



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
12.02.2014 Bulletin 2014/07

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

(21) Application number: **13179163.4**

(22) Date of filing: **02.08.2013**

(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

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(30) Priority: **09.08.2012 IT PR20120053**

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(54) **Household electrical appliance for drying items and operating method**

(57) Household electrical appliance for drying items comprising:

- a drying compartment (2) for the items;
- a first channel (3) which envisages an inlet (31) of a fluid present in the drying compartment (2) and an outlet (32) for re-introducing said fluid into the drying compartment (2);
- suction and movement means (30) of said fluid into the first channel (3);
- a second channel (4) which envisages a cooling air inlet (41) from the outside of the household electrical appliance (1) and an air outlet (42) to the outside of the household electrical appliance (1);
- suction and movement means (40) of said air into the second channel (4);
- a heat exchanger (5) which puts into thermal communication at least one stretch of the first channel (3) and a stretch of the second channel (4) and in which the cooling air takes heat away from the fluid transiting in the first channel (3);
- purification means (6) of the cooling air, said purification means (6) being electrically powered and being placed along the second channel (4) to treat the air intended to be returned to the outside of the household electrical appliance (1).

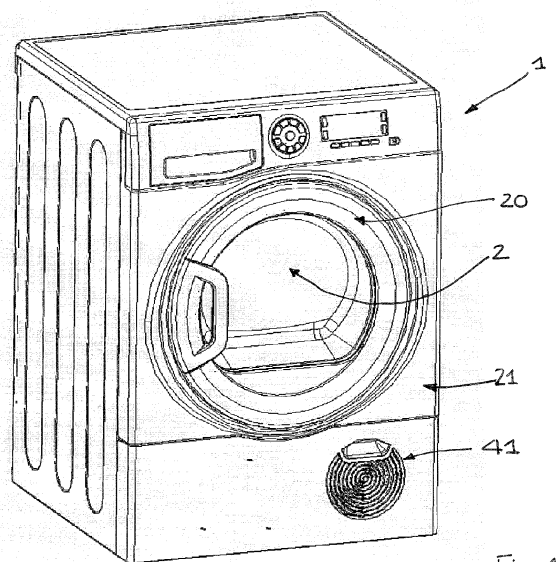


Fig. 1

Description

[0001] This invention relates to a household electrical appliance for drying items. A household electrical appliance for drying items is known comprising a drying compartment for items to which access is possible through a door. Appropriately such a household electrical appliance comprises a first channel comprising:

- a first stretch for evacuating the damp air present in the drying compartment;
- a heat exchange zone in which the condensation takes place of the humidity present in the air transiting along the first stretch;
- a second stretch for re-introducing into the drying compartment the air transiting in the first channel.

[0002] Along the second stretch, the air is heated and then reused for drying the items present in the compartment. The second stretch is downstream of the heat exchange zone which is in turn downstream of the first stretch. Likewise, the household electrical appliance comprises a cooling channel that takes air from the outside, takes heat away from the air present in the heat exchange zone of the first channel and returns the heated air to the external environment.

[0003] Typically, a household electrical appliance of the type described above is known in the field of the art as a condensation dryer and is typically arranged in a domestic environment such as a bathroom or a basement. Document DE3004168A1 discloses a domestic clothes drying machine directing cooling air from front port into condenser and around drum to rear exit.

[0004] In this context, the technical task on which the present invention is based is to propose an improvement to said household electrical appliance for drying items.

[0005] In particular, an object of the present invention is to provide a household electrical appliance for drying items that at the same time allows an air purification treatment to be performed on the air present in the room in which the electrical household appliance is placed.

[0006] Furthermore, an object of the present invention is to provide a household electrical appliance for drying items that performs said purification treatment making the energy consumption required for such an operation minimal.

[0007] The specified technical objective and the set aims are substantially attained by a household electrical appliance for drying items, comprising the technical characteristics set down in one or more of the appended claims.

