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(54) DEVICE FOR COOLING THE HANDLE OF AN OVEN

(57) Cooling device (7) for cooling a handle of a door (5) of a cooking oven (1), comprises a fan with electric motor (10) and an axial flow impeller (11), a tubular flow guide (13) having an inlet opening (14) and an outlet opening (15) facing the door (5), wherein the impeller (11) is arranged inside the flow guide (13) in an inlet zone (16) in the proximity of the inlet opening (14), and a flow section of the flow guide (13) widens in a first direction (18) orthogonal to the rotational axis (17) of the impeller (11) and tapers in a second direction (19) orthogonal to both the rotational axis (17) and the first direction (18), going from the inlet zone (16) up to the outlet opening (15).

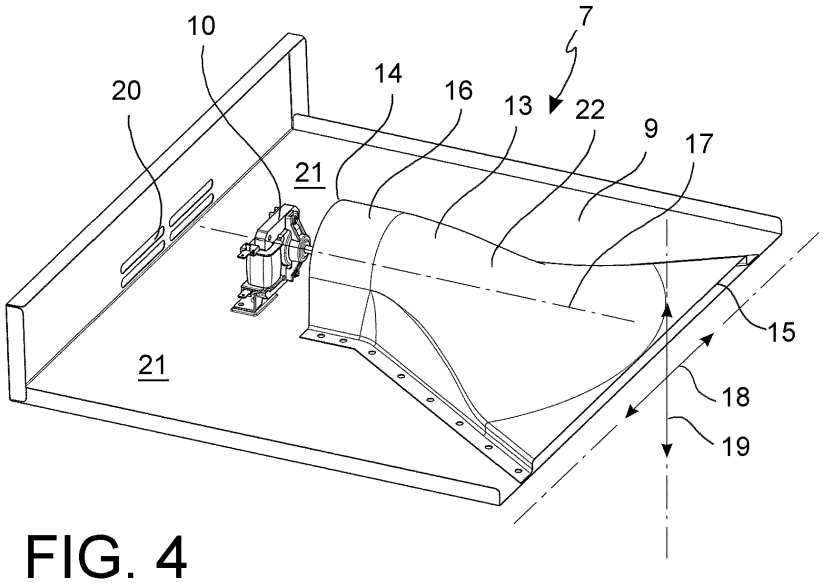

FIG. 4

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Description

[0001] The object of the present invention is a device for cooling the handle of a cooking oven, in particular a home cooking oven.

[0002] Home cooking ovens comprise a housing that internally forms a cooking cavity able to be heated by heating means, for example electrical resistances, and able to be closed by means of a front door equipped with a handle positioned in an upper region of the door. In order to avoid burns during use of the cooking oven, it is known to cool the gripping zone of the door through a cooling air flow.

[0003] For this purpose, ovens of the prior art comprise a fan positioned in a cooling space arranged above the cooking cavity and able to be actuated to suck ambient air, for example through a suction opening formed in a rear wall of the housing, and direct it through a horizontal slit of the front wall of the oven in the front zone (gripping zone) of the door of the oven.

[0004] The most common known solution uses as fan a radial fan actuated by an electric motor, both with horizontal rotational axis parallel to the upper edge of the door of the oven, in which the blades of the radial fan extend axially along a significant portion or even along the entire width of the cooling space (Figure 1). This solution is reliable in terms of cooling, but it has a complex, expensive and heavy structure, as well as being very noisy due to the vicinity of the fan to the front wall of the over. Moreover, in the case of suction of the ambient air through a small-sized opening, the fan thus configured cannot ensure an even distribution of the cooling flow over the entire width of the handle of the oven.

[0005] A further known solution uses as fan a radial fan actuated by an electric motor, both with vertical rotational axis (Figure 2). This fan has small dimensions and low cost, but tends to lose the lubricant oil from the rotary supports (bushes, bearings) by the effect of gravity.

[0006] The purpose of the present invention is therefore to propose a system for cooling the gripping zone of the door of cooking ovens having characteristics such as to avoid the drawbacks of the prior art.

[0007] Particular purposes of the invention are the reduction of the manufacturing and operating costs, of the weight and of the noise of the cooling system, as well as a more targeted distribution of the cooling flow along the gripping zone of the door of the oven.

[0008] At least part of the objectives are accomplished through a cooling system according to claim 1. The dependent claims concern advantageous embodiments.

