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(54) **Dehumidifyer unit and dryer device comprising such dehumidifyer unit**

(57) This document discloses a dehumidifyer unit, comprising a casing, presenting an air inlet for moist air and an air outlet for dehumidified air, and a dehumidifyer apparatus, which is substantially enclosed by the casing. The casing is mostly formed of an expanded polymer material.

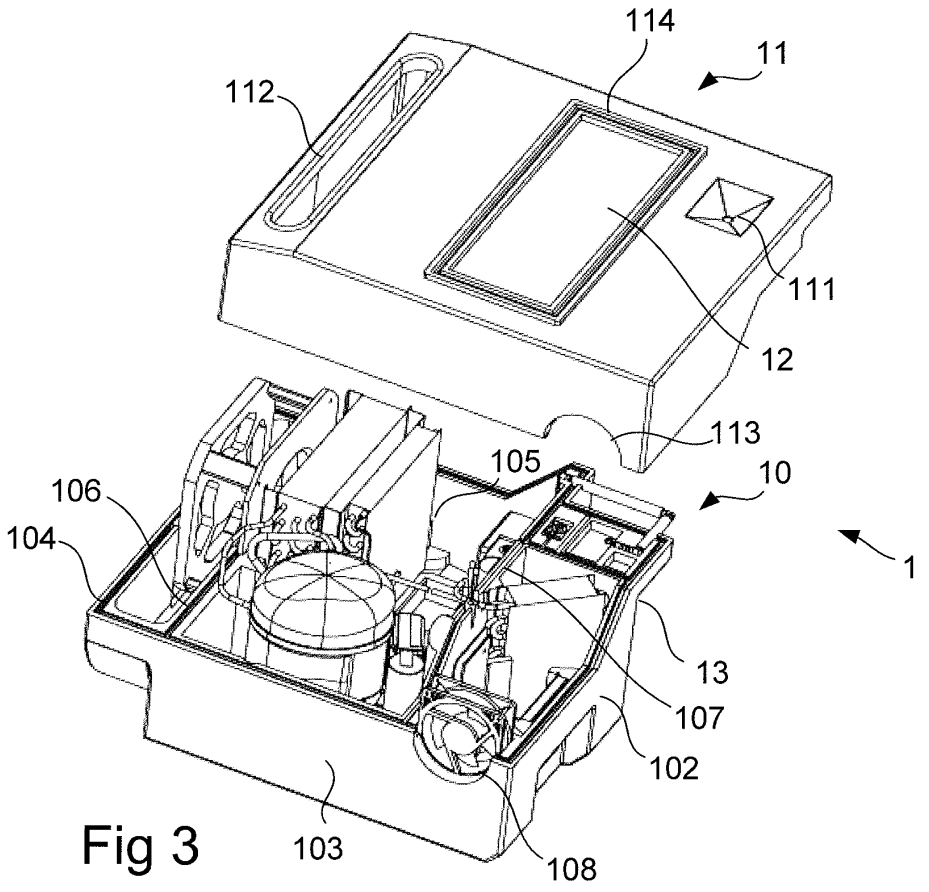

Fig 3

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Description

Technical field

[0001] The present document relates to a dehumidifyer unit and a dryer device comprising such dehumidifyer unit. The document also relates to a method of manufacturing a dehumidifyer unit and a dryer device.

Background

[0002] Drying cabinets and tumble dryers are examples of dryer devices which are used for the quick drying of laundry indoors. The drying effect of so-called condenser drying cabinets and condenser tumble dryers is achieved by dehumidification. Warm and dry air is transported from a dehumidifyer unit to a space containing wet laundry, which causes the water in the laundry to evaporate. Moist air is transported to the dehumidifyer unit where water is condensed and collected in a container or discharged to a drain if such a connection exists.

[0003] JP2005- 230324 discloses a dehumidifyer cabinet comprising a drying space containing a plurality of fixed supports for supporting shoes to be dried and a dehumidification space, in which a dehumidifyer apparatus, comprising an absorption dehumidifyer, is formed. Thermally insulating material is provided on the walls of the dehumidification space.

[0004] As with other types of electrical home appliances, it is important that dryer devices be energy efficient. It is also desirable that they operate quietly and be simple and economical to manufacture and maintain. There is a need to improve known dryer devices with respect to all of these aspects.

Summary

[0005] An object is to provide a dryer device the construction of which allows for cheaper production and maintenance and has improved characteristics with respect to energy efficiency and noise level.

[0006] The present invention is defined by the appended independent claims. Embodiments are set forth in the dependent claims, in the description and in the drawings.

[0007] According to a first aspect, a dehumidifyer unit for a dryer device is provided. The dehumidifyer unit comprises a casing with an air inlet for moist air and an air outlet for dehumidified air and a dehumidifyer apparatus which is substantially enclosed by the casing. The casing comprises a lower part and an upper part. The lower part comprises a bottom plate, which forms a vertical support for the dehumidifyer apparatus. The lower part comprises at least one outer wall and/or at least one partition wall, formed in one piece with the bottom plate.

[0008] By "substantially enclosed" is meant that the casing can comprise openings through which a few components of the dehumidifyer apparatus can protrude or be exposed.

[0009] By "vertical support" is meant a support that acts mainly in the vertical direction.

[0010] The casing is mostly formed of an expanded polymer material. By "mostly formed" is meant that the casing consists of expanded polymer material to at least 50 percentage by volume, alternatively at least 60 percentage by volume, at least 70 percentage by volume, at least 80 percentage by volume, at least 90 percentage by volume or at least 95 percentage by volume. By "expanded polymer material" is meant polymer material inflated by a gas to reduce the density relative to the starting material. The amount of air in the expanded polymer material can be at least 60 percentage by weight, at least 80 percentage by weight, at least 85 percentage by weight, at least 90 percentage by weight or at least 95 percentage by weight. The rest is polymer resin. The density of the expanded polymer material is thus substantially lower than that of the polymer resin.

[0011] Non- limiting examples of expanded polymer materials include expanded thermoplastics, expanded thermosetting plastics, expanded urethanes and expanded rubber or rubber- like materials. Specific examples of materials include EPS (expanded polystyrene- also known as "styrofoam") , EPP (expanded polypropylene) and EPE (expanded polyethene) .

[0012] The expanded polymer can have open or closed cells.

[0013] The expanded polymer material can be formed by one piece of expanded material or a plurality of smaller pieces of material joined by melting or gluing.

[0014] By "lower part" is meant a structure which forms a main support for the different parts of the dehumidifyer apparatus and which holds the parts in place relative to each other.

[0015] The lower part can further comprise one or several outer walls. By "outer wall" is meant an outwardly exposed wall.

[0016] The lower part can have at least one partition wall which is integrated with the bottom plate. By "partition wall" is meant a wall which completely or partly defines two spaces within the casing. By "integrated" is meant that the partition wall is made in one piece with or fixedly attached to the bottom plate.

[0017] The lower part can comprise at least one horizontal support for the dehumidifyer apparatus, which horizontal support is integrated with the lower part.

[0018] The upper part can comprise a lid which completely or partly covers the dehumidifyer apparatus from above.

[0019] The lid can have at least one integrated outer wall as well as at least one integrated partition wall.

[0020] All of, or some of, the following can be substantially formed of the expanded polymer material: the bottom plate, the lid, the outer walls and the partition walls.

[0021] By "substantially formed" is meant that the outer wall is formed of the expanded polymer material, except any optional inner or outer surface layers of such kind that they basically do not affect the strength properties

of the outer wall.

[0022] The lower part can comprise one or several reinforcing elements. By "reinforcing element" is meant an object which results in increased rigidity and supporting capacity. Non-limiting examples of reinforcing elements are nets, plates and elongated objects. The reinforcing elements can be formed of, for example, wood, plastic or metal.

[0023] A dryer device, comprising a dryer housing and said dehumidifyer unit detachably arranged in the dryer housing, is also provided. The dehumidifyer unit can be arranged without fasteners. Should there be any fasteners, then their effect can be only substantially parallel with the direction of insertion into the dryer housing of the dehumidifyer unit. The dryer housing encloses a drying space for the objects to be dried.

[0024] The dryer housing can have a partition wall which separates the drying space from a dehumidification space in which the dehumidifyer unit is detachably arranged.

[0025] The dryer housing can have a distribution duct for air which is substantially in alignment with the air outlet of the dehumidifyer unit when this is inserted in the dryer housing. By "substantially in alignment with" is meant that the air outlet and the distribution duct are positioned so that air can flow from the air outlet to an opening in the distribution duct.

[0026] There can be one or several supports for object to be dried in the dryer space. The support can be fixedly arranged, such as a hanger, or movable and drivable relative to the drying space, such as the rotation drum in a tumble dryer.

[0027] According to second aspect, a method of manufacturing a dehumidifyer unit is provided. The manufacturing steps comprise forming a casing of expanded polymer material, which casing has an air inlet for moist air and an air outlet for dehumidified air, and mounting a dehumidifyer apparatus in the casing. The method further comprises forming the lower part to have a bottom plate which forms a vertical support for the dehumidifyer apparatus and forming the lower part to have at least one outer wall and/or partition wall, formed in one piece with the bottom plate.

[0028] The casing can be formed by compression moulding of the expandable polymer material.

[0029] A method of manufacturing a dryer device is also provided. The manufacturing steps comprise forming a dryer housing, which encloses a drying space, forming a dehumidifyer unit according to the description above and arranging the dehumidifyer unit in the dryer housing.

Brief description of the drawings

[0030] The following drawings are included for exemplifying purposes.

Fig. 1a is a schematic front view of a drying cabinet.

Fig. 1b is a schematic sectional view of the drying cabinet along the line A-A in Fig. 1a.

Fig. 2 is a schematic sectional top view of a dehumidifyer unit.

Fig. 3 is a schematic perspective top view of a dehumidifyer unit.

Fig. 4 is a schematic sectional side view of a tumble dryer.

Fig. 5a is a schematic perspective side view of a tumble dryer with a base and a casing with a dehumidifyer unit.

Fig. 5b is a schematic perspective side view of a tumble dryer with a fixedly mounted base and the casing with the dehumidifyer unit ready to be inserted into the base.

Description of embodiments

[0031] Fig. 1a is a schematic front view of a drying cabinet 2 which can have a user interface 28. Fig. 1b is a schematic view along the line A-A in Fig. 1a and shows components in the drying cabinet 2 which can comprise a door 24, a bottom wall 26, a front wall 27, and a drying space 23 with supports 22 for objects to be dried. A vertical rear duct 21 can connect the drying space 23 with a dehumidifyer unit 1 which is detachably arranged in the lower part of the drying cabinet, possibly below a partition wall 25. The dehumidifyer unit 1 can have a space 13 for a collecting container and a casing which can consist of an upper part 11 and a lower part 10 with a bottom 101. In the upper part 11, there is an air inlet 114 which can be provided with a filter 12.

[0032] Fig. 2 shows, from above and schematically, some of the components of the dehumidifyer unit 1, which components can be mounted in a lower part of a casing 10. The figure shows the space 13 for a collecting container (not shown) and the front wall 102, left wall 103, back wall 104, right wall 105, back partition wall 106 and front partition wall 107, all of which are optional, of the lower part 10 of the casing. A main fan 1004 can be arranged along the back wall 104, and, connected to an optional fan opening 108, there can be another fan 1006. The main fan 1004 can be mounted adjacent to a condenser 1003 which can be connected to an evaporator 1002, a compressor 1001 and a sub-condenser 1007. There can also be a water pump 1005 in the casing.

[0033] Fig. 3 is a perspective top view of the dehumidifyer unit 1 and some of its components. The figure illustrates the lower part 10 of a casing, which comprises the front wall 102, the left wall 103, the back wall 104, the right wall 105, the back partition wall 106 and the front partition wall 107. Also shown are the space 13 for a collecting container (not included) and the fan openings 108 and 113, the latter of which can belong to the upper part 11 of the casing. In the upper part 11 of the casing, there is an air inlet 114, which can be provided with a filter 12, and an air outlet 112 which is arranged to be in alignment with the rear duct 21 when the dehumidifyer

unit 1 is detachably mounted in the drying cabinet 2. There can also be a collecting funnel 111 in the upper part 11 of the casing.

[0034] The functioning of the drying cabinet 2 is controlled by means of a user interface 28 which typically, but not necessarily, is located on the door 24 of the drying cabinet 2, and which can have the form of, for example, buttons, knobs or a touch screen. A controller of the dehumidifyer unit is controlled, wirelessly or non-wirelessly, via the user interface 28. The controller can be arranged in the dryer housing, in the door or in the dehumidifyer unit. During operation of the drying cabinet, the detachable dehumidifyer unit 1 is arranged in the drying cabinet. The lower part 10 and the upper part 11 of the casing are assembled together and some kind of fasteners, for example slits, bolts or braces, which prevent the relative movement of the parts in at least the horizontal plane. The main fan 1004 of the dehumidifyer unit 1 draws moist air from the drying space 23 into the dehumidifyer unit 1 through the air inlet 114, which optionally can be provided with a filter. The evaporator 1002 condenses the water in the moist air. Dehumidified warm air is spread into drying space 23 via the air outlet 112 and the rear duct 21 which is in alignment with the air outlet 112. The condensed water accumulates on the bottom 101 of the casing in a space defined by the back partition wall 106 and the front partition wall 107. The water pump 1005 pumps the condensed water to a detachable container placed in the space 13 for a collecting container. The water which may accumulate on the partition wall 25 of the dryer housing 23, or directly on the upper casing 11 of the dehumidifyer unit 1 if there is no partition wall, is transported to the collecting container via the collecting funnel 111. Any surplus heat can be transferred away from the dehumidifyer unit by the fan 1006 and the sub-condenser 1007 which can be connected in series or in parallel to the condenser 1003.

[0035] Fig. 4 is a schematic sectional side image of a tumble dryer 3 in which arrows show the flow of air in the tumble dryer during use. The tumble dryer 3 can have a door 34, a drying space 33, a drum which forms a support 32 for objects to be dried and a vertically arranged rear duct 31. The tumble dryer can also comprise a partition wall 35 below which a detachable dehumidifyer unit 1' can be arranged. The dehumidifyer unit 1' can have a front wall 102' and a back wall 104' and has an air inlet 114' and an air outlet 112' which is arranged to be in alignment with an optional rear duct 31. Also shown are the compressor 1001, the evaporator 1002 and the main fan 1004 of the dehumidifyer unit 1'.

[0036] Fig. 5a shows a schematic perspective side view of some components in a tumble dryer 3. The figure shows a dryer housing 300 which can be arranged to be mountable on a base 301. Note that the base 301 and the dryer housing 300 also can form a unit and that the dryer housing 300 can be replaced by the dryer housing of some other type of dryer device, such as a drying cabinet. The base can be arranged to accommodate a detachable dehumidifyer unit 1' which can comprise a lower part 10 and an upper part 11 of a casing, which parts are shown disassembled.

[0037] Fig. 5b is a schematic perspective side view of the dryer housing 300 arranged on the base 301 in which the detachable dehumidifyer unit 1' can be inserted. The dehumidifyer unit 1' is shown with the lower part 10 and the upper part 11 of the casing assembled together.

[0038] The dehumidifyer unit 1 can be manufactured as follows. The casing is substantially formed of expanded polymer material. For example, a compression moulding process, such as that conventionally used for forming products made of EPE, EPP or EPS, can be used for manufacturing the upper part 11 in one piece and the lower part 10 in one piece. Alternatively, the upper part 11 and/or the lower part 10 can be manufactured by two or more pieces of expanded polymer material, which are joined by, for example, a binder or welding.

[0039] The components of the dehumidifyer apparatus are mounted and connected to each other. Components which need to be joined using heat (by welding or soldering) can be joined before being arranged in the lower part 10. The other components can be mounted directly in the lower part 10 and subsequently connected to each other. When the dehumidifyer apparatus has been mounted in the casing, the upper part 11 is arranged on the lower part 10, wherein the dehumidifyer unit 1 is completed. The dehumidifyer unit can then be inserted in a dehumidification space in a dryer device, such as a drying cabinet 2 or a tumble dryer 3.

[0040] The dehumidifyer unit 1 can function as a condenser dehumidifyer or some other known type of dehumidifyer, for example an absorption dehumidifyer, a thermoelectric dehumidifyer, an air conditioner or a combination thereof.

Claims

1. Dehumidifyer unit, comprising:

a casing, presenting an air inlet for moist air and an air outlet for dehumidified air, and
a dehumidifyer apparatus, which is substantially enclosed by the casing,
wherein the casing is formed of an expanded polymer material to at least 50 percent by volume and comprises a lower part and an upper part,
wherein the lower part comprises a bottom plate, which forms a vertical support for the dehumidifyer apparatus,
characterized in that
the lower part comprises at least one outer wall and/or at least one partition wall, formed in one piece with the bottom plate.

2. Dehumidifyer unit according to claim 1, wherein the

lower part comprises at least one horizontal support for the dehumidifyer apparatus, which horizontal support is integrated with the lower part.

3. Dehumidifyer unit according to claim 1, wherein the upper part comprises a lid over the dehumidifyer apparatus.

4. Dehumidifyer unit according to claim 3, wherein the upper part comprises at least one outer wall and/or at least one partition wall, integrated with the lid.

5. Dehumidifyer unit according to any of the claims 3-7, wherein said bottom plate, lid, outer walls and/or said partition walls are substantially formed of said expanded polymer material.

6. Dehumidifyer unit according to any of the preceding claims,
wherein the upper part and/or the lower part comprises at least one reinforcing element.

7. Dryer device, comprising:

a dryer housing, which encloses a drying space, and
a dehumidifyer unit according to any of the preceding claims,
wherein the dehumidifyer unit is detachably arranged in the dryer housing.

8. Dryer device according to claim 7,
wherein the dryer housing has a partition wall which separates the drying space from a dehumidification space, and
wherein the dehumidifyer unit is detachably arranged in the dehumidification space.

9. Dryer device according to claim 7 or 8, wherein the dryer housing comprises a distribution duct, which, when the dehumidifyer unit is inserted in the dryer housing, is substantially in alignment with the air outlet.

10. Dryer device according to any of the claims 7-9, wherein the drying space presents a support for objects to be dried.

11. Dryer device according to claim 10, wherein the support is fixed relative to the drying space.

12. Dryer device according to claim 10, wherein the support is drivingly movable relative to the drying space.

13. Method of manufacturing a dehumidifyer unit, comprising:

forming a casing of expanded polymer material, which casing comprises a lower part and an upper part and presents an air inlet for moist air and an air outlet for dehumidified air,
forming the lower part to have a bottom plate which forms a vertical support for the dehumidifyer apparatus,
forming the lower part to have at least one outer wall and/or partition wall, formed in one piece with the bottom plate, and
mounting a dehumidifyer apparatus in the casing.

14. Method according to claim 13, wherein the casing is formed by compression moulding of the expandable polymer material.

15. Method of producing a dryer device, comprising:

forming a dryer housing, which encloses a drying space,
forming a dehumidifyer unit according to claim 13 or 14, and
arranging the dehumidifyer unit in the dryer housing.

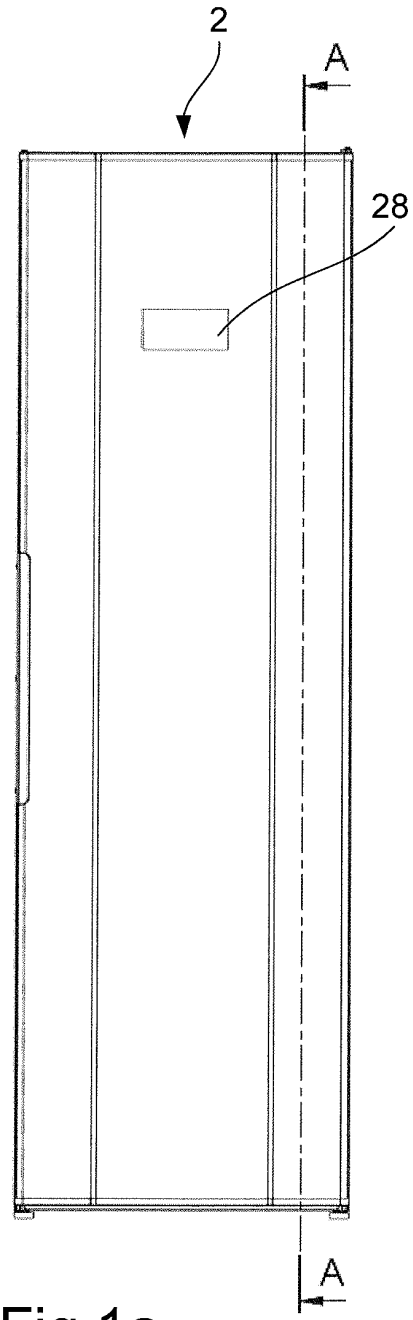

Fig 1a

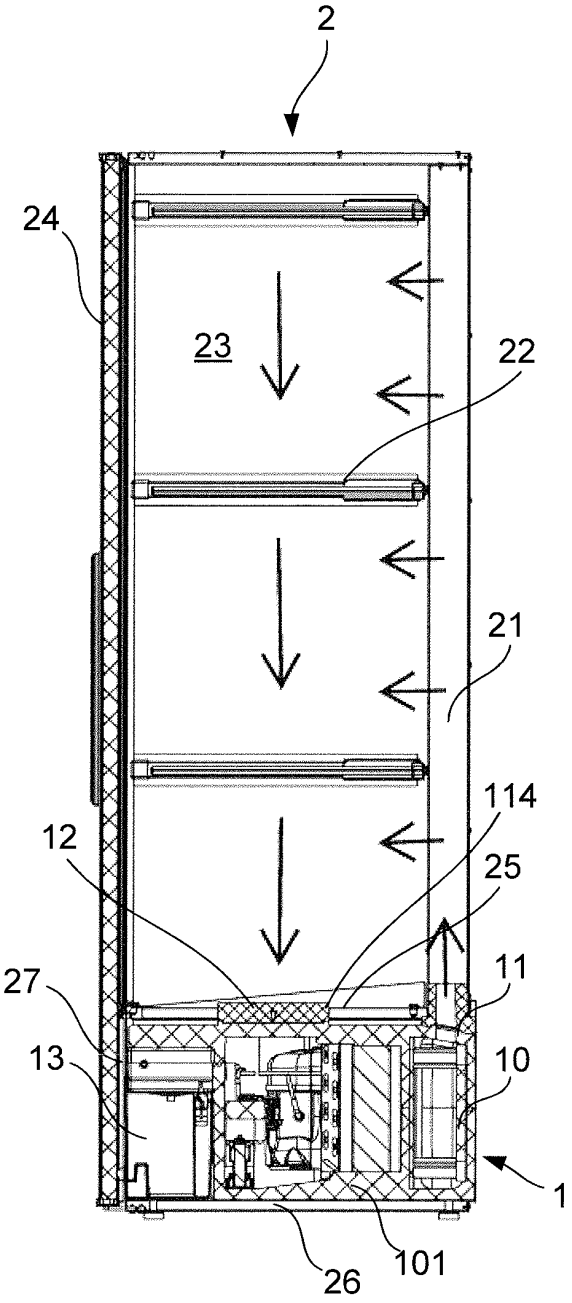

Fig 1b

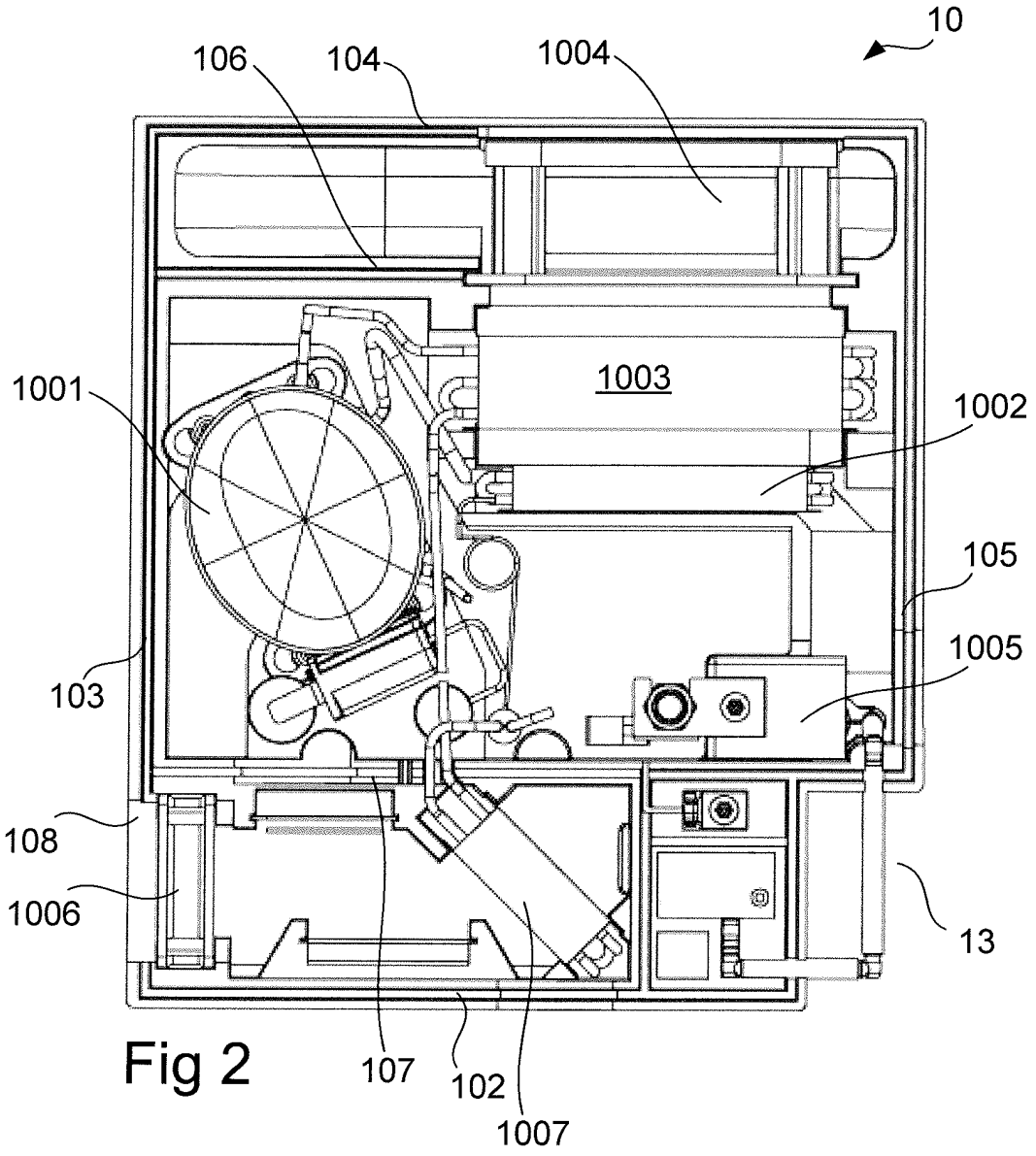
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Fig 2

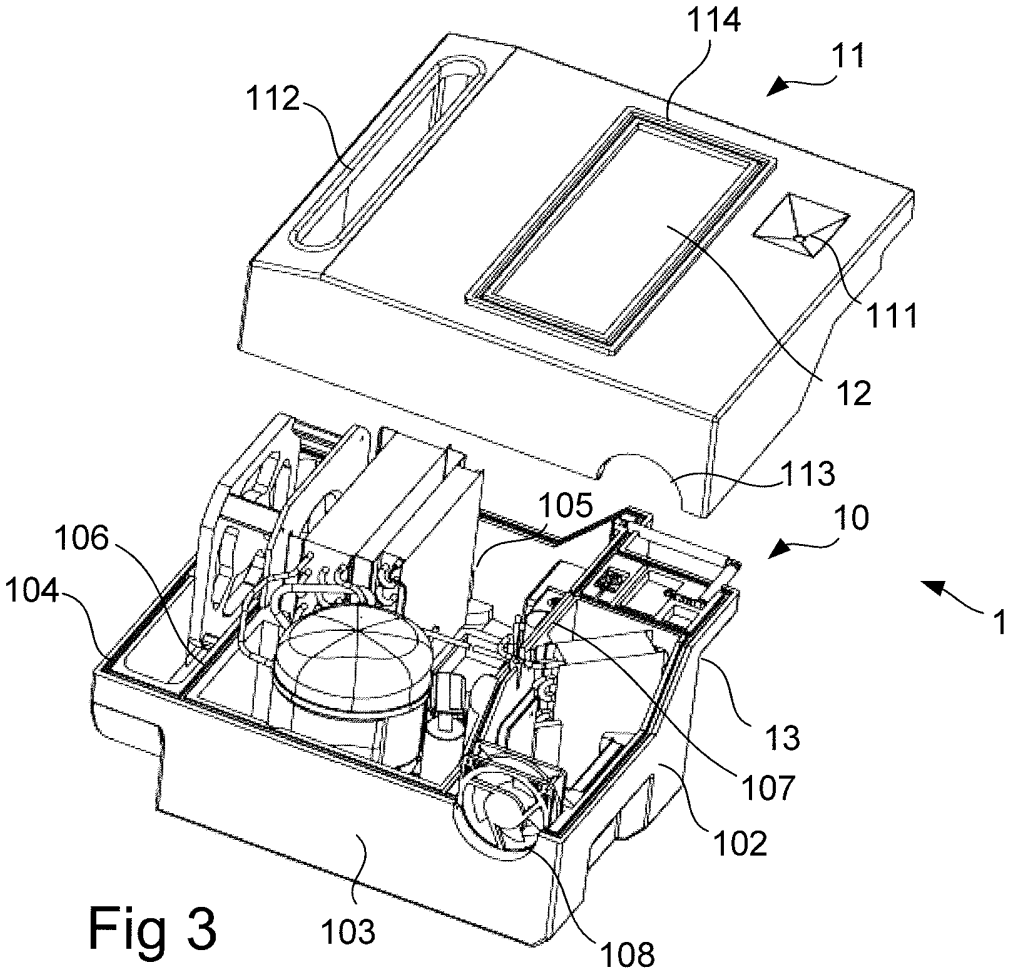

Fig 3

