

(19)



(11)

EP 2 314 757 A1

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:
27.04.2011 Bulletin 2011/17

(51) Int Cl.:
D06F 58/20^(2006.01) D06F 58/24^(2006.01)

(21) Application number: **09425411.7**

(22) Date of filing: **20.10.2009**

(84) Designated Contracting States:
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 SE SI SK SM TR
Designated Extension States:
AL BA RS

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(54) Household appliance with improved condenser cooling system

(57) The present invention concerns a household appliance comprising a casing (12) with a condenser (15) housed therein for removing air from a wet air flow, first conveying means (16) for causing wet air to flow through the condenser (15), and second conveying means (17, 28, 29, 33) for causing cooling air (19) to flow through

the condenser (15) and cool the wet air, said second conveying means (17, 28, 29, 33) being adapted to draw the cooling air (19) from outside the casing (12) through an air inlet (18). The inlet (18) is in a position in which it faces towards a floor (20) on which the household appliance (11) lies in its operating position.

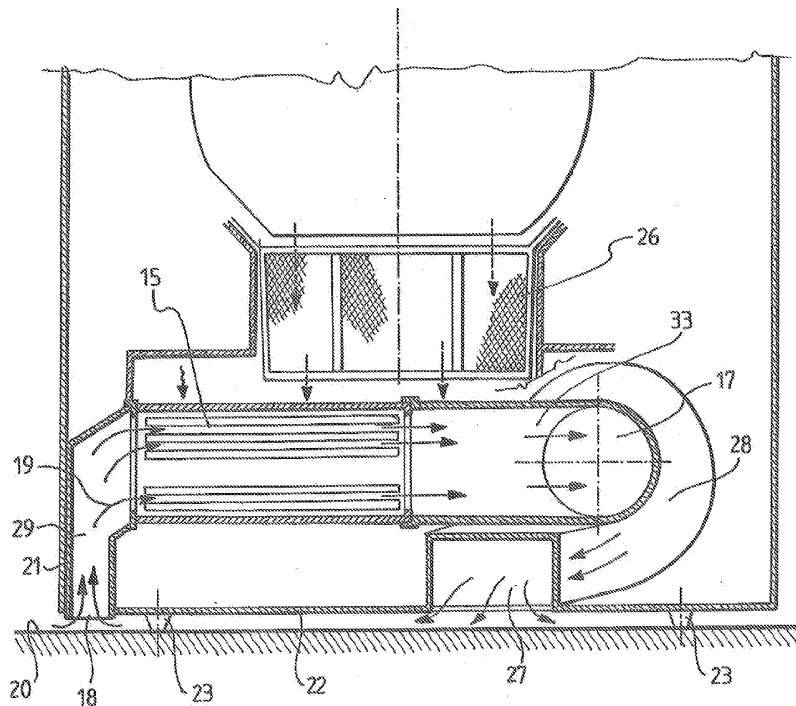


Fig. 2

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Description

[0001] The present invention relates to a household appliance, particularly a laundry dryer, having a condenser and an improved condenser cooling system.

[0002] It is known in the art to provide laundry dryer machines comprising a rotary drum adapted to receive the laundry to be dried, means for heating the drying air and a condenser for removing the moisture contained in the drying air at the exit of the rotary drum. These parts are arranged within an outer casing of the household appliance.

[0003] The machine also comprises a special fan for successively circulating the drying air through the drum, the condenser and the heating means (typically an electrical resistor).

[0004] A second fan is also provided for feeding cooling air through the condenser. The cooling air is typically caused to flow into the laundry dryer through an opening of a side wall of the appliance casing.

[0005] If the environment that surrounds the household appliance is relatively warm, the condenser cooling might not be enough to ensure a satisfactory and effective dehumidification action on the air flow that comes out of the drum. This may affect the results of the whole drying cycle, leaving the laundry still partially wet at the end of the treatment.

[0006] In view of the above state of the art, the object of the present invention is to provide a household appliance, particularly a laundry dryer, wherein the condenser can ensure a satisfactory condensing action on a wet air flow, even with a relatively high room temperature.

[0007] A further object is to provide a household appliance that has a simple, inexpensive and compact structure.