[0008] Further characteristics and advantages of the present invention will become more evident from the non-limiting description of a preferred but not exclusive embodiment of a household electrical appliance for drying items, as illustrated in the accompanying drawings, in which:

- Figure 1 shows a perspective view of a household electrical appliance for drying items according to the present invention;
- Figures 2 and 3 show details of the household electrical appliance of Figure 1;
- Figure 4 shows an accessory that can be used with the household electrical appliance of Figure 1;
- Figure 5 shows a schematic view of a household electrical appliance according to the present invention.

[0009] In the appended figures reference number 1 indicates a household electrical appliance for drying items (clothing, textiles, cloths, etc.). The household electrical appliance 1 is typically a dryer, in particular a condensation dryer. A further example of a household electrical appliance for drying items could be a washer-dryer (wherein as well as the drying function there is also a washing function). The household electrical appliance 1 comprises a compartment 2 for drying items. Typically such a compartment 2 is accessible by a user through a door 20. Usually the household electrical appliance 1 comprises a front portion 21 that develops between the top and the bottom. The door 20 is typically afforded in said front portion 21.

[0010] The household electrical appliance 1 further comprises a first channel 3 which envisages an inlet 31 of a fluid present in the drying compartment (2) and an outlet 32 for re-introducing said fluid into the drying compartment 2. The household electrical appliance 1 further comprises suction and movement means 30 of said fluid into the first channel 3. Typically the suction and movement means 30 of the fluid into the first channel 3 are comprised by a same fluid movement organ. Usually the suction and movement means 30 comprise an electrically activated impeller.

[0011] The household electrical appliance 1 further comprises a second channel 4 which envisages an inlet 41 of cooling air from the outside of the household electrical appliance 1 and an air outlet 42 to the outside of the household electrical appliance 1.

[0012] Appropriately the household electrical appliance 1 comprises suction and movement means of the air into the second channel 4.

[0013] Appropriately the household electrical appliance 1 further comprises a heat exchanger 5 that puts into thermal communication at least one stretch of the first channel 3 and a stretch of the second channel 4. In the exchanger 5 the cooling air takes heat away from the fluid transiting in the first channel 3. Typically this heat being taken away determines the condensation of the vapour particles present in the fluid transiting in the first channel 3. Consequently this heat exchanger 5 is a condenser. In fact, the fluid present in the first channel 3 upstream of the heat exchanger 5 is damp air (the humidity is taken away from the items placed in the compartment 2).

[0014] Appropriately the household electrical appli-

ance 1 comprises purification means 6 of the cooling air. The purification means 6 are electrically powered and are placed along the second channel 4 to treat the air intended to be returned to the outside of the household electrical appliance 1 (after taking the heat away from the fluid transiting in the first channel 3).

[0015] Advantageously the heat exchanger 5 and/or the second channel 4 and/or the purification means 6 lie on a lower base of the household electrical appliance 1.

[0016] Consequently the second channel 4 performs a double function. A first important function is that of conveying cooling air to the heat exchanger 5 in order to ensure the correct operation of the household electrical appliance 1 for drying items. In fact such cooling air determines the condensation of the vapour present in the fluid transiting in the first channel 3 and therefore allows the re-introduction (after heating) of said fluid into the drying compartment 2.

[0017] A second important function is that of enabling the purification of the air of the environment in which the household electrical appliance 1 is placed (for example a bathroom, a basement, etc.). On this point the suction and movement means 40 of the air at least in one operating mode process an air flow rate greater than or equal to 200 m³/h. In this way in just few minutes it is theoretically possible to treat all the air present in an environment such as a bathroom of 15-20m³.

[0018] Appropriately the fluid transiting in the first channel 3 and the air transiting in the second channel 4 meet in the exchanger 5, but do not mix. Appropriately the purification means 6 of the cooling air comprise/coincide with an ozonizer and/or an ionizer and/or a UV lamp and/or an electrostatic filter. The purification means 6 therefore perform the function of purifying the cooling air transiting in the second channel 4. Appropriately the purification means 6 allow harmful bacteria, pollen and bad smells to be eliminated and more generally the quality of the air to be improved. Along the first channel 3 downstream of the heat exchanger 5 fluid heating means 9 are advantageously present. Still downstream of the heat exchanger 5 the suction and movement means 30 of the fluid into the first channel 3 are also present.