[0009] In order to better understand the invention and appreciate the advantages thereof, a non-limiting embodiment and some variations thereof will be described, with reference to the attached figures, in which:

- figure 1 is a partial perspective view of an oven cooling system of the prior art;
- figure 2 is a partial perspective view of a further oven cooling system of the prior art;
- figure 3 is a perspective view of an oven cooling device according to the invention in which an air guide is removed;
- figure 4 illustrates the device of figure 3 in which an air guide is applied;
- figure 5 is a view from above of the cooling device according to the invention;
- figure 6 is a vertical-axial sectional view of the cooling device according to an embodiment of the invention.
- figure 7 shows a cooking oven with a cooling system according to the invention. With reference to the figures, a cooking oven 1 comprises a housing 2 that internally forms a cooking cavity 3 able to be heated through heating means 4, for example electrical resistances, and closable by means of a front door 5 equipped with a gripping zone or handle 6 positioned in an upper region of the door 5. The oven 1 also comprises a cooling device 7 for air cooling the gripping zone 6 of the door 5.

[0010] The cooling device 7 can be installed in a cooling space 8 formed in the housing 2 next to, in particular above, the cooking cavity 3 (with the oven 1 in the position of use) and comprises:

- a base wall 9 that can be a wall delimiting the cooling space 8,
- a fan connected to the base wall 9 and having an electric motor 10 and an axial flow impeller 11 connected to a shaft 12 of the electric motor 10,
- a tubular flow guide 13 connected to the base wall 9 and having an inlet opening 14 and an outlet opening 15 facing a cooling opening 24 formed in a front wall 25 of the housing 2 close to the gripping zone 6 (for example close to the upper edge) of the door 5,

wherein the axial flow impeller 11 is positioned inside the tubular flow guide 13 in an inlet zone 16 close to the inlet opening 14, and wherein a flow section of the tubular flow guide 13, perpendicular to the rotational axis 17 of the impeller 11, gradually widens in a first direction 18 perpendicular to the rotational axis 17 and gradually tapers in a second direction 19 perpendicular both to the rotational axis 17 and the first direction 18, going from the inlet zone 16 up to the outlet opening 15.

[0011] The outlet opening 15 has the shape of a preferably rectilinear slit, extending in the first direction 18 and facing a cooling opening 24 formed in a front wall 25 of the housing 2 close to the gripping zone 6 (for example close to the upper edge) of the door 5.

[0012] As can be seen in figure 7, the cooling device 7 thus configured can also cause a secondary cooling flow of the door, using the primary air flow as driving fluid that sucks the secondary flow by Venturi effect.

[0013] Thanks to the use of a fan with axial flow impeller it is possible to generate a cooling flow with high energy efficiency and without substantial deviations and diver-

sions in the path of the flow itself, reducing weight, bulk and manufacturing and operating costs of the fan. Moreover, thanks to the geometry and positioning of the flow guide 13 with respect to the axial flow impeller 11, a more even distribution of the cooling flow at the outlet opening 15 and, therefore a more efficient cooling of the handle 6 of the oven is obtained.

[0014] Moreover, the gradual transition of the geometry of the flow guide 13 from the inlet zone 16 to the outlet zone 15 allows ambient air to be sucked through a suction opening 20 of the housing 2 of small dimensions or, alternatively, from lateral zones 21 of the cooling space 8, without jeopardising the correct distribution of the cooling flow along the gripping zone 6.

[0015] In accordance with an embodiment, the rotational axis 17 of the impeller 11 (and the drive shaft 12 concentric with it) is oriented in an approximately horizontal direction and the flow section of the tubular flow guide 13, seen in a section plane perpendicular to the rotational axis 17 of the impeller 11, gradually widens in a horizontal direction perpendicular to the rotational axis 17 and gradually tapers in the vertical direction, going from the inlet zone 16 up to the outlet opening 15. Preferably, the rotational axis 17 of the impeller 11 is substantially perpendicular to the plane of the door 5 in closed position.

[0016] Advantageously, the tubular flow guide 13 has a substantially symmetrical shape with respect to a vertical plane of symmetry that comprises the rotational axis 17 of the impeller 11 (and the axis of the drive shaft 12).

[0017] In an embodiment, the electric motor 10 is positioned outside the flow guide 13 and the drive shaft 12 or a transmission shaft extends from the outside of the flow guide 13 through the inlet opening 14 up to the inlet zone 16.