[0008] According to the present invention, this object is fulfilled by a household appliance comprising:

- a casing that houses a condenser for removing water from a wet air flow,
- first conveying means for causing wet air to flow through the condenser, and
- second conveying means for causing cooling air to flow through the condenser to cool said wet air,

said second conveying means being adapted to draw the cooling air from outside the casing through an air inlet, **characterized in that** said inlet is in a position in which it faces towards a floor on which the household appliance lies in an operating position.

[0009] The characteristics and advantages of the present invention will appear from the following detailed description of one practical embodiment, which is given as a non limiting example with reference to the annexed drawings, in which:

- Figure 1 is a perspective view of a household appliance of the invention, with certain parts being omitted

for a clearer vision of the internal components of the appliance,

- Figure 2 is an elevational cross sectional view of the condenser and its cooling system,
- 5 - Figure 3 is a plan view of the condenser and its cooling system.

[0010] The figures show a laundry dryer 11 having an outer casing 12, with a rotary drum 13, a condenser 15 and heating means 14 arranged therein.

[0011] The rotary drum 13 has a cavity for receiving the laundry to be dried, and is rotated, during operation, by known motor means.

[0012] The heating means 14, preferably consisting of an electrical resistor, have the task of heating the drying air 24 circulating in the household appliance.

[0013] Condenser 15 has, in use, the task of removing moisture from the drying air that comes out of the drum 13 and may be formed as is known per se in the art. For instance, the condenser 15 may include tube bundles designed to carry wet air and be impinged upon by the cooling air flow.

[0014] The laundry dryer also comprises first conveying means 16 for successively circulating the drying air through the rotary drum 13, the condenser 15 and the heating means 14.

[0015] The first conveying means 16 are preferably made of a fan placed downstream from the condenser 15 and upstream from the heating means 14.

[0016] Preferably, a drying air filter 26 is placed downstream from the drum 13 and upstream from the condenser 15.

[0017] A tank 30 is also placed downstream from the condenser 13 for collecting condensed water, the latter being then pumped by the pump 31 into a container 32 located at the front opening of the household appliance. By opening the window 25 that closes the front opening, the container 32 may be removed from the household appliance and emptied of condensed water and being able to access the drying cavity of the drum 13.

[0018] The household appliance 11 also comprises second conveying means 17, 28, 29, 33 for causing the cooling air 19 to flow through the condenser 15.

[0019] The wet air flow 24 that comes out of the drum 13 flows through the condenser 15 in a first direction and the cooling air flow 19 flows through it in a second direction. Preferably, the direction of the cooling air flow through the condenser 15 is transverse to the direction of the wet air flow 24.

[0020] The second conveying means include a fan 17. The fan 17 is preferably placed downstream from the condenser 15, with respect to the direction of the cooling air flow 19.

[0021] The second conveying means are adapted to draw the cooling air 19 from outside the casing 12.

[0022] Particularly, according to the invention, the second conveying means are adapted to draw the cooling air from outside the casing 12 through an inlet 18 that

faces towards the floor 20 on which the household appliance 11 lies in its operating position.

[0023] As used herein, the term "operating position" is intended to indicate the normal position that the household appliance 11 takes when it performs its primary task (for instance, in the case of a laundry dryer, the task of drying laundry).

[0024] This particular novel position of the cooling air inlet 18 affords a more efficient cooling action in the condenser 15. In fact, air is normally colder near the floor of a room, and warmer at higher levels. Furthermore, air is forced to flow over the floor (which is normally colder than air) before entering the condenser. This allows the cooling air to be on average colder than the air in the room where the household appliance is located. Therefore, even when ambient temperature is relatively warm, the laundry dryer may ensure a satisfactory cooling action on the wet air that flows through the condenser 15. This affords a more effective condensation effect, and a generally more effective laundry drying cycle.

[0025] The inlet 18 faces towards the floor, with its axis so oriented as to cross the floor 20. Preferably, in the operating condition, the axis of the inlet 18 is inclined at an angle of less than 45° to a line orthogonal to the floor; in a particularly preferred embodiment, as shown in the figures, the axis of the inlet 18 is substantially orthogonal to the floor 20, in the operating position of the household appliance.

[0026] Preferably, the inlet 18 is made of an inlet opening formed in the bottom wall 22 of the casing 12 of the laundry dryer 11.