[0019] The purification means 6 of the cooling air (with respect to the flow direction of the air into the second channel 4) are placed upstream of the heat exchanger 5. This is important since the seals of the heat exchanger 5 may not guarantee perfect insulation and consequently a bit of the humidity could be present downstream of the exchanger 5 in the second channel 4. This humidity could interfere with and/or damage the purification means 6 which are electrically powered (especially if an ozonizer or an electrostatic filter or an ionizer are used) if they are downstream of the exchanger 5. Furthermore the air temperature upstream of the heat exchanger 5 is substantially ambient temperature whereas downstream there may be temperatures that could strain the operation of the purification means 6 reducing their reliability and duration. In the preferred embodiment the purification

means 6 with respect to the flow direction of the air into the second channel 3 are placed upstream of the air suction and movement means 40. Typically the air suction and movement means 40 are placed upstream of the heat exchanger 5. Typically the suction and movement means 40 of the air into the second channel 4 are constituted by a same air movement organ. Usually the suction and movement means 40 comprise an electrically activated impeller 400. Typically such an impeller 400 is made of plastic. The use of an impeller 400 made of plastic reduces the interaction with any ions generated by the purification means 6 (like in the event that the means 6 are an ionizer). The advantage of positioning the purification means 6 upstream of the impeller 400 is connected with the fact that at the suction of the impeller 400 the air flow is more stable and regular than at the delivery. Consequently it is possible to treat a larger quantity of air.

[0020] The second channel 4 preferably comprises a housing 70. Typically this housing 70 is placed upstream of the suction and movement means 40 of the air into the second channel 4. In particular the housing 70 comprises a wall 71 that separates the inside of the housing 70 from an electronic control board of the household electrical appliance 1. The purification means 6 project into the housing 70 starting from said wall 71 or are at least partly afforded along said wall 71. In this way the purification means 6 can be easily wired considering their vicinity to the electronic board (which must obviously be electrically powered in turn).

[0021] Appropriately at the inlet 41 of the second channel 4 there is a safety grille 72. This grille 72 prevents an operator accidentally putting a hand into the second channel 4. It further prevents the risk that the suction and movement means 40 can suck up solid bodies of dimensions such as to damage the impeller 400 or the exchanger 5 or other parts of the second channel 4. The grille 72 separates the housing 70 from the outside of the household electrical appliance 1. The purification means 6 are therefore in proximity to an inlet 41 in the second channel 40. This improves the visibility of the means 6 and simplifies assembly and especially maintenance interventions.

[0022] In an optional embodiment the household electrical appliance 1 comprises a support 8 suitable to support at least a garment of clothing (which could also be for example a pair of shoes) or a textile item. The heat exchanger 5 comprises at least a first removable part and at least in a first operating configuration of the household electrical appliance 1 said support 8 is positioned in the place of said at least one first part of the exchanger 5. In said first operating configuration said support 8 is hit by the cooling air transiting in the second channel 4.

[0023] Appropriately said support 8 is a container that identifies a compartment 80 suitable to contain said at least one garment of clothing or textile item (see Figure 4). The container comprises at least a first opening 81 for the inlet of air into the compartment 80 and a second opening 82 for the exit of air from the compartment 80.

The first removable part of the exchanger in the first configuration of the household electrical appliance 1 is replaced by said container. Preferably the whole exchanger 5 is removable and replaced in the first configuration by the container. The exchanger 5 could be in an extractable drawer in order to facilitate its replacement with the container. In the first operating configuration the first opening 81, the second opening 82 and said compartment 80 are crossed by the cooling air and contribute to putting in fluid communication the inlet 41 and the outlet 42 of the second channel 4. The utility of the container is the possibility to store textile items or garments of clothing that need to be cooled down. In this way the cooling air is forced into the container simulating the exposure of the items to the open air. Examples of application could be: removing sweat from trainers, but also treating delicate items such as wool jumpers (where there may be scruples about actually washing them as there could be the risk of ruining the item). This treatment is particularly advantageous in the case of the present invention since the external cooling air has also undergone purification thanks to the means 6. Consequently the quality of the air introduced into the container is better than the air present outside the household electrical appliance 1. Should the container in the first configuration only partly replace the exchanger 5 the treatment of the items present in the container is simultaneous to the drying of the items placed in the drying compartment 2.