[0018] In this way, the electric motor 10 is positioned in the suction region of the ambient air and, therefore, cooled, without hindering the flow inside the guide 13.

[0019] In accordance with an embodiment, going from the inlet zone 16 up to the outlet opening 15, the tubular flow guide 13 widens in the first direction (horizontal) with an extension having double curvature ("S" shaped) and an angle of divergence 26 between the wall of the tubular flow guide 13 and the rotational axis 17 (seen in a horizontal section plane) in a first portion adjacent to the inlet zone 16 is smaller than the angle of divergence 26" in a third portion adjacent to the outlet opening 15, whereas the angle of divergence 26" in the third portion is smaller than the angle of divergence 26' in a second intermediate portion between the first and third portion.

[0020] Similarly, going from the inlet zone 16 to the outlet zone 15, the tubular flow guide 13 narrows in the second direction (vertical) with an extension having double curvature ("S" shaped) and an angle of convergence 27 between the wall of the tubular flow guide 13 and the rotational axis 17 (seen in a vertical section plane) in the first portion adjacent to the inlet zone 16 is smaller than the angle of convergence 27" in the third portion adjacent to the outlet opening 15, whereas the angle of divergence 27" in the third portion is smaller than the angle of divergence 27' in a second intermediate portion between the first and third portion.

[0021] Advantageously, the Bi/Bo ratio between the width Bi of the flow guide 13 in the inlet region 16 and the width Bo of the outlet opening 15 in the first direction 18 (horizontal width) is in the range from 0.18 to 0.3, preferably about 0.236.

[0022] The Hi/Ho ratio between the height Hi of the flow guide 13 in the inlet region 16 and the height Ho of the outlet opening 15 in the second direction 19 (vertical height) is in the range from 11 to 7, preferably about 8.95.

[0023] Moreover, the Hi/Bi ratio between the height Hi and the width Bi of the flow guide 13 in the inlet region 16 is in the range from 1.2 to 0.9, preferably in the range from 1 to 0.92, even more preferably about 0.96, whereas the ratio Ho/Bo between the height Ho and the width Bo of the outlet opening 15 is in the range from 0.01 to 0.04, preferably in the range from 0.02 to 0.03, even more preferably about 0.025.

[0024] Moreover, the Bo/L ratio between the width of the outlet opening 15 and the length of the flow guide 13 in the direction of the rotational axis 17 is in the range from 0.8 to 2, preferably in the range from 1.2 to 1.6, even more preferably about 1.44.

[0025] In a preferred embodiment, the geometric parameters of the flow guide 13 are:

Hi = 89.5 mm
Bi = 93.2 mm
Ho = 10 mm
Bo 395 mm
L = 274 mm

[0026] These geometric configurations of the flow guide have proven particularly advantageous to minimise the noise of the cooling flow.

[0027] Advantageously, in the inlet zone 16 the flow guide 13 has a substantially constant shape in section.

[0028] The flow guide 13 can be formed from a portion, which is preferably approximately flat, of the base wall 9 and a rounded half-shell 22 connected to the base wall 9, for example through a plurality of screws, along two substantially flat side edges thereof 23.

[0029] The flow guide 13 can be made of metal plate, plastic material or composite material reinforced with fibres. The axial flow impeller 11 is preferably made of plastic material.

[0030] Of course, those skilled in the art can bring further modifications and variants to the cooling device 7 and to the cooking oven 1 according to the present invention, in order to satisfy contingent and specific requirements, all of which are in any case covered by the scope of protection of the invention, as defined by the following claims.

Claims

1. A cooling device (7) for cooling a gripping zone (6) of a door (5) of a cooking oven (1),
the cooling device (7) comprising:

- a base wall (9),
- a fan connected to the base wall (9) and having an electric motor (10) and an axial flow impeller (11) connected to a shaft (12) of the electric motor (10),
- a tubular flow guide (13) connected to the base wall (9) and having an inlet opening (14) and an outlet opening (15) intended to face in the proximity of the gripping zone (6) of the door (5),

wherein the axial flow impeller (11) is arranged inside the tubular flow guide (13) in an inlet zone (16) in the proximity of the inlet opening (14),
and wherein a flow section of the tubular flow guide (13), orthogonal to the rotational axis (17) of the impeller (11), gradually widens in a first direction (18) orthogonal to the rotational axis (17) and gradually tapers in a second direction (19) orthogonal to both the rotational axis (17) and the first direction (18), going from the inlet zone (16) up to the outlet opening (15).