[0027] The inlet 18 is advantageously located in the proximity of a side wall 21 of the casing.

[0028] Preferably, the inlet 18 has an elongate shape (as clearly shown in Figure 3) and extends along a side edge of the bottom wall 22 of the casing. This configuration provides satisfactory flow and distribution of air into the condenser, without requiring any special size or high-power fan 17.

[0029] Preferably, the inlet 18 is at 0.5 cm to 5 cm from the floor, with the household appliance in its operating position, due to the provision of support means 23 that keep the household appliance 11 (and the inlet 18) at a desired height. This both provides an improved cooling effect and ensures a sufficient flow into the condenser.

[0030] Preferably, the width of the inlet 18 (i.e. the smaller size of the inlet 18) as shown in Figure 2, is greater than the distance of the inlet 18 from the floor 20, with the household appliance 11 in its operating position.

[0031] The second conveying means also include a conduit 29 that carries the cooling air from the inlet 18 to the condenser 15, and a conduit 33 that carries the cooling air from the condenser 15 to the fan 17. A conduit 28 is also provided for carrying the cooling air from the fan 17 to the outlet 27.

[0032] In one embodiment, the outlet 27 is made of an opening formed in the front wall of the casing 11. Preferably, in this case, the outlet is located at a distance

equal to at least half the width of the household appliance. This avoids any air recirculation below the appliance, and prevents the air that comes out of the outlet 27, and heated in the condenser, from being sucked back into the inlet 18.

[0033] The cold circuit system should be advantageously in line with the motor and the circuit should be under vacuum. This ensures a more uniform flow through the condenser, as compared with e.g. the uniformity obtained under pressure, and ensures lower parasitic flow distortions. Furthermore, this circuit under vacuum promotes and enhances the local temperature of the ventilation system within the movable casing.

[0034] The above clearly shows that the objects of the present invention have been fulfilled.

[0035] Particularly, the invention provides a household appliance having a condenser and an effective condenser cooling system. The position of the cooling air inlet actually ensures satisfactory condenser cooling, even when the surrounding environment is relatively warm. This allows an effective drying cycle relatively independently of environmental conditions.

[0036] Furthermore, due to the particular shape and position of the inlet, the household appliance is inexpensive and compact, and sufficient air flows may be obtained for proper operation of the condenser.

[0037] Those skilled in the art will obviously appreciate that a number of changes and variants may be made to the arrangements as described hereinbefore to meet incidental and specific needs, without departure from the scope of the invention, as defined in the following claims.

Claims

1. A household appliance comprising:
 - a casing (12) that houses a condenser (15) for removing water from a wet air flow,
 - first conveying means (16) for causing wet air to flow through the condenser (15), and
 - second conveying means (17, 28, 29, 33) for causing cooling air (19) to flow through the condenser (15) and cool said wet air,

said second conveying means (17, 28, 29, 33) being adapted to draw the cooling air (19) from outside the casing (12) through an air inlet (18), **characterized in that** said inlet (18) is in a position in which it faces towards a floor (20) on which the household appliance (11) lies in its operating position.
2. A household appliance as claimed in claim 1, **characterized in that** said inlet (18) is formed at an opening of a bottom wall (22) of the casing.
3. A household appliance as claimed in any of the preceding claims, **characterized in that** the inlet (18)

is in the proximity of a side wall (21) of the casing.

4. A household appliance as claimed in one or more of the preceding claims, **characterized in that** the inlet (18) has a narrow elongate shape and extends along a side edge of said bottom wall (22). 5

5. A household appliance as claimed in one or more of the preceding claims, **characterized in that** it has an outlet (27) through which, in use, cooling air is ejected from the appliance after flowing through the condenser (15), said outlet (27) consisting of an opening on a side wall or on said bottom wall (22) of the casing of the household appliance. 10
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6. A household appliance as claimed in one or more of the preceding claims, **characterized in that** the outlet (27) is at a distance from the inlet (18) equal to at least half the width of the casing (12) of the household appliance. 20

7. A household appliance as claimed in one or more of the preceding claims, **characterized in that** it has support means (23) for keeping, in use, said inlet (18) at 0.5 cm to 5 cm from the floor (20). 25

8. A household appliance as claimed in one or more of the preceding claims, **characterized in that** the axis of the inlet (18) is substantially orthogonal to the floor (20), when the household appliance is in the operating position. 30