[0024] Advantageously the household electrical appliance 1 during the normal operation implements a drying cycle of items placed in the drying compartment 2. This cycle comprises the steps of:

- drawing a wet fluid from the drying compartment 2;
- determining the condensation of at least part of the humidity present in said fluid;
- heating the fluid;
- re-introducing the fluid into the drying compartment 2 (to reuse it for drying the items).

[0025] The household electrical appliance 1 is also able to implement a purification treatment of the cooling air transiting in the second channel 4. Advantageously the purification treatment is at least partly simultaneous to the performance of the drying cycle. This does not exclude the fact that the user may decide to perform the air purification treatment even in the absence of the drying cycle (even if this choice is less energy efficient). The invention as it is conceived enables multiple advantages to be attained.

[0026] In particular it enables the air present in the room where the household electrical appliance 1 is placed to be treated for a negligible cost. For example the ionizer can consume less than 1 Watt whereas the operation of the suction and movement means 40 of the air into the second channel 4 would be necessary anyway for the operation of the household electrical appliance 1 for drying items.

[0027] The invention as conceived is susceptible to numerous modifications and variants, all falling within the scope of the inventive concept characterised thereby. Furthermore all the details can be replaced by other technically equivalent element. In practice, all the materials used, as well as the dimensions, can be any according to requirements.

10 Claims

1. Household electrical appliance for drying items comprising:

- a drying compartment (2) for said items;
 - a first channel (3) which envisages an inlet (31) of a fluid present in the drying compartment (2) and an outlet (32) for re-introducing said fluid into the drying compartment (2);
 - suction and movement means (30) of said fluid into the first channel (3);
 - a second channel (4) which envisages a cooling air inlet (41) from the outside of the household electrical appliance (1) and an air outlet (42) to the outside of the household electrical appliance (1);
 - suction and movement means (40) of said air into the second channel (4);
 - a heat exchanger (5) which puts into thermal communication at least one stretch of the first channel (3) and a stretch of the second channel (4) and in which the cooling air takes heat away from the fluid transiting in the first channel (3);
- characterised in that** it comprises purification means (6) of the cooling air, said purification means (6) being electrically powered and being placed along the second channel (4) to treat the air intended to be returned to the outside of the household electrical appliance (1).

2. Household electrical appliance according to claim 1, **characterised in that** the purification means (6) of the cooling air comprise/coincide with an ozonizer and/or an ionizer and/or a UV lamp and/or an electrostatic filter.

3. Household electrical appliance according to claim 1 or 2, **characterised in that** the purification means (6) of the cooling air with respect to the air flow direction in the second channel (4) are placed upstream from the heat exchanger (5).

4. Household electrical appliance according to any of the previous claims, **characterised in that** the purification means (6) of the cooling air, with respect to the air flow direction in the second channel (3) are placed upstream from the air suction and movement means (40).

5. Household electrical appliance according to any of the previous claims, **characterised in that** the air suction and movement means (40) at least in one operating mode process an air flow rate greater than or equal to 200 m³/h. 5

