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(54) **Drying or washing/drying machine comprising interchangeable condensation means**

(57) The invention relates to a clothes (2) drying or washing/drying machine (1), comprising a heater (8), a heat exchanger (9), and a tub inside of which a rotary drum (3) is located, wherein the heat exchanger (9) is at least partly interchangeable with a drawer (110) where items to be subjected to a drying and/or refreshing treatment, such as clothes, footwear or the like, can be placed.

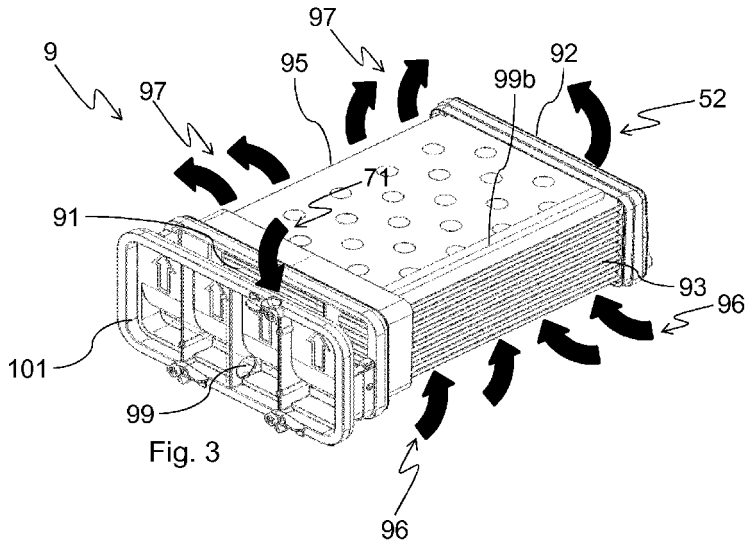

Fig. 3

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Description

[0001] The present invention relates to a drying or washing/drying machine according to the preamble of claim 1.

[0002] As is known, in order to subject clothes made of textiles such as wool, cashmere or the like, or footwear or the like, to a drying cycle, it is necessary to take special measures to prevent such items from suffering any damage. In such cases, drying supports are used, which are generally called "racks", and which can be placed into the rotary drum of said machine (see annexed Fig. 1) to contain or hold clothes or footwear, so as to avoid any contact between said clothes or said footwear and the rotary drum, which might otherwise damage the fibres or the most delicate parts thereof. These drying supports can suspend the clothes or footwear at the centre of the rotary drum, since they are usually coupled to the inner edge of the door of the drying machine (through which access can be gained to the inside of the rotary drum), so that the delicate clothes or the footwear will not be subjected to the rotary motion imparted by the rotary drum, but only to a drying air flow that will remove humidity therefrom.

[0003] When these drying supports are in use, it is however difficult to use the rotary drum for drying other laundry not requiring particular attention, because such moving laundry might hit against and cause damage to the drying support.

[0004] Furthermore, it would be desirable to be able to subject footwear or the like to refreshing cycles without giving rise to hygiene problems for the rotary drum of the drying or washing/drying machine.

[0005] The present invention aims at solving these and others problems by providing a drying or washing/drying machine as set forth in the appended claim 1.

[0006] The idea at the basis of the present invention is to use a drying or washing/drying machine comprising condensing means which can be interchanged with a drawer capable of containing items such as clothes, footwear or the like, so that the rotary drum will still be usable at the same time. Moreover, when the exchanger is removed, the machine advantageously turns itself into an open-cycle drying or washing/drying machine, referred to in the industry as "vented", wherein most of the air will not reenter the drum during the refreshing cycles, thus creating no hygiene problems.

[0007] Further advantageous features of the present invention will be set out in the appended claims.

[0008] These features as well as further advantages of the present invention will become more apparent from the following description of an embodiment thereof as shown in the annexed drawings, which are supplied by way of non-limiting example, wherein:

Fig. 1 shows a prior-art drying support containing footwear;

Fig. 2 shows a diagram of the machine of the invention, which comprises an exchanger that can be replaced with a drawer capable of containing items;

Figs. 3 and 4 are perspective views of the exchanger separated from the machine of Fig. 2;

Fig. 5 is a perspective side view of the drawer separated from the machine of Fig. 2;

Figs. 6 and 7 are further perspective side views of the drawer of Fig. 2.

[0009] With reference to Fig. 2, there is shown a drying or washing/drying machine 1 that comprises drying means and a tub (not shown in the drawings), inside of which a rotary drum 3 is positioned, where laundry items 2 can be placed for subjecting them to a drying process; said tub comprises a front access door 4, through which laundry items 2 can be loaded into or unloaded from the drum 3, an inlet 5 for a drying flow of dry hot air 51, and an outlet 7 for a flow of humid hot air 71.