9. A household appliance as claimed in one or more of the preceding claims, **characterized in that** the smallest width of the inlet (18) is greater than the distance of the inlet (18) from the floor (20), when the household appliance is in its operating position. 35

10. A household appliance as claimed in one or more of the preceding claims, **characterized in that** it is a laundry dryer comprising a rotary drum (13) for receiving the laundry to be dried and heating means (14) for heating a drying air, wherein said first conveying means are adapted to successively circulate the drying air through the drum (13), the condenser (15) and the heating means (14). 40
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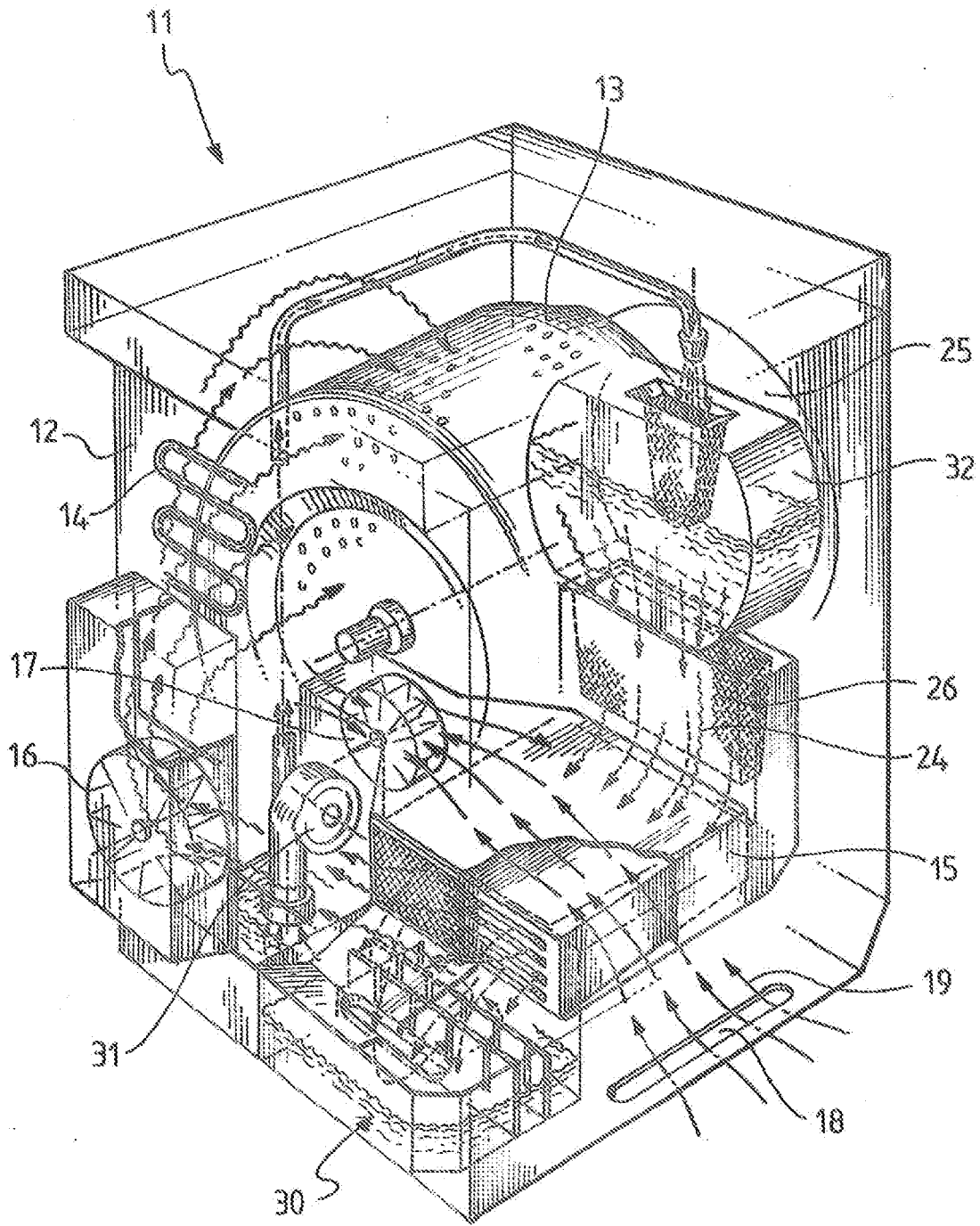