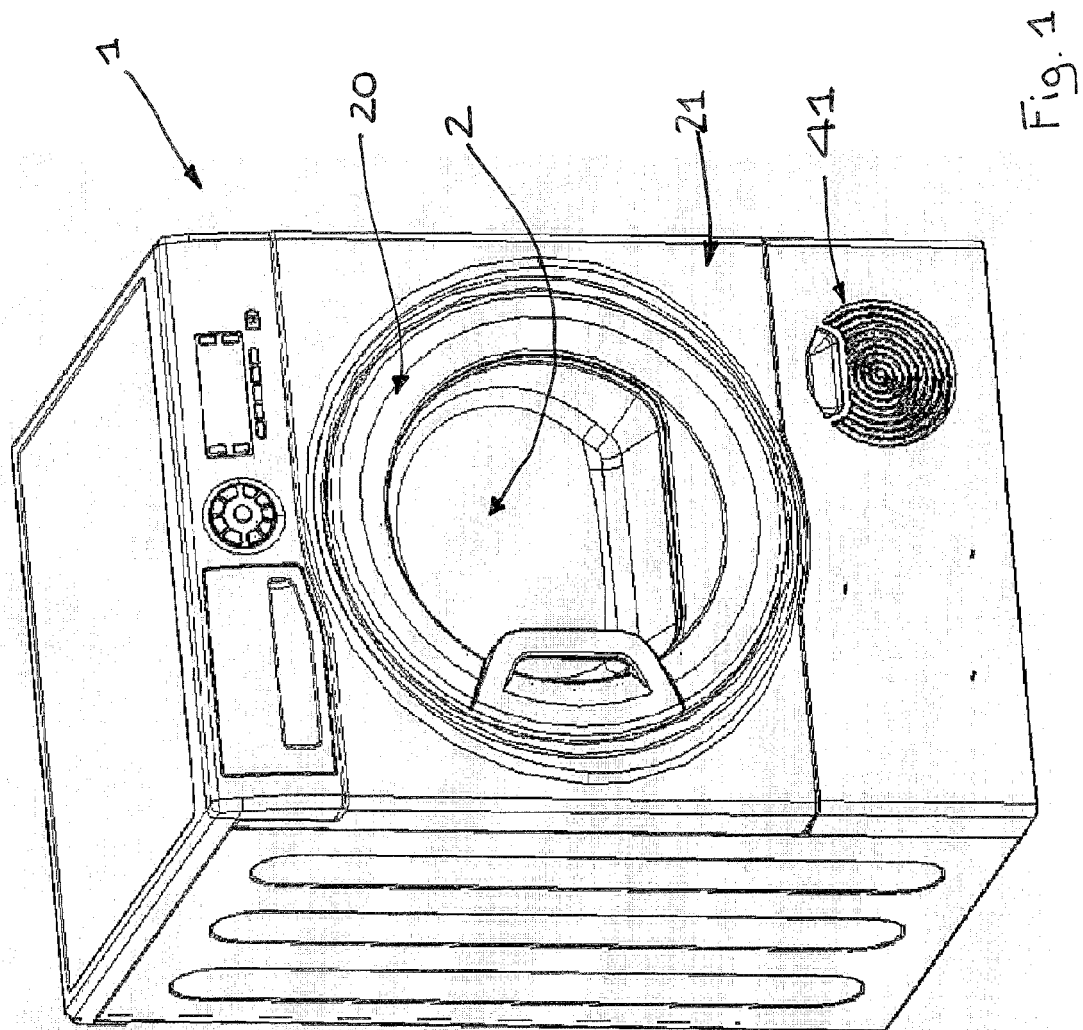
6. Household electrical appliance according to any of the previous claims, **characterised in that** it comprises an electronic control board of the household electrical appliance (1); said second channel (4) comprising a housing (70) in turn comprising a wall (71) which separates the inside of the housing (70) from the electronic board; said purification means (6) projecting themselves within the housing (70) starting from said wall (71) or being at least partly obtained along said wall (71). 10 15

7. Household electrical appliance according to claim 6, **characterised in that** it comprises a safety grille (72) which contributes to delimiting said housing (70) separating it from the outside of the household electrical appliance (1), said grille (72) being obtained in correspondence with a front portion of the household electrical appliance (1). 20 25

8. Household electrical appliance according to any of the previous claims, **characterised in that** it comprises a support (8) suitable to support at least one garment of clothing or a textile item or a pair of shoes; said heat exchanger (5) comprising at least one first part which is removable; at least in a first operating configuration of the household electrical appliance (1) said support (8) being positioned in the place of said at least one first part of the exchanger (5); in said first operating configuration said support (8) being hit by the air transiting in the second channel (4). 30 35

9. Operating method of the household electrical appliance according to any of claims 1 to 8, **characterised in that** it implements a purification treatment of the cooling air transiting in the second channel (4), said air purification treatment being performed by said purification means (6). 40

10. Method according to claim 9, **characterised in that** it implements a drying cycle of items placed in the drying compartment (2), said cycle comprising the steps of: 45
 - drawing a wet fluid from the drying compartment (2); 50
 - determining the condensation of at least part of the humidity present in said fluid;
 - heating the fluid;
 - re-introducing the fluid into the drying compartment (2); the purification treatment being at least partly contemporaneous to the performance of the drying cycle. 55



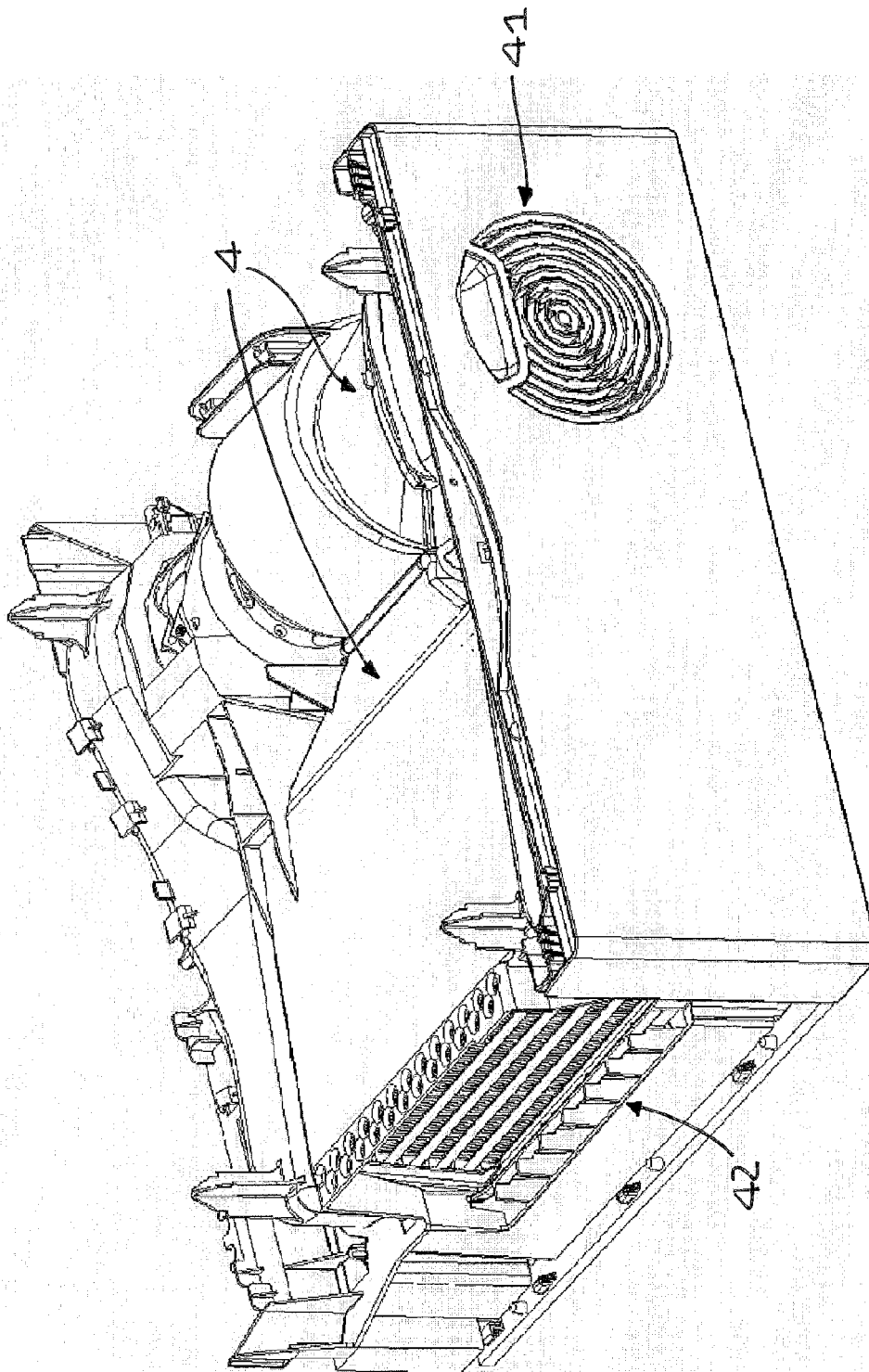


Fig. 2

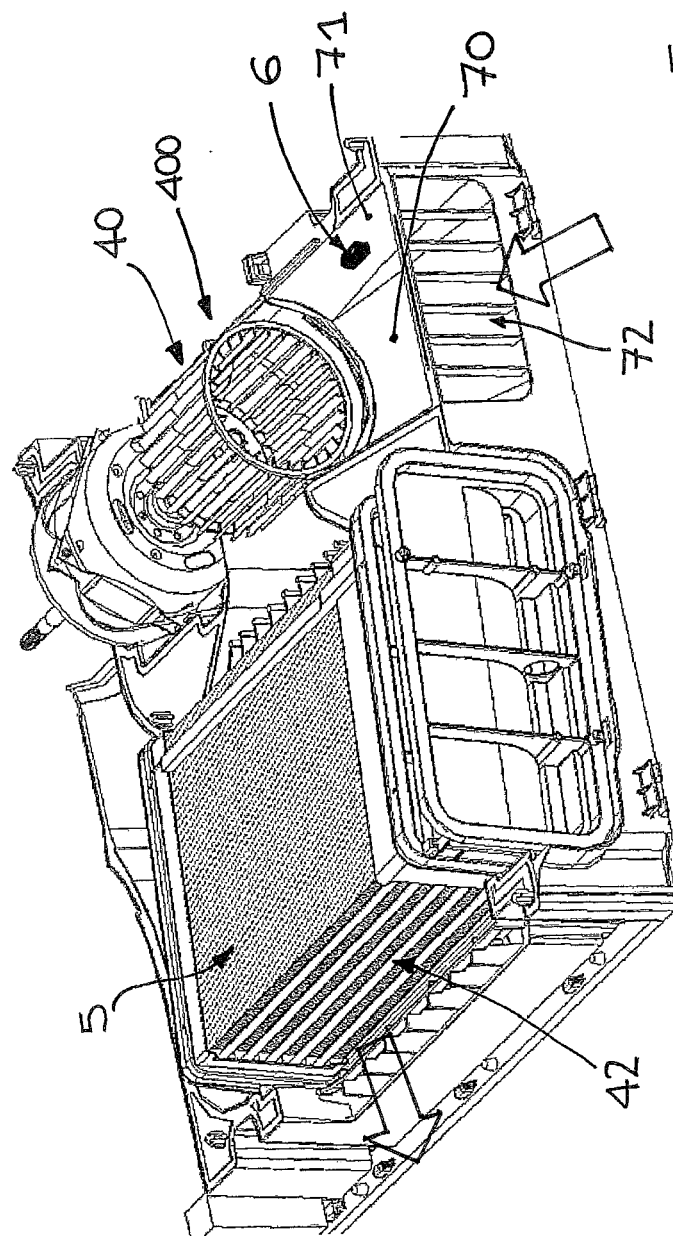
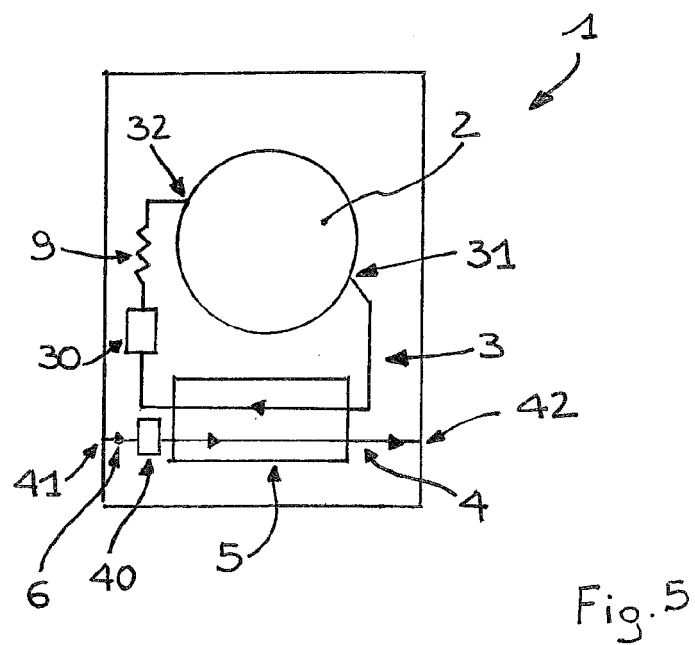
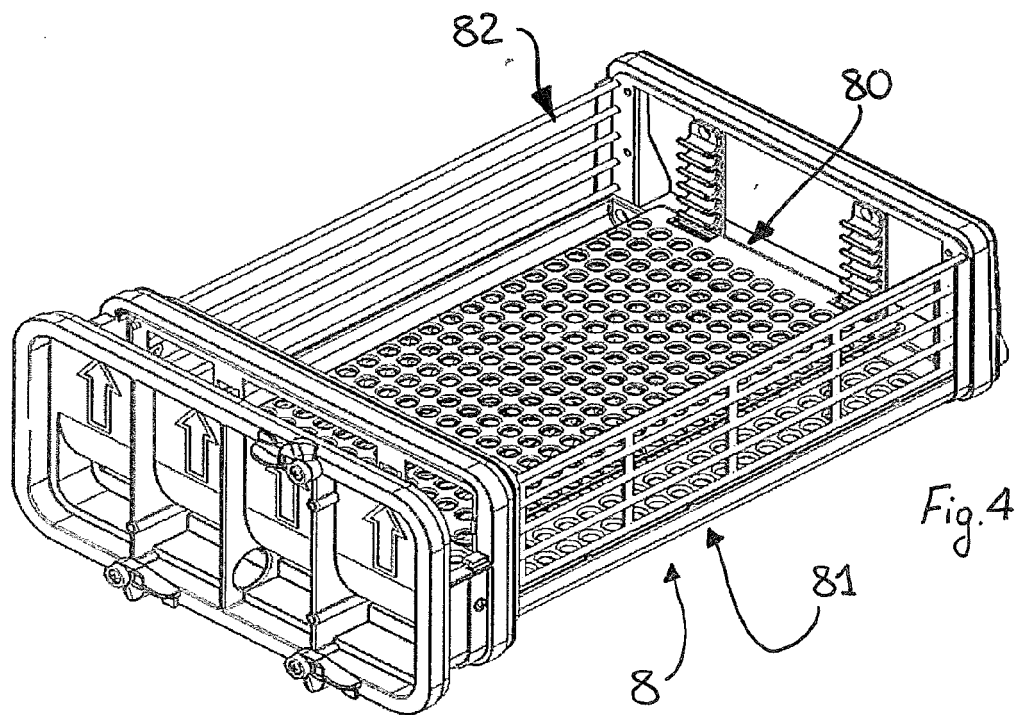


Fig.3





EUROPEAN SEARCH REPORT

Application Number
EP 13 17 9163

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	DE 30 04 168 A1 (BOSCH SIEMENS HAUSGERAETE [DE]) 13 August 1981 (1981-08-13) * the whole document *	1-10	INV. D06F58/24 D06F58/20
A	EP 2 314 757 A1 (CANDY SPA [IT]) 27 April 2011 (2011-04-27) * the whole document *	1-10	
A	EP 0 716 178 A2 (SHARP KK [JP]) 12 June 1996 (1996-06-12) * the whole document *	1-10	
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		26 November 2013	Stroppa, Giovanni
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			

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EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 13 17 9163

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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26-11-2013

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EP 2314757	A1	27-04-2011	NONE
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REFERENCES CITED IN THE DESCRIPTION

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