting frame of the door 4 further comprises a terminal body 20 (fig. 5) associated to the two struts 8, and positioned along the upper edge of door 4.

**[0033]** In particular, said body 20 has a first portion 21 which forms a deflector which, when the door is in its closed position, forms an extension of the separating wall 67 of the two ducts 6 and 7, reducing the flow section for the air flow blown to the outside through the expulsion duct 7, and a second separating portion 22, which separates and seals off the two innermost gaps 52 from the outermost gap 51.

**[0034]** More in particular, the deflector 21, when the door 4 is in its closed position, forms a passageway 70 with a variable cross-section, which decreases towards the direction of expulsion of the air flow; the deflector forms a sort of terminal opening for the expulsion duct 7 with an overhanging horizontal portion 23 of the oven supporting structure.

**[0035]** Effectively, the air flow through the expulsion duct 7 is forced to pass through a further narrowing 70

before being completely expelled.

**[0036]** The second separating portion 22 is formed by a flat profile integral with the deflector 21, which is inserted into the central gap 52, directly contacting the outermost plate-like element 43 along its whole width, inhibiting the flow of air from the innermost gaps 52 towards the outermost one 51.

**[0037]** Obviously, said second portion 22 may be put into contact with the outermost face, as long as it ensures a seal which inhibits the air from flowing from the two innermost gaps 52 towards the outermost gap 51 and vice versa.

**[0038]** The fixing of the terminal body 20 to the struts 8 is obtained by interposing the two lateral blocking portions 24, associated to the free ends of the body 20, which are shaped in such a way as to cooperate with the terminal body 20 and the two struts 8.

**[0039]** In particular, teeth 25 protrude from each lateral blocking portion 24, which correspond to the gaps 51, 52.

**[0040]** According to the present invention, the two innermost gaps 52 isolated from the outermost gap 51, communicate with the suction duct 6, whose inlet section 6a is aligned to the upper edge of the innermost plate 42 and to the innermost plate-like element 43 when the door 4 is in its closed position.

**[0041]** In particular, the lower wall of the suction duct 6 is horizontally positioned at a height such that it is aligned to the upper edge of the innermost plate 42, when the door 4 is closed.

**[0042]** In this example, the edge of the innermost plate-like element 43 reaches a level lower than that of the innermost plate 42, whereas the rest of the outermost plate-like element 43 reaches a height greater than the one reached by the innermost plate 42.

**[0043]** The outermost gap 51, when the door 4 is in its closed position, is connected to the expulsion duct 7 at the narrowing 70.

**[0044]** In particular, the outermost gap 51 opens at the top directly behind the deflector 21 of the terminal body 20, with respect to the flow direction.

**[0045]** Obviously, all gaps 51, 52 are connected to the outside through an opening which preferably spans the whole width of the door 4, which is left free at the lower edge of the same door 4.

**[0046]** Regarding operation, when the oven 1 is switched on, the blower 5, whose rotational axis is horizontal and parallel to the plane of door 4, draws a first air flow to rise through the two innermost gaps 52, via the suction duct 6, which is connected only to the two gaps 52.

**[0047]** Said first air flow is immediately expelled by the same blower 5, through the expulsion duct 7, which is positioned above the suction duct 6. Before leaving the oven 1, said first air flow passes through the narrowing 70, which lies directly behind the expulsion duct 7.

**[0048]** The first horizontal air flow, due to a Venturi effect, draws a second air flow upwards, which rises through the outermost gap 51, at the narrowing 70 formed

by the deflector 21, and finally leaves the oven, as shown by the arrows in fig. 5.

**[0049]** In other words, at the narrowing 70 a sort of suction effect is applied to the second air flow which, therefore, is drawn together with the first air flow exiting from the expulsion duct 7, immediately after the latter has left the outermost gap 51 at its upper side.

**[0050]** In this way, the rate at which hot air is replaced in the outermost gap 51, i.e. the one adjacent to the outermost plate 41, is extremely high, so that excessive heating of the outermost plate 41 is avoided.