Fig. 1

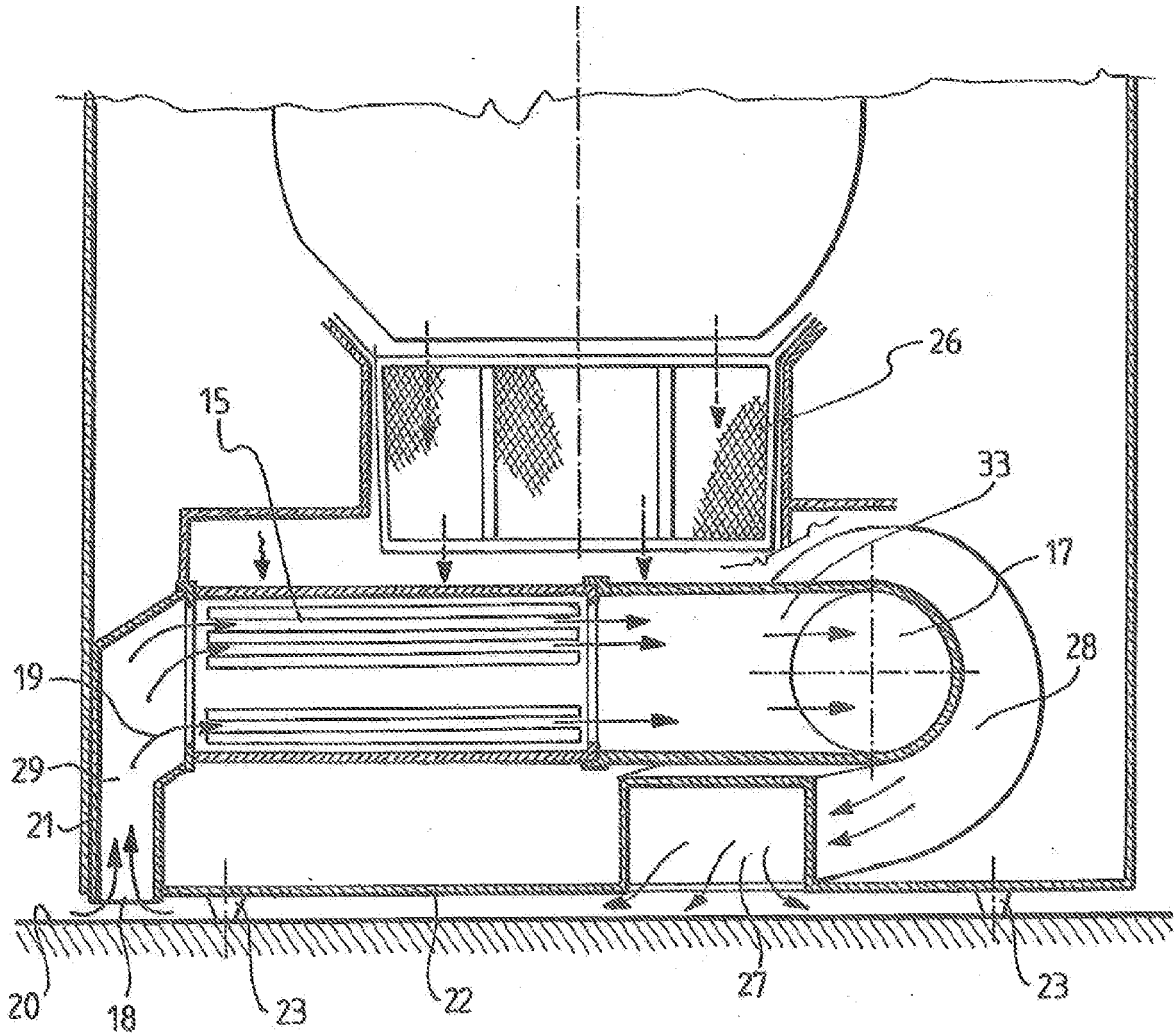


Fig. 2

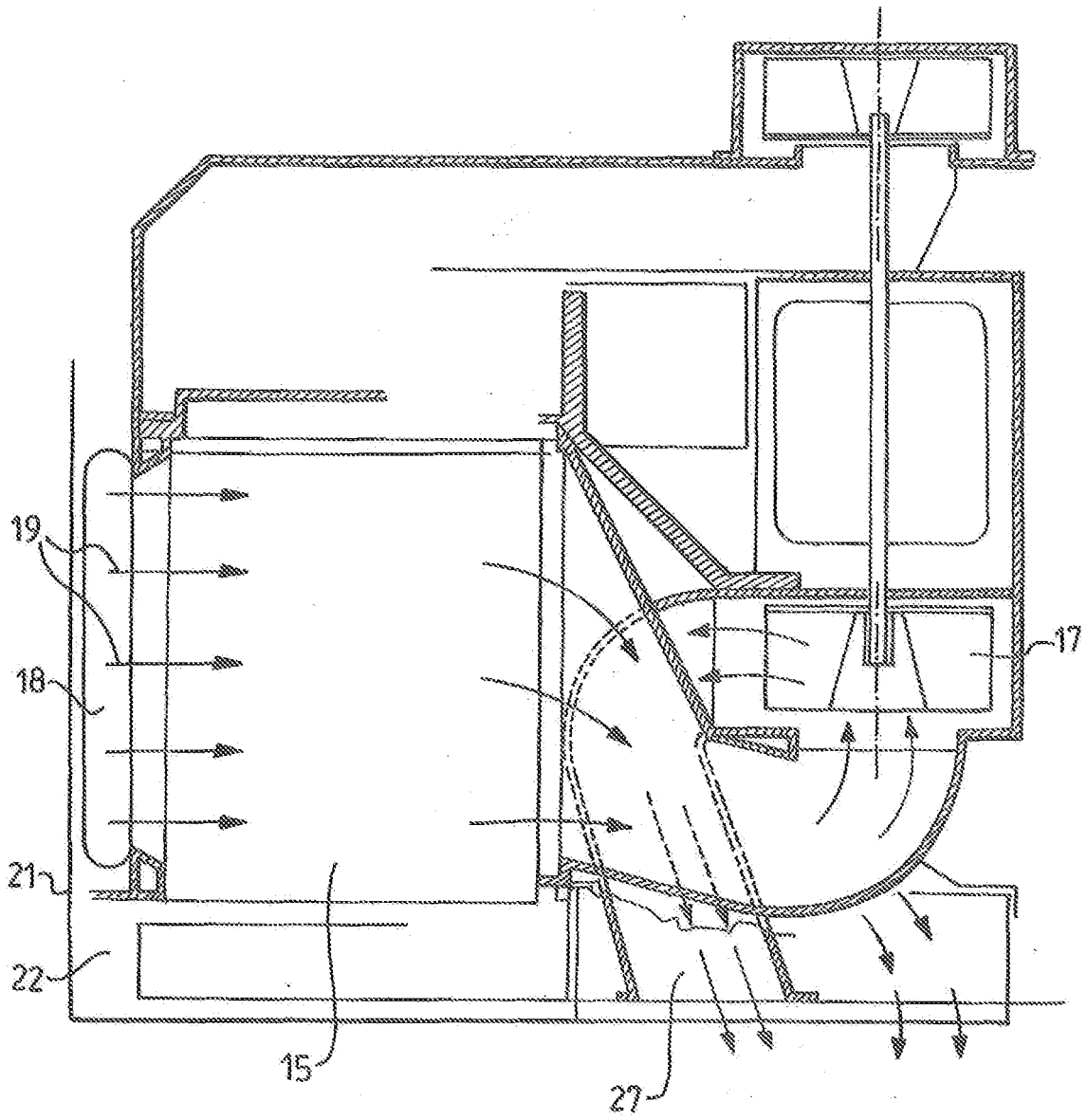


Fig. 3



EUROPEAN SEARCH REPORT

Application Number
EP 09 42 5411

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The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (IPC)
			D06F
Place of search		Date of completion of the search	Examiner
Munich		8 April 2010	Fachin, Fabiano
CATEGORY OF CITED DOCUMENTS		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	
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		& : member of the same patent family, corresponding document	

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**ANNEX TO THE EUROPEAN SEARCH REPORT
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EP 09 42 5411

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