[0010] The drying means comprise a heater 8, preferably located in the proximity of the rear of the tub, which comprises heating means, preferably electric ones, capable of increasing the temperature of a dehumidified cold air flow 52; said heater 8 also comprises a cold air inlet 81 and a hot air outlet 82.

[0011] Through the inlet 81 the heater 8 receives the dehumidified cold air flow 52, which, by lapping heating means, preferably consisting of electric resistors or a heat pump, produces the drying flow of dry hot air 51, which then flows out through the hot air outlet 82; said hot air duct 82 is in fluidic communication with the tub of the drying or washing/drying machine through the inlet 5.

[0012] Also with reference to Figures 3 and 4, the machine 1 further comprises condensing means, in turn comprising an exchanger 9, preferably of the cross-flow type, and a tank 10 for collecting the condensed water generated by condensation of the humidity present in the humid hot air flow 71; said exchanger 9 is located inside a compartment 100 in fluidic communication with both an outside environment and the rotary drum 3, wherein said compartment 100 has preferably a parallelepipedon shape and apertures on all of its side surfaces, one of which faces towards the outside environment, and comprises guiding means (not shown in the annexed drawings) that make the exchanger 9 totally or partially separable from the machine 1, so that said exchanger 9 can be replaced with a drawer 110 by a user of the machine 1.

[0013] The drawer 110 is advantageously compatible with the compartment 100, its shape being preferably the same as that of the exchanger 9.

[0014] When the exchanger 9 is present in the compartment 100, the machine 1 operates in a closed-cycle mode, whereas when the drawer 110 is present in said compartment 100, the machine 1 operates in an open-cycle mode, since the rotary drum 3 is in fluidic communication with the outside environment.

[0015] The exchanger 9 comprises a humid hot air inlet 91, a dehumidified cold air outlet 92, a cooling cold air inlet 93, a condensate drain 94, and a hot air outlet 95.

[0016] When the machine 1 is in closed-cycle mode, and therefore the exchanger 9 is inside the compartment 100, the humid hot air inlet 91 is crossed by the humid hot air flow 71, the dehumidified cold air outlet 92 is crossed by the dehumidified cold air flow 52, the cooling cold air inlet 93 is crossed by a cooling air flow 96, the condensate drain 94 is crossed by a condensed water flow 98, and the hot air outlet 95 is crossed by a heated air flow 97.

[0017] The humid hot air inlet 91 is in fluidic communication with the tub outlet 7 through an extraction duct (not shown in the annexed drawings), whereas the dehumidified cold air outlet 92 is in fluidic communication with the tub inlet 5 through an intake duct (not shown in the annexed drawings).

[0018] Along the extraction duct a fan 12 is installed, which speeds up the circulation of the air flows in the extraction and intake ducts.

[0019] Also along the extraction duct, preferably upstream of the fan 12, one may advantageously install an anti-lint filter 11 for trapping any lint produced by the laundry items 2 during the drying treatment.

[0020] The cold cooling air inlet 93 and the hot air outlet 95 are both in fluidic communication with the outside environment and, for the purpose of advantageously increasing the efficiency of the exchanger 9, the velocity of the cooling air flow 96 may advantageously be increased by using an external fan 13.

[0021] The condensate drain 94 is in fluidic communication with the tank 10 through a condensate duct (not shown in the drawings), by means of which the condensed water flow 98 arrives at and is collected in the tank 10.

[0022] In order to make it advantageously easier to extract/insert the exchanger 9 from/into the compartment 100, said exchanger 9 comprises a handle 99 positioned on the front face of said exchanger 9, i.e. where the humid hot air inlet 91 is located. In addition, the exchanger 9 may also comprise one or more rails 99b compatible with the guiding means of the compartment 100, making it advantageously easier to insert/extract the exchanger 9 into/from the compartment 100.

[0023] As an alternative or in addition to the handle 99, the exchanger 9 may comprise a cover 101, on which the handle 99 is preferably arranged, which is similar to a cover 111 comprised in the drawer 110 that will be described below. This cover 101 is coupled to the front face of the exchanger 9, so as to seal the compartment 100 from the outside environment by coupling to an outer edge (not shown in the drawings) of the compartment 100. This advantageously prevents the air flows 71 and 52 from dissipating into the outside environment, thus reducing the energetic efficiency of the machine 1 when said machine 1 is in an operating condition.