**[0051]** According to a preferred embodiment of the present invention, the oven 1 is provided with a chimney 80 for extracting exhaust gases from the cooking chamber 2, which is connected to the expulsion duct 7.

**[0052]** Moreover, the blower 5 is connected to a shirt 90 adjacent to the back of the chamber 2, in which a motor 91 for a common radial ventilator 92 is provided, in order to generate a replacement of air inside the shirt 90 as well.

**[0053]** Further air inlets, communicating with the blower 5, are provided underneath and on the sides of the oven.

**[0054]** In the present description, all the definitions regarding spatial positions of elements forming the door 4 refer to the door 4 in its closed position, i.e. in a generally vertical position.

**[0055]** Although reference has been explicitly made to a door 4 having three gaps 51, 52, it is possible to provide a door 4 with any number of gaps separated by plate-like elements, as long as the innermost gaps are isolated from the outermost gap and are connected to the suction duct 6.

**[0056]** In its simplest form, not illustrated, the door 4 may comprise only two gaps, connected to the suction duct 6 and narrowing 70, respectively.

**[0057]** As can be appreciated by the above description, the oven with an air cooled door according to the present invention meets the requirements and overcomes the disadvantages referenced in the introduction of the present invention, with reference to the prior art.

**[0058]** In fact, the oven according to the present invention allows a continuous replacement of the hot air which is in direct contact with the outermost glass pane of door 4, maintaining a suitable temperature and ensuring the thermal security requirements for users.

**[0059]** Obviously, those skilled in the art will readily introduce various modifications and variants to the described oven with air cooled door, in order to meet any contingent and specific need, which by the way are all comprised inside the protection scope of the invention, as defined in the following claims.

## Claims

1. An oven (1) comprising an air cooled door (4), movable from a closed position, inhibiting access to the

oven cooking chamber (2), to an open position, allowing access to the chamber (2), wherein said door (4) comprises a first (51) and second (52) gap, which are positioned on the outer and inner side of door (4) respectively, when the door is in its closed position, **characterized in that** when the oven is operating and the door (4) is in its closed position, air moving means (5) draw a first air flow, rising through said second gap (52), through a suction duct (6), and blow it to the outside, through an expulsion duct (7), wherein through said first gap (51) a second air flow rises, not being able to pass through said suction duct (6), and encounters said first air flow exiting from the expulsion duct (7), immediately after having left the first gap (51).

2. Oven according to claim 1, wherein said second air flow encounters said first air flow exiting from the expulsion duct (7), at a narrowing (70), which is formed by a deflector (21) associated to the same door (4), when the door is in its closed position.

3. Oven according to claim 2, wherein said deflector (21) forms an extension of the expulsion duct (7), and is located downstream with respect to the direction of flow.

4. Oven according to claims 2 or 3, wherein said deflector (21) is positioned above said second gap (52), and is fixed to two lateral supporting struts (8) of the door (4).

5. Oven according to any of the preceding claims, wherein said door (4) comprises an outermost plate (41), an innermost plate (42) and an intermediate plate-like element (43), which are parallel and opposed to each other, in order to form said first (51) and second (52) gaps.

6. Oven according to claim 5, wherein said door (4) comprises a further plate-like element (43), in order to form a further second gap (53), communicating with said suction duct (6).

7. Oven according to any of the preceding claims, wherein said suction duct (6) and said expulsion duct (7) are generally horizontal and have an inlet section (6a) and an outlet section (7a) positioned in the upper area of said gaps (51, 52).

8. Oven according to any of the preceding claims, in which said suction (6) and expulsion (7) ducts are overlapping, wherein the expulsion duct is in the upper position, and both are separated by a common separating wall (67), and are formed by a respective flared conduit.

9. Oven according to any of the preceding claims, com-

prising a separating portion (22) associated to the door (4), which separates said second gap (52) from said first gap (51), so that the second air flow cannot be drawn through the suction duct.

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10. Oven according to claim 9, wherein said separating portion (22) is formed by a flat profile associated to said deflector (21), forming a single terminal body (20), which is positioned along the upper edge of the door (4).

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11. Oven according to any of the preceding claims, wherein said air moving means comprise a blower (5), which is mounted above the chamber (2) and is positioned on the side opposed to the side where the door (4) is mounted, in order to generate an air flow which is perpendicular to the plane of the door (4), in its closed position.

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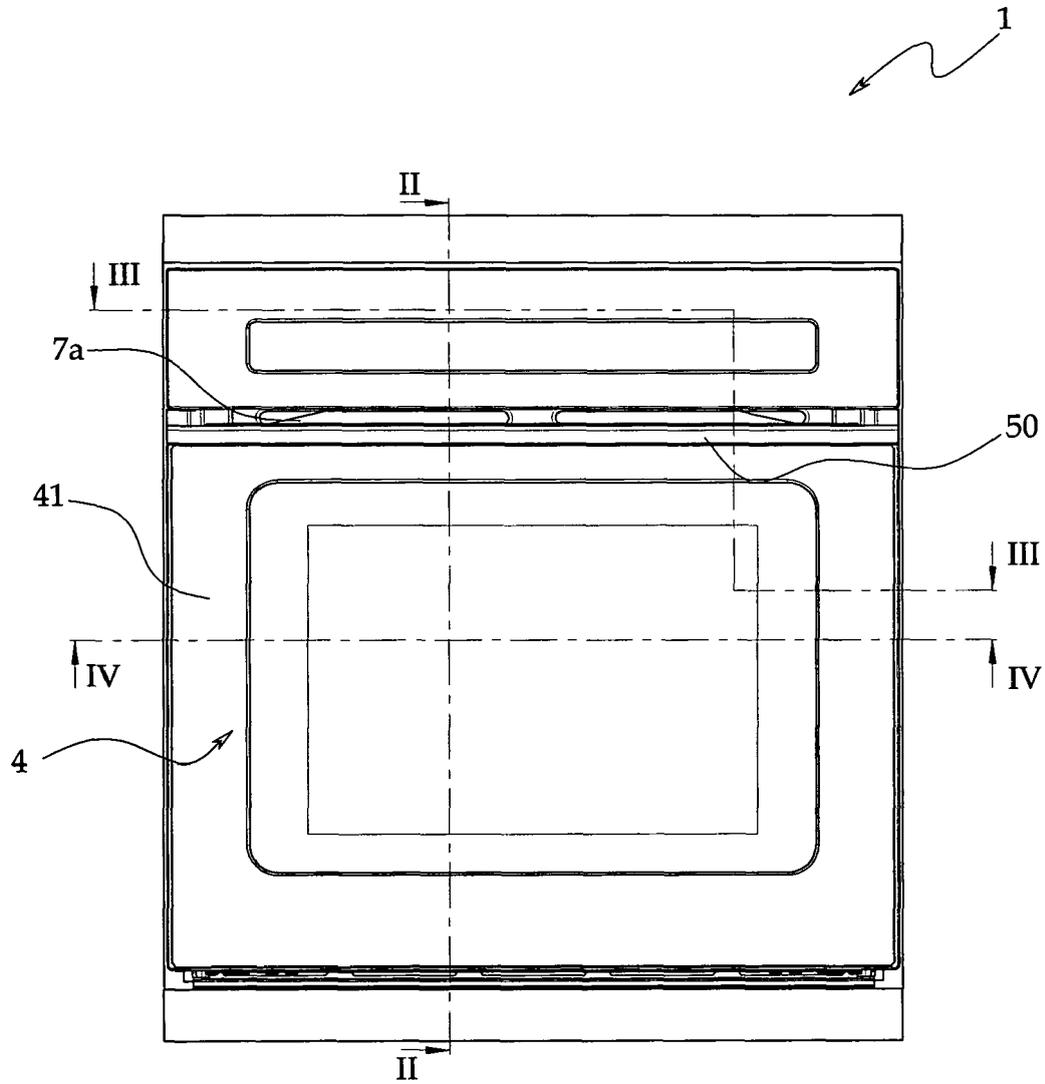


FIG.1

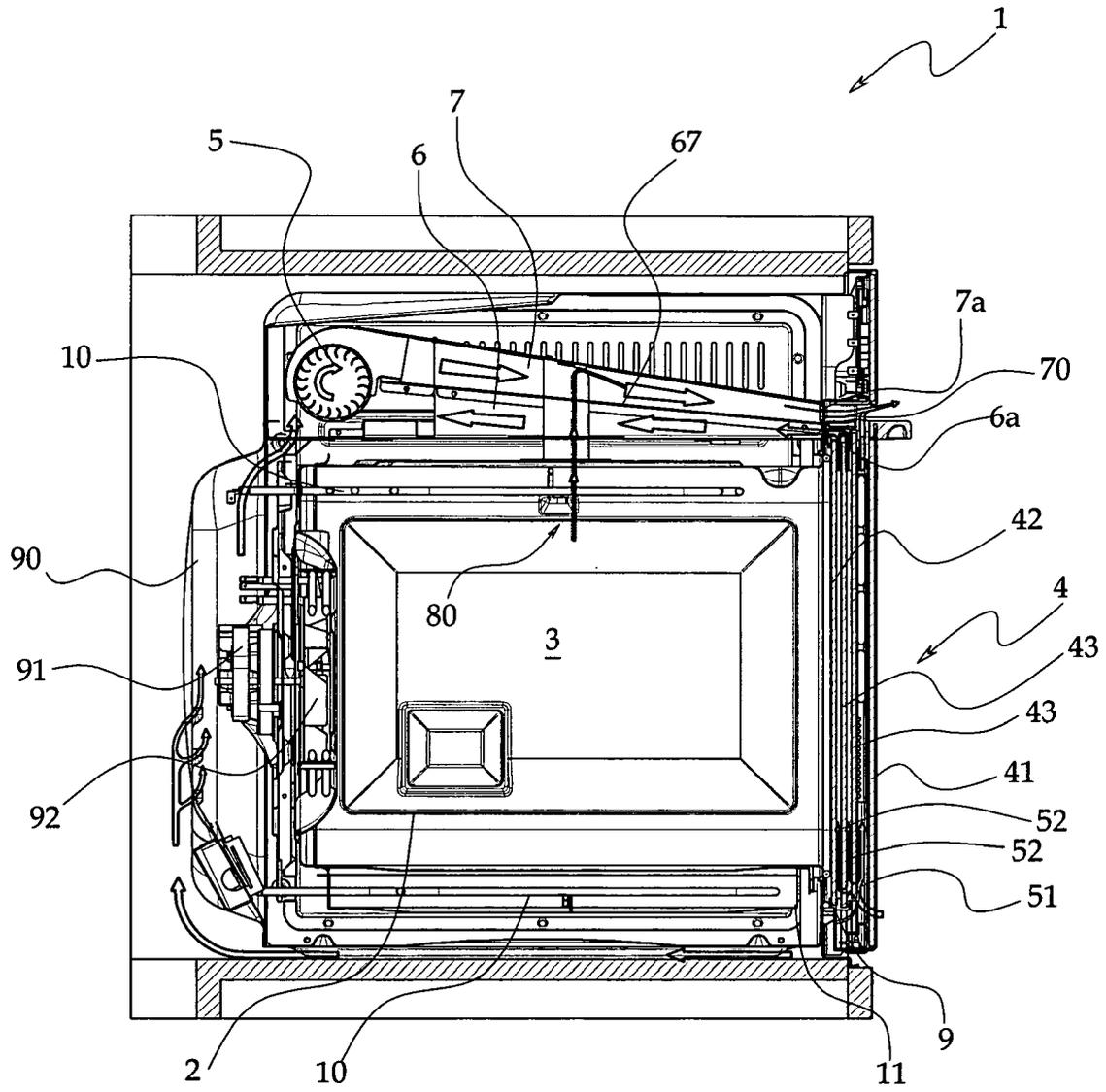


FIG.2

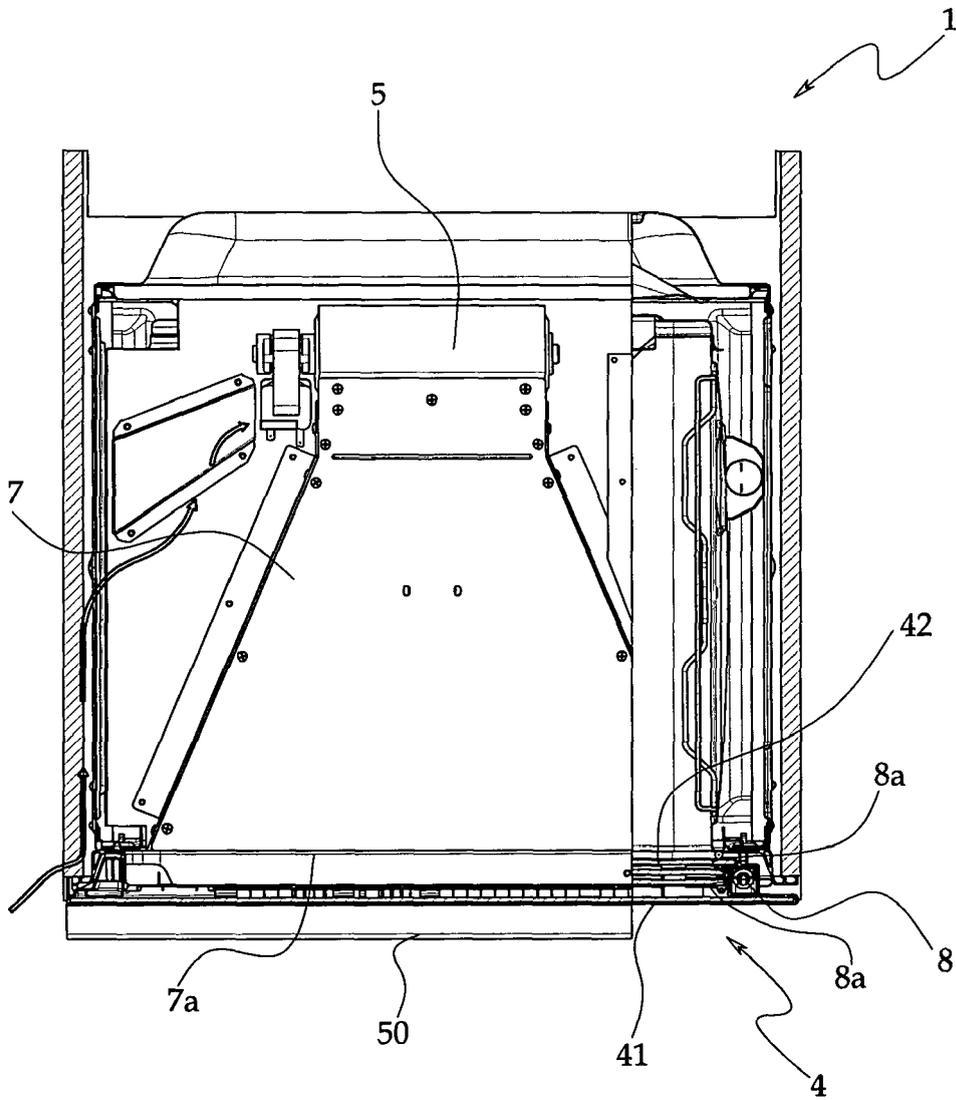


FIG.3

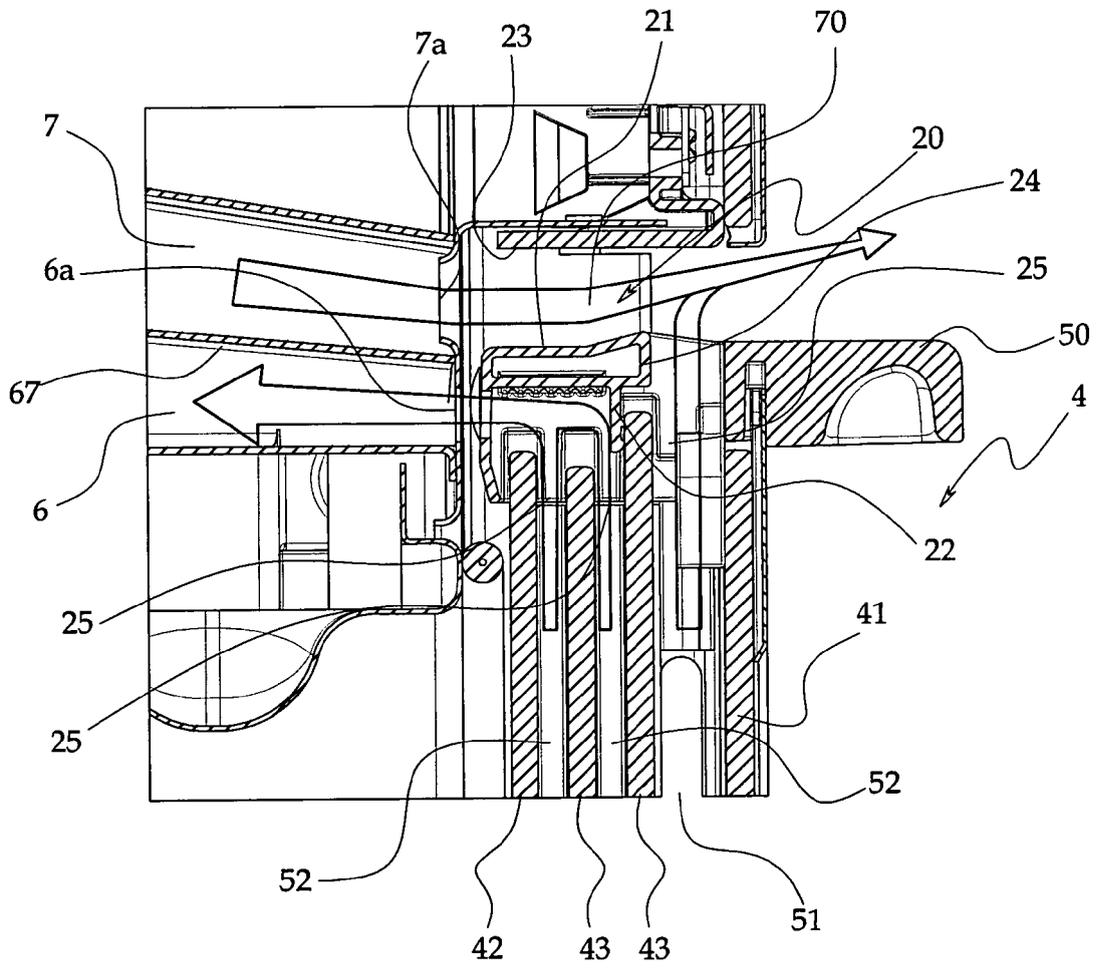


FIG.5

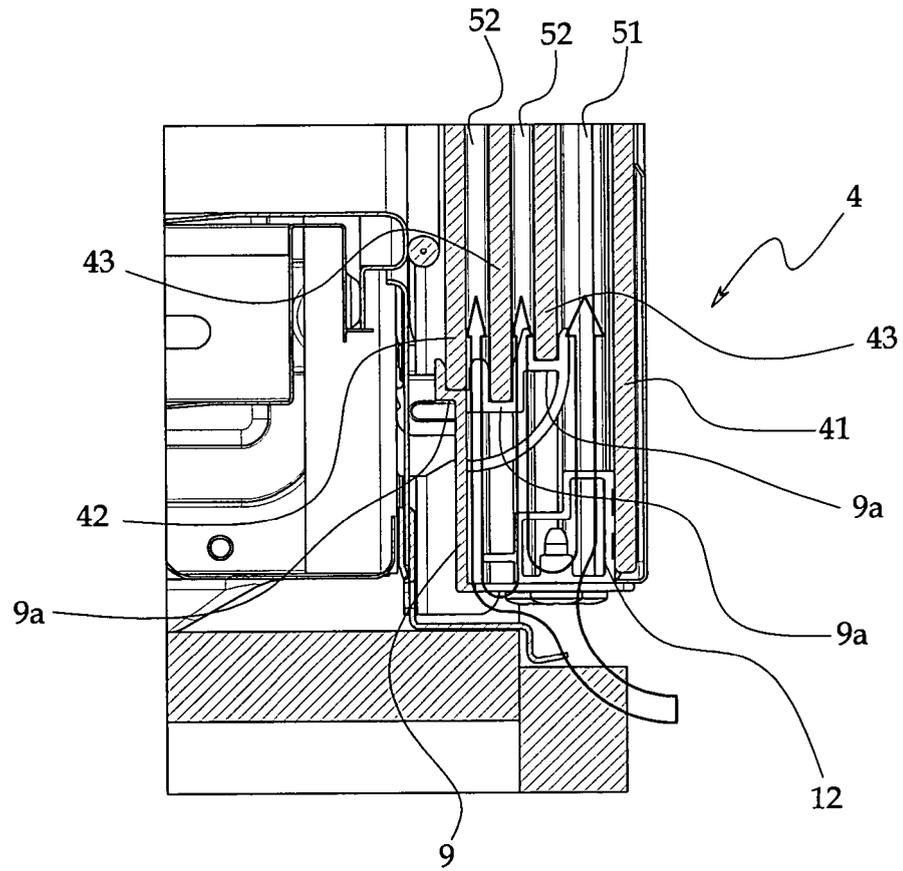


FIG. 6

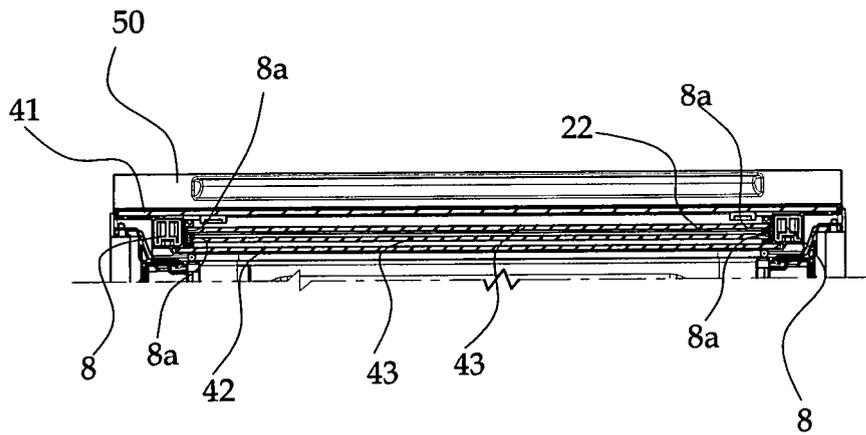


FIG. 4



| DOCUMENTS CONSIDERED TO BE RELEVANT  |   |   |   |
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| The present search report has been drawn up for all claims   |   |   |   |
| Place of search<br>Munich  |   | Date of completion of the search<br>5 December 2007   | Examiner<br>Blot, Pierre-Edouard        |
| CATEGORY OF CITED DOCUMENTS<br>X : particularly relevant if taken alone<br>Y : particularly relevant if combined with another document of the same category<br>A : technological background<br>O : non-written disclosure<br>P : intermediate document |   | T : theory or principle underlying the invention<br>E : earlier patent document, but published on, or after the filing date<br>D : document cited in the application<br>L : document cited for other reasons<br>.....<br>& : member of the same patent family, corresponding document |   |

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**ANNEX TO THE EUROPEAN SEARCH REPORT  
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