2. The cooling device (7) according to claim 1, wherein a rotational axis (17) of the impeller (11) is oriented in an approximately horizontal direction, and the flow section of the tubular flow guide (13), as seen in a cross-sectional plane orthogonal to the rotational axis (17), gradually widens in a horizontal direction orthogonal to the rotational axis (17) and gradually tapers in a vertical direction, going from the inlet zone (16) up to the outlet opening (15).

3. The cooling device (7) according to claim 1 or 2, wherein the electric motor (10) is located externally to the flow guide (13) and the shaft (12) extends through the inlet opening (14) up into the inlet zone (16).

4. The cooling device (7) according to one of the preceding claims, wherein, going from the inlet zone (16) up to the outlet opening (15), the flow guide (13) widens in the first direction with a double curve trend, in which a divergence angle (26) between the wall of the flow guide (13) and the rotational axis (17) in a first length adjacent to the inlet zone (16) is less than the divergence angle (26") in a third length adjacent to the outlet opening (15), while the divergence angle (26") in the third length is less than the divergence angle (26') in a second length intermediate between the first and the third lengths.

5. The cooling device (7) according to one of the preceding claims, wherein, going from the inlet zone (16) up to the outlet opening (15), the flow guide (13) narrows in the second direction with a double curve trend,
wherein a convergence angle (27) between the wall of the tubular flow guide (13) and the rotational axis (17) in a first length adjacent to the inlet zone (16) is less than the convergence angle (27") in the third length adjacent to the outlet opening (15), while the convergence angle (27") in the third length is less than the convergence angle (27') in a second length intermediate between the first and the third lengths.

6. The cooling device (7) according to one of the preceding claims, wherein the (Bi/Bo) ratio between the width (Bi) of the flow guide (13) in the inlet region (16) and the width (Bo) of the outlet opening (15) in the first direction (18) ranges from 0.18 to 0.3, or it is about 0.24.

7. The cooling device (7) according to one of the preceding claims, wherein the (Hi/Ho) ratio between the height (Hi) of the flow guide (13) in the inlet region (16) and the height (Ho) of the outlet opening (15) in the second direction (19) ranges from 11 to 7, or it is about 9.0.

8. The cooling device (7) according to one of the preceding claims, wherein the (Hi/Bi) ratio between the height (Hi) and the width (Bi) of the flow guide (13) in the inlet region (16):

- ranges from 1.2 to 0.8, or
- it is about 0.96,

and wherein the (Ho/Bo) ratio between the height (Ho) and the width (Bo) of the outlet opening (15):

- ranges from 0.005 to 0.045, or
- it is about 0.025,

and wherein the (Bo/L) ratio between the width at the outlet opening (15) and the length of the flow guide (13) in the direction of the rotational axis (17):

- ranges from 1.2 to 1.6, or
- it is about 1.44.

9. The cooling device (7) according to one of the preceding claims, wherein, in the inlet zone (16), the flow guide (13) has a tubular shape having a substantially constant cross-section.

10. The cooling device (7) according to one of the preceding claims, wherein the flow guide (13) is formed by an approximately planar portion of the base wall (9) and a bulging half-shell (22), separately manufactured and subsequently connected to the base wall (9).

11. A cooking oven (1) comprising a housing (2), a heatable cooking cavity (3) formed in the housing, a door (5) for opening and closing the cooking cavity (3), a cooling device (7) for cooling a gripping zone (6) of the door (5), said cooling device (7) being arranged in a cooling compartment (8) obtained in the housing (2) externally to the cooking cavity (3) and it comprises:

- a base wall (9),
- a fan connected to the base wall (9) and having an electric motor (10) and an axial flow impeller (11) connected to a shaft (12) of the electric motor (10),
- a tubular flow guide (13) connected to the base wall (9) and having an inlet opening (14) and an outlet opening (15) facing in the proximity of the gripping zone (6),

wherein the axial flow impeller (11) is arranged inside the tubular flow guide (13) in an inlet zone (16) in the proximity of the inlet opening (14), and wherein a flow section of the tubular flow guide (13), orthogonal to the rotational axis (17) of the impeller (11), gradually widens in a first direction (18) orthogonal to the rotational axis (17) and gradually tapers in a second direction (19) orthogonal to both the rotational axis (17) and the first direction (18), going from the inlet zone (16) up to the outlet opening (15).

12. A cooking oven (1) according to claim 10, wherein the rotational axis (17) of the impeller (11) is substantially orthogonal to the plane of the door (5) when it is in the closed position.

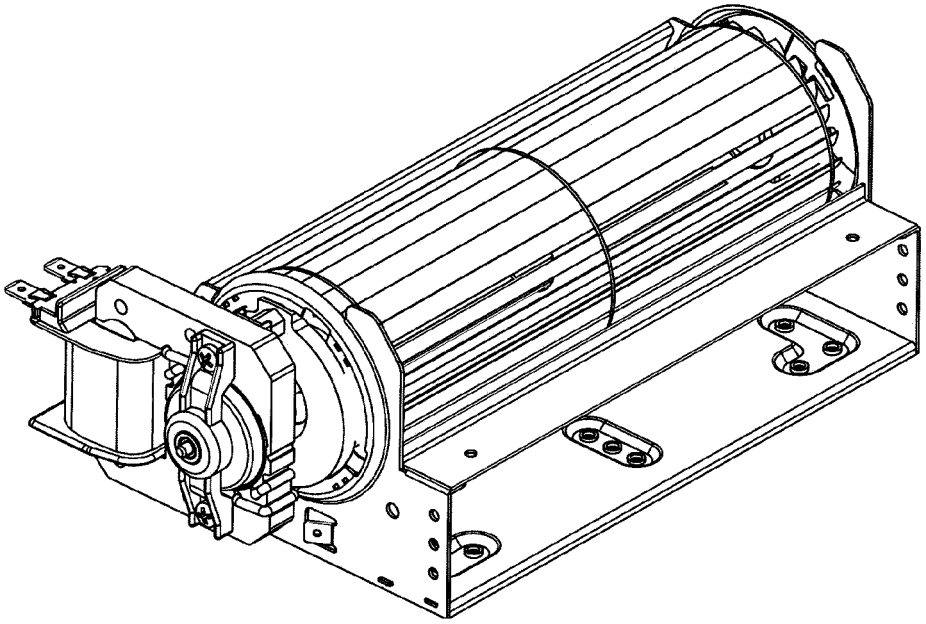

FIG. 1

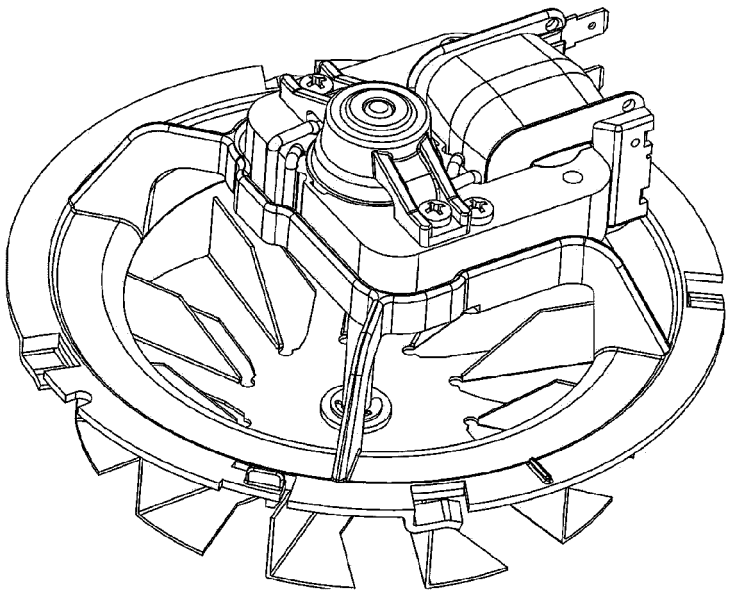

FIG. 2

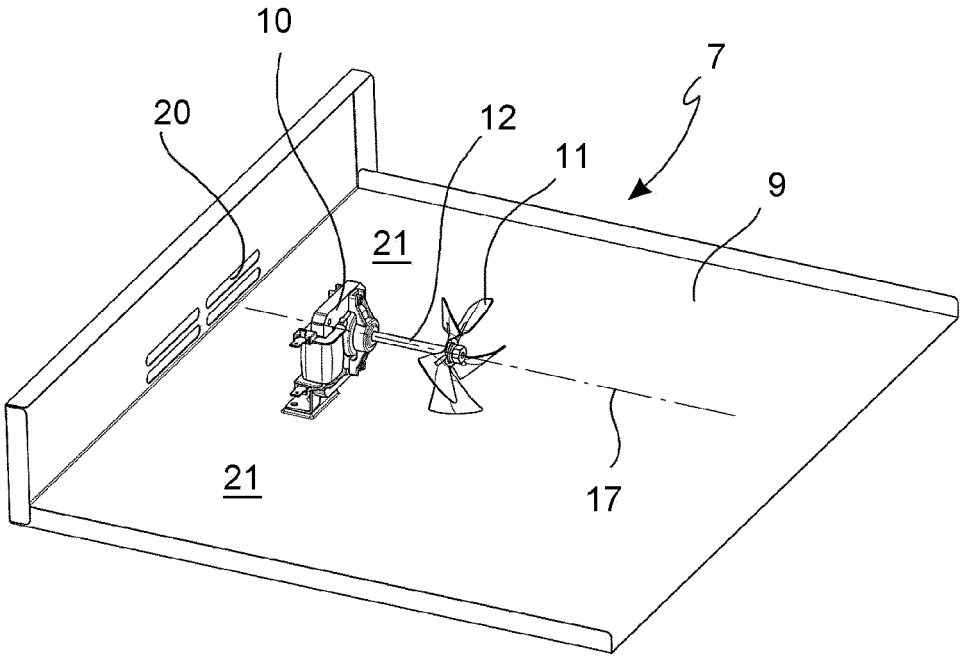

FIG. 3

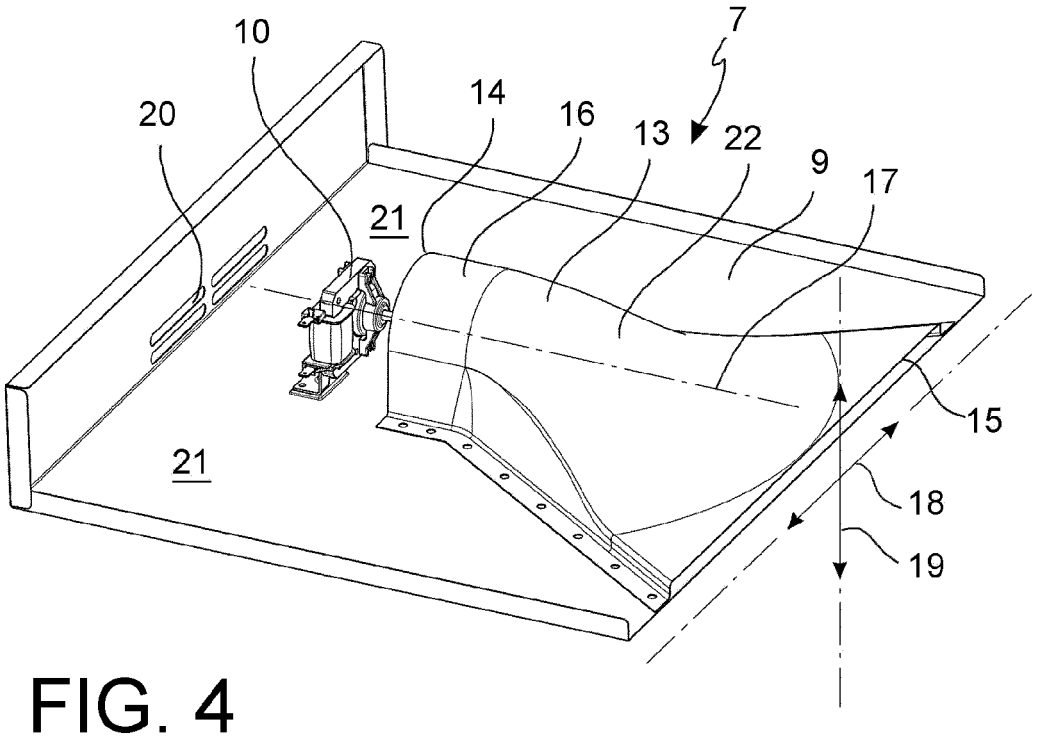

FIG. 4

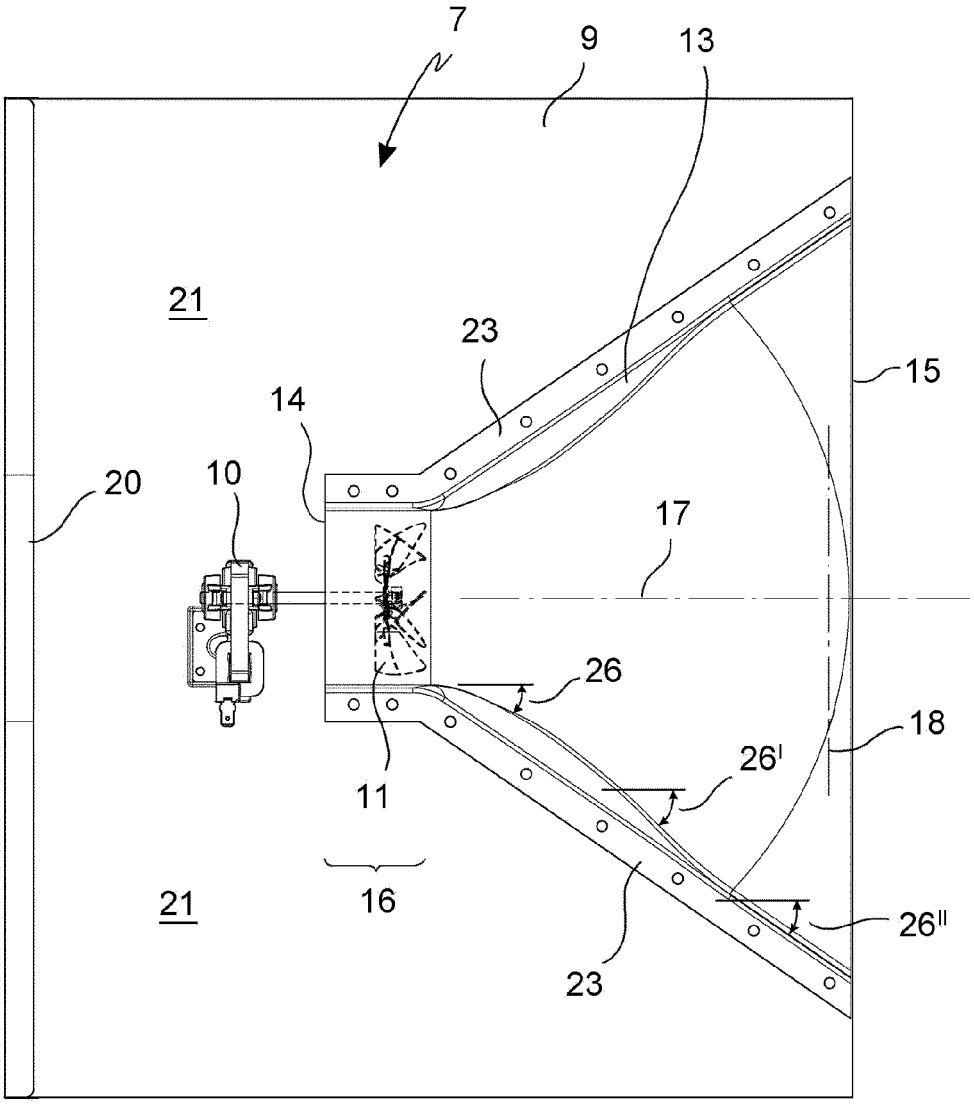
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FIG. 5

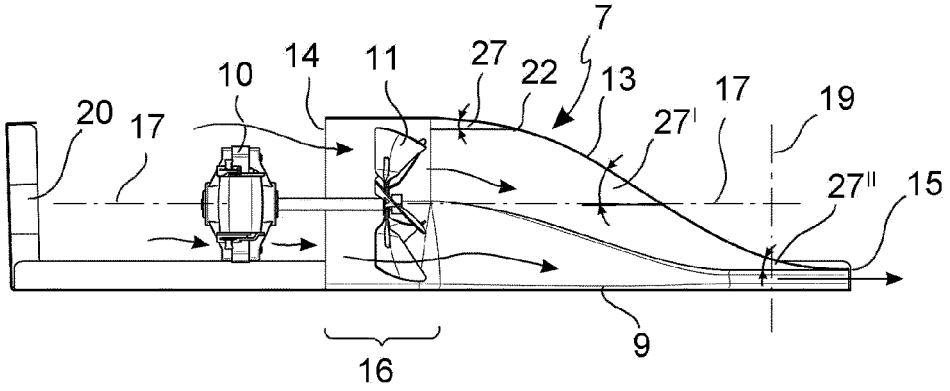
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FIG. 6

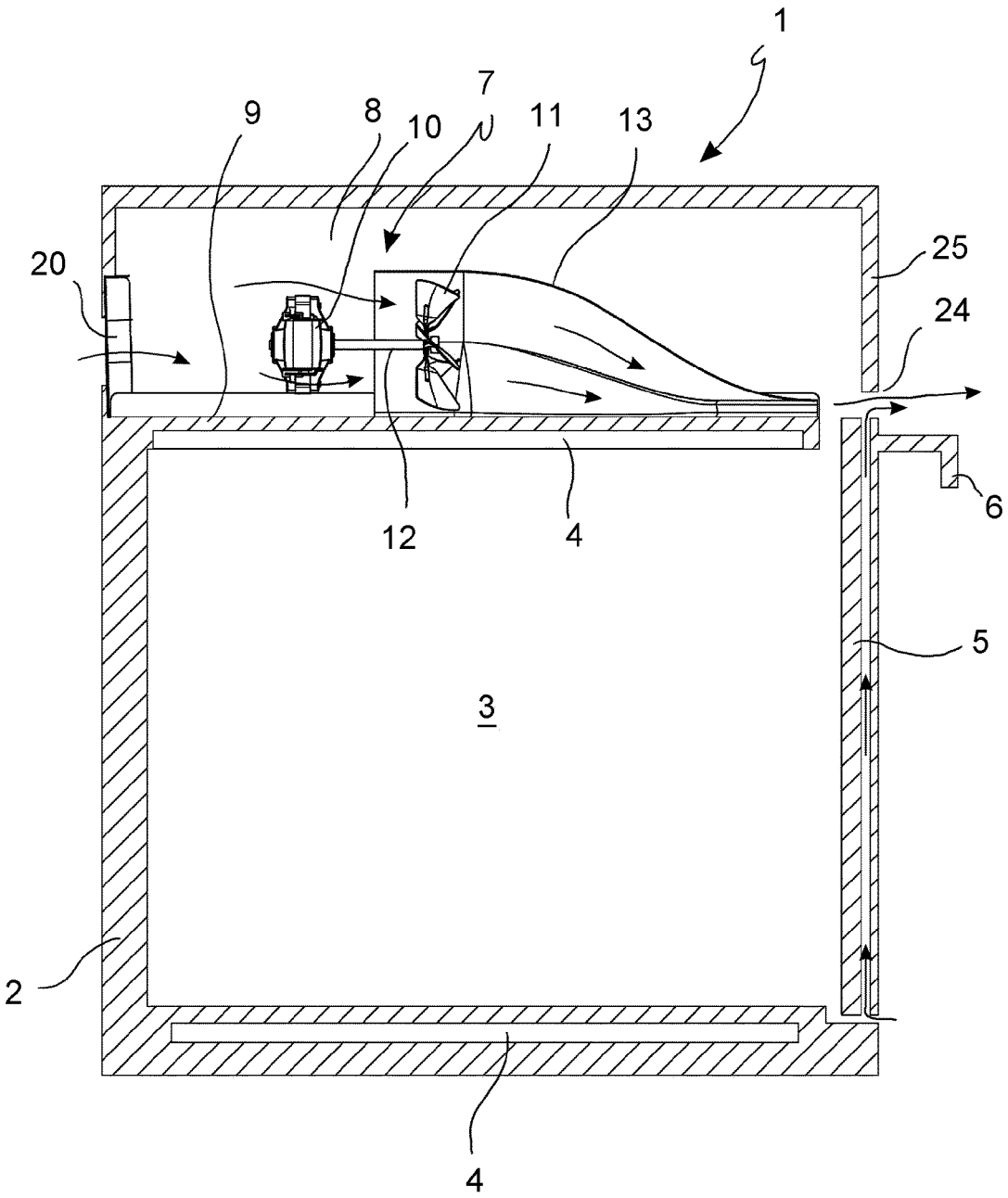

FIG. 7

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EUROPEAN SEARCH REPORT

Application Number
EP 15 17 6568

DOCUMENTS CONSIDERED TO BE RELEVANT

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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	11 December 2015	Verdoodt, Luk

CATEGORY OF CITED DOCUMENTS

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