[0024] Also with reference to Figures 5, 6, and 7, the drawer 110 comprises the following parts:

- the cover 111, which, by coupling to the outer edge of the compartment 100, ensures a proper seal also by means of a gasket 112 positioned around the inner edge of said cover 111;
- a front frame 113, coupled to the cover 111 and arranged parallel thereto;
- a rear frame 114, arranged parallel to the front frame 113;
- a first side wall 115;
- a second side wall 116;
- a bottom 117;

wherein both the bottom 117 and the walls 115,116 are coupled to said frames 113,114 and are arranged orthogonally thereto, thus forming a rigid and hollow parallelepipedon-shaped structure into which items can be placed, such as, for example, clothes, footwear or the like, to be subjected to a drying and/or refreshing treatment. Both frames 113 and 114, which are preferably made of plastic material or the like, are open, i.e. they allow the passage of an air flow through them, thus only having a structural and guiding function to allow the association with the compartment 100.

[0025] The coupling between the cover 111 and the front frame 113 is achieved through fastening means, such as screws or the like, engaging into spacer elements 118 and 119, which are respectively comprised in the cover 111 and in the front frame 113; such spacer elements 118 and 119 advantageously allow creating a gap 120 that allows the air flow 71 coming from the rotary drum 3 to enter the drawer 110 from above.

[0026] The side walls 115 and 116, which are preferably made of plastic or metallic material or the like, respectively comprise edges 115a and 116a to allow the passage of the air flows 96 and 97 coming from / directed towards the environment outside the machine 1. In fact, the use of the edges 115a and 116a advantageously ensures good rigidity of the whole drawer 110 at the cost of a negligible reduction of the usable flow section for the air flows 96 e 97.

[0027] The bottom 117 is preferably made out of a layer of plastic or metallic material with holes allowing the water contained in the laundry to drip onto the bottom of the compartment 100 and then be conveyed into the tank 10.

[0028] The second side wall 116 may comprise a support frame 121 on which a dust filter and/or a fragrance container and/or the like can advantageously be mounted, so as to perfume the clothes or footwear being subjected to a drying or refreshing treatment and/or to limit any pollutants (e.g. dust, pollen or the like) deposited by the air flow 96 onto the clothes or footwear during the treatment.

[0029] Both frames 113 and 114 may respectively comprise one or more supporting means 122 and 123 positioned inside each one of said frames 113,114, said supporting means 122 and 123 being preferably arranged vertically and facing each other in pairs. In this manner, it is possible to exploit said supporting means 122,123 for positioning movable supports 124, such as

shelves or bars, wherein said movable supports 124 are so shaped as to engage and cooperate with the supporting means 122,123; for this purpose, said supporting means 122,123 may comprise holes preferably having a rectangular section or any other shape.

[0030] The movable supports 124 allow the laundry items that must be subjected to a drying or refreshing treatment to be advantageously positioned in such a way as to increase the area lapped by the air flows 71,96 entering the drawer 110, thus increasing the energetic efficiency of the machine 1.

[0031] In order to simplify the positioning of said movable supports 124 inside the drawer 110, a saw-tooth support 125 may be coupled to each one of the supporting means 122,123, preferably by exploiting the holes of said supporting means 122,123.

[0032] When using these supports 125, the movable support 124 can be coupled to the drawer 110 by first engaging it with the supporting means 122 of the front frame 113, i.e. by inserting it into the holes of said supporting means 122, and then coupling it to the saw-tooth supports 125 of the rear frame 114 with a downward movement. In this manner, when the movable support 124 has to be removed from the drawer 110, it will be sufficient to disengage it first from the saw-tooth supports 125 and then pull it out of the supporting means 122.

[0033] When the machine 1 is in closed-cycle mode, the outlet 7 is in fluidic communication with said condensing means, as opposed to the outside environment, thus advantageously preventing the moisture from being dispersed in the surrounding environment. When the machine is in open-cycle mode, instead, a large part of the air flow 71 exiting the rotary drum 3 is dispersed into the surrounding environment after having lapped the laundry items placed in the drawer 110 by means of the cooling air flow 96.

[0034] The advantages deriving from the open-cycle mode are attained both during the execution of a refreshing cycle and during the execution of a laundry drying cycle, or a combination thereof.

[0035] During the execution of a refreshing cycle, in fact, the rate of the air flow 52 entering the rotary drum 3 is advantageously reduced, thus reducing any problems related to the hygiene of said drum 3, since most dirt particles coming from the laundry placed in the drawer 110 are carried out of the machine 1 by the air flow 97.

[0036] On the other hand, when executing a drying cycle one can advantageously dry both said items and the laundry items 2 by placing said items into the drawer 110 and the laundry items 2 into the rotary drum 3.

[0037] A further advantage is given by the possibility of executing a drying cycle along with a refreshing cycle, by placing the laundry to be dried into the rotary drum 3 and the items to be subjected to a refreshing cycle into the drawer 110. In this configuration, there is also the advantage that the items in the drawer 110, in addition to being subjected to the refreshing cycle, are also subjected to a humidification cycle, which may be useful in order to prepare said items for a subsequent hot ironing process, thereby also limiting the dispersion of moisture into the environment.

[0038] The humidification cycle occurs because the water present in the laundry items 2 placed in the rotary drum is first removed through the combined action of the heat generated by the operation of the heater 8 and of the air current generated by the fan 12, and is then condensed into the items placed in the drawer 110 through the action of the cooling air flow 96.

[0039] Many variations are possible with respect to the main embodiment described above.

[0040] A first variant comprises an exchanger which is functionally equivalent to the exchanger 9 of the above-described embodiment, and which comprises a fixed portion and a movable portion. The fixed portion always stays positioned inside the compartment 100, whereas the movable portion of the exchanger 9 can be replaced with a drawer which is functionally equivalent to the above-described drawer 110.

[0041] This drawer may comprise a through duct which prevents the rotary drum 3 from being placed in fluidic communication with the outside environment; this gives the advantage that the machine 1 will always operate in closed-cycle mode, whether the drawer or all exchanger portions are present, thus solving the problem of the hygiene of the rotary drum 3. This solution turns out to be particularly interesting when footwear is to be subjected to a refreshing treatment.

[0042] Of course, the example described herein may be subject to further variations, which will nonetheless still fall within the scope of the following claims.

Claims

1. A clothes (2) drying or washing/drying machine (1), comprising a heater (8), a heat exchanger (9), and a tub inside of which a rotary drum (3) is located, **characterized in that** the heat exchanger (9) is at least partly interchangeable with a drawer (110).

2. A machine (1) according to claim 1, comprising a compartment (100) in fluidic communication with both an environment outside the machine (1) and the rotary drum (3), wherein the heat exchanger (9) and/or the drawer (110) are placed in said compartment (100).

3. A machine (1) according to claim 2, wherein the exchanger (9) comprises a fixed portion and a movable portion, wherein the fixed portion always stays positioned inside the compartment (100) and wherein the movable portion of the exchanger (9) can be replaced with the drawer.

4. A machine (1) according to claim 3, wherein the

drawer comprises a through duct which prevents the rotary drum (3) from being placed in fluidic communication with the outside environment.

5. A machine (1) according to claim 1 or 2, wherein the exchanger (9) is fully interchangeable with the drawer (110).

6. A machine (1) according to any one of claims 2 to 5, wherein the drawer (110) comprises a vertically arranged cover (111) which is sealingly coupled to an outer edge of the compartment (100), a front frame (113) coupled to the cover (111) and arranged parallel thereto, a rear frame (114) arranged parallel to the front frame (113), a first side wall (115), a second side wall (116) and a bottom (117), wherein the bottom (117) and the walls (115,116) are coupled to said frames (113,114) and are arranged orthogonally thereto, thus forming a rigid and hollow parallelepipedon-shaped structure into which items can be placed.

7. A machine (1) according to claim 6, wherein the cover (111) and the front frame (113) comprise spacer elements (118,119) which, when coupled together, create a gap (120) between said cover (111) and said front frame (113), thus allowing an air flow (71) coming from the rotary drum (3) to enter the drawer (110).

8. A machine (1) according to claim 6 or 7, wherein the first side wall (115) and the second side wall (116) comprise edges (115a,116a) to allow the passage of air flows (96,97) coming from or directed towards the environment outside the machine (1).

9. A machine (1) according to any one of claims 6 to 8, wherein the second side wall (116) comprises a support frame (121) to which a fragrance container and/or a dust filter can be coupled, so as to perfume the items and/or limit the dust or dirt particles transported by an air flow (96) coming from the environment outside the machine (1).

10. A machine (1) according to any one of claims 6 to 9, wherein the front frame (113) and the rear frame (114) comprise, respectively, one or more supporting means (122,123) positioned inside each one of said frames (113,114).

11. A machine (1) according to claim 10, wherein movable supports (124), such as shelves or bars, are coupled to the supporting means (122,123) in order to facilitate the positioning of the laundry items and to increase the area thereof which is lapped by the air flows circulating in the drawer (110).

12. A machine (1) according to claim 11, wherein at least one of the supporting means (122,123) comprises a saw-tooth support (125) to facilitate the coupling and/or decoupling of the movable support (124) to/from said supporting means (122,123).

13. A machine (1) according to any one of the preceding claims, wherein the heat exchanger (9) is of the cross-flow type.

Prior Art

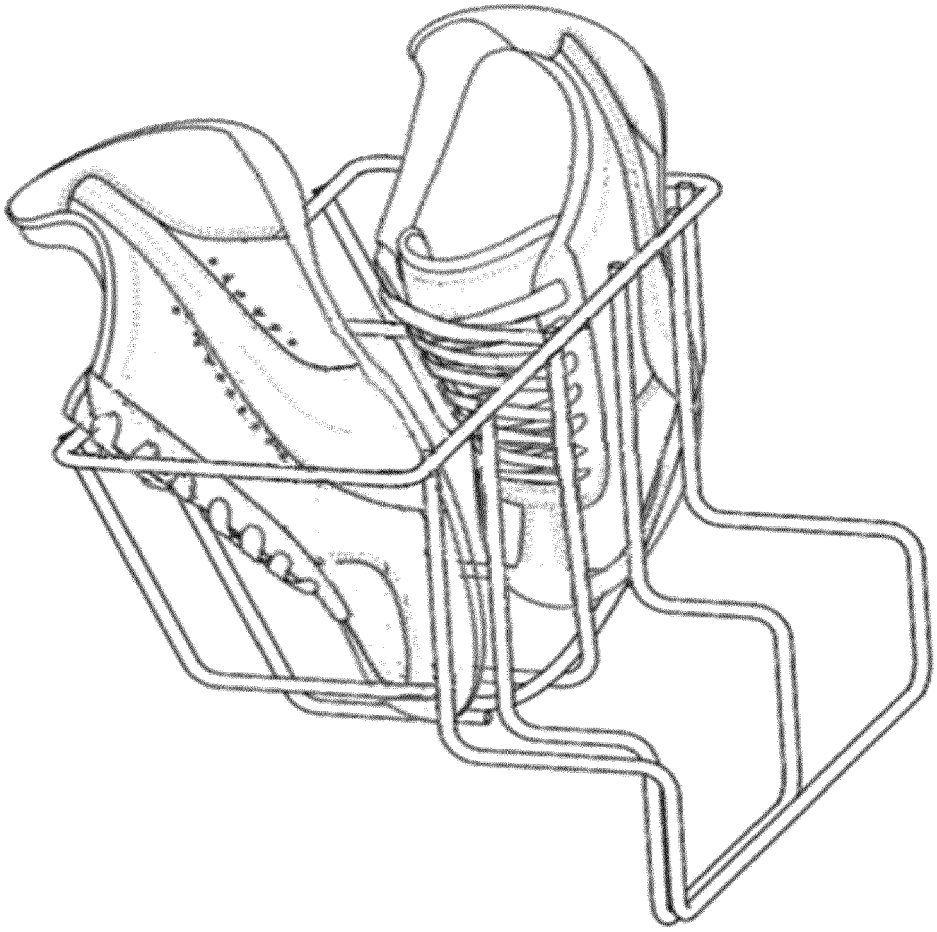

Fig. 1

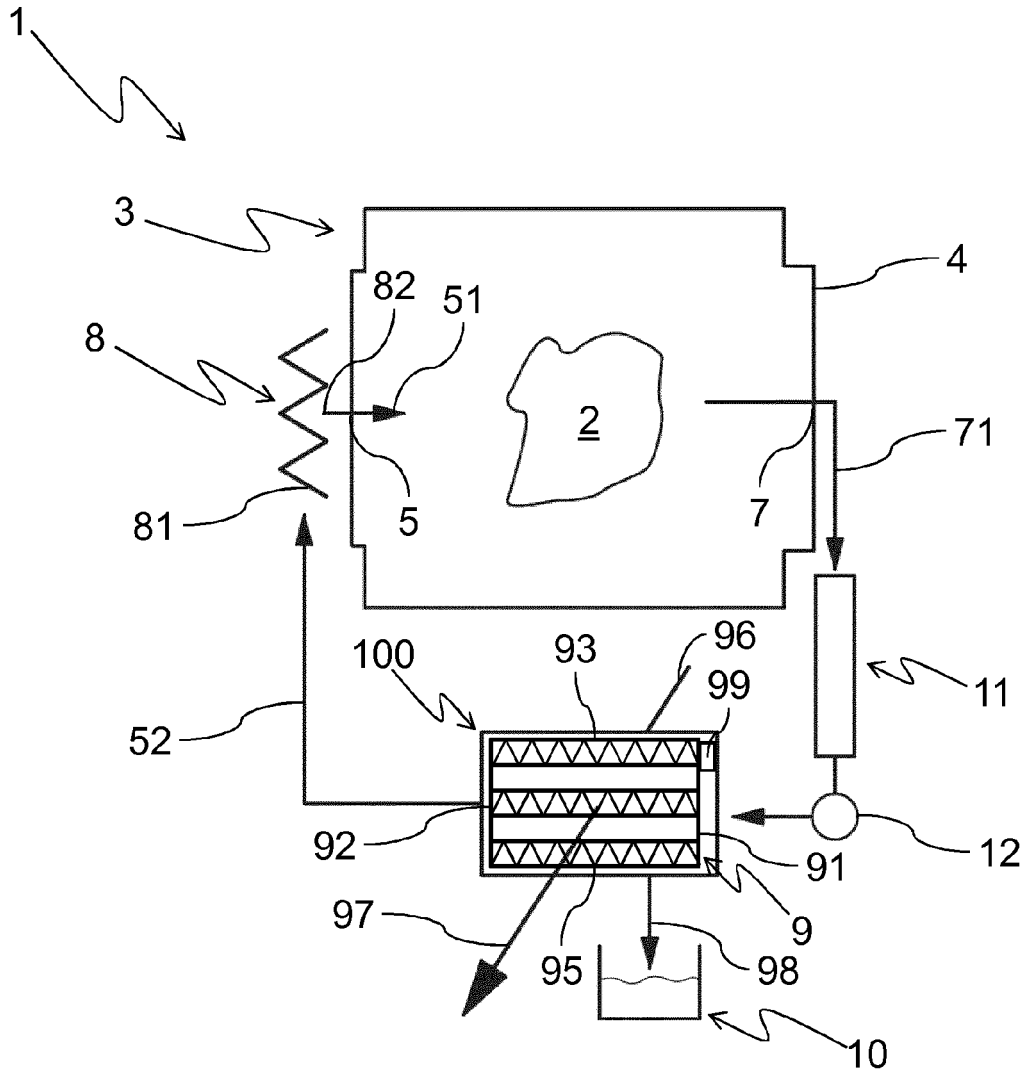

Fig. 2

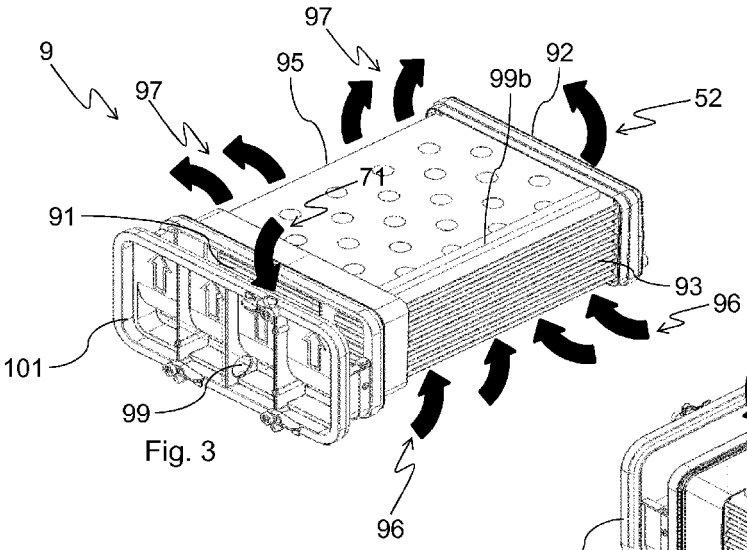
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Fig. 3

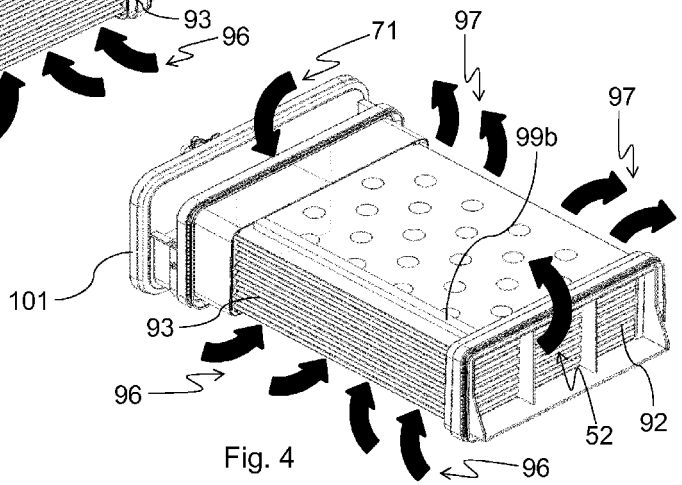
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Fig. 4

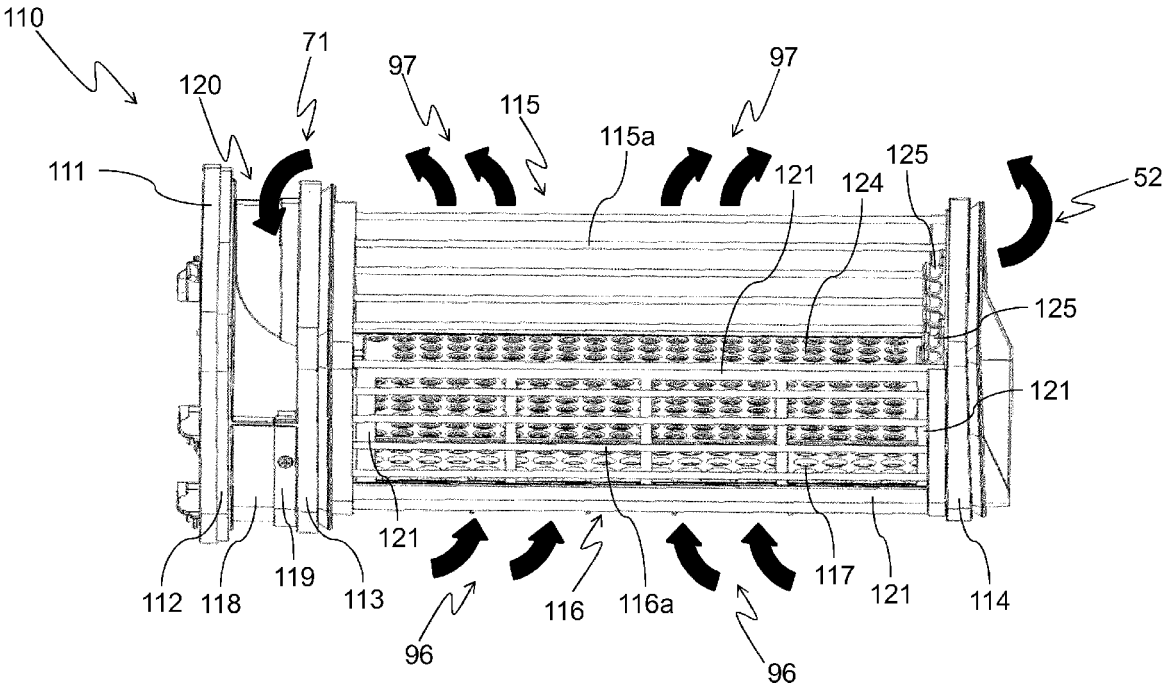
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Fig. 5

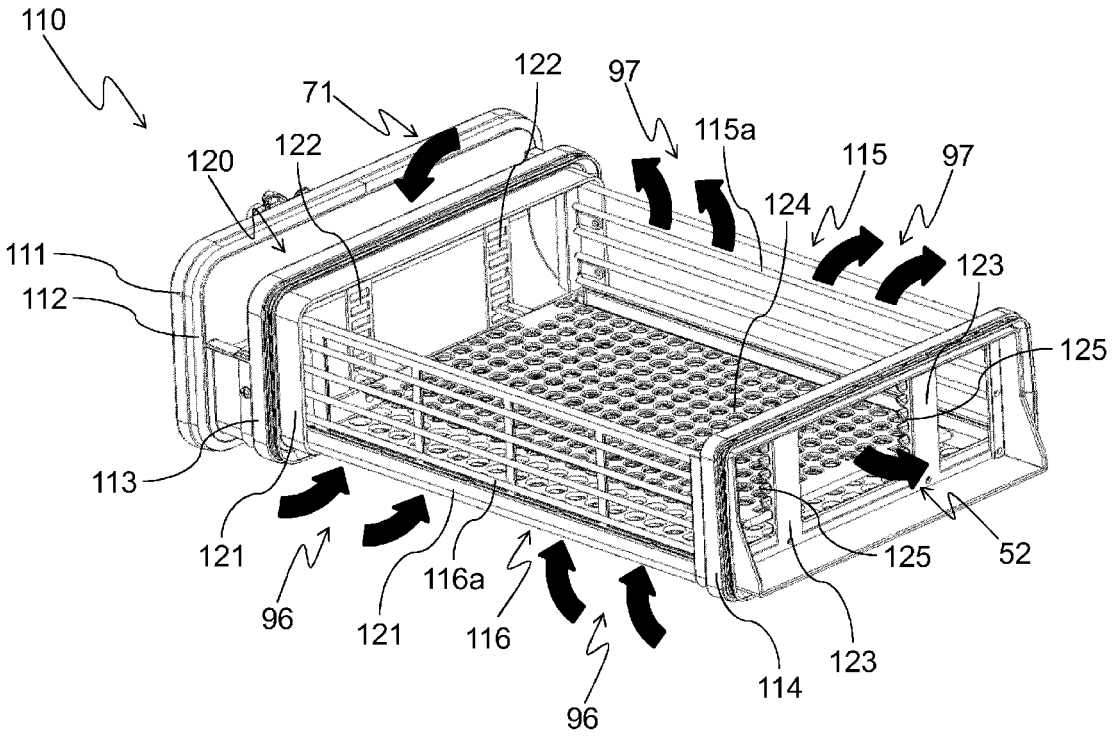
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Fig. 6

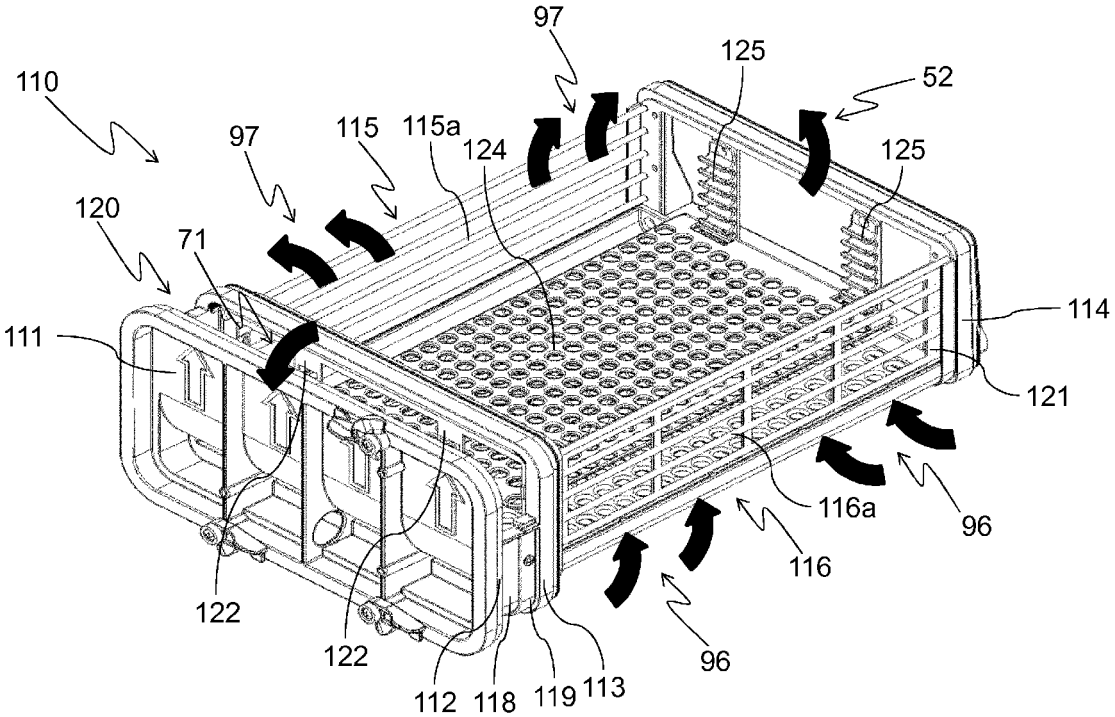
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Fig. 7

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EUROPEAN SEARCH REPORT

Application Number
EP 13 17 5772

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 A	EP 2 196 578 A1 (ELECTROLUX HOME PROD CORP [BE]) 16 June 2010 (2010-06-16) * paragraphs [0059], [0060]; figures 2,3 * -----	1-5 6-13	INV. D06F58/24
A	EP 1 936 022 A1 (ELECTROLUX HOME PROD CORP [BE]) 25 June 2008 (2008-06-25) * paragraphs [0046], [0047]; figure 3 * -----	1-13	

TECHNICAL FIELDS SEARCHED (IPC)

D06F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	11 November 2013	Stroppa, Giovanni

CATEGORY OF CITED DOCUMENTS

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 2196578 A1	16-06-2010	AT 525514 T	15-10-2011
		EP 2196578 A1	16-06-2010
		ES 2375458 T3	01-03-2012
EP 1936022 A1	25-06-2008	NONE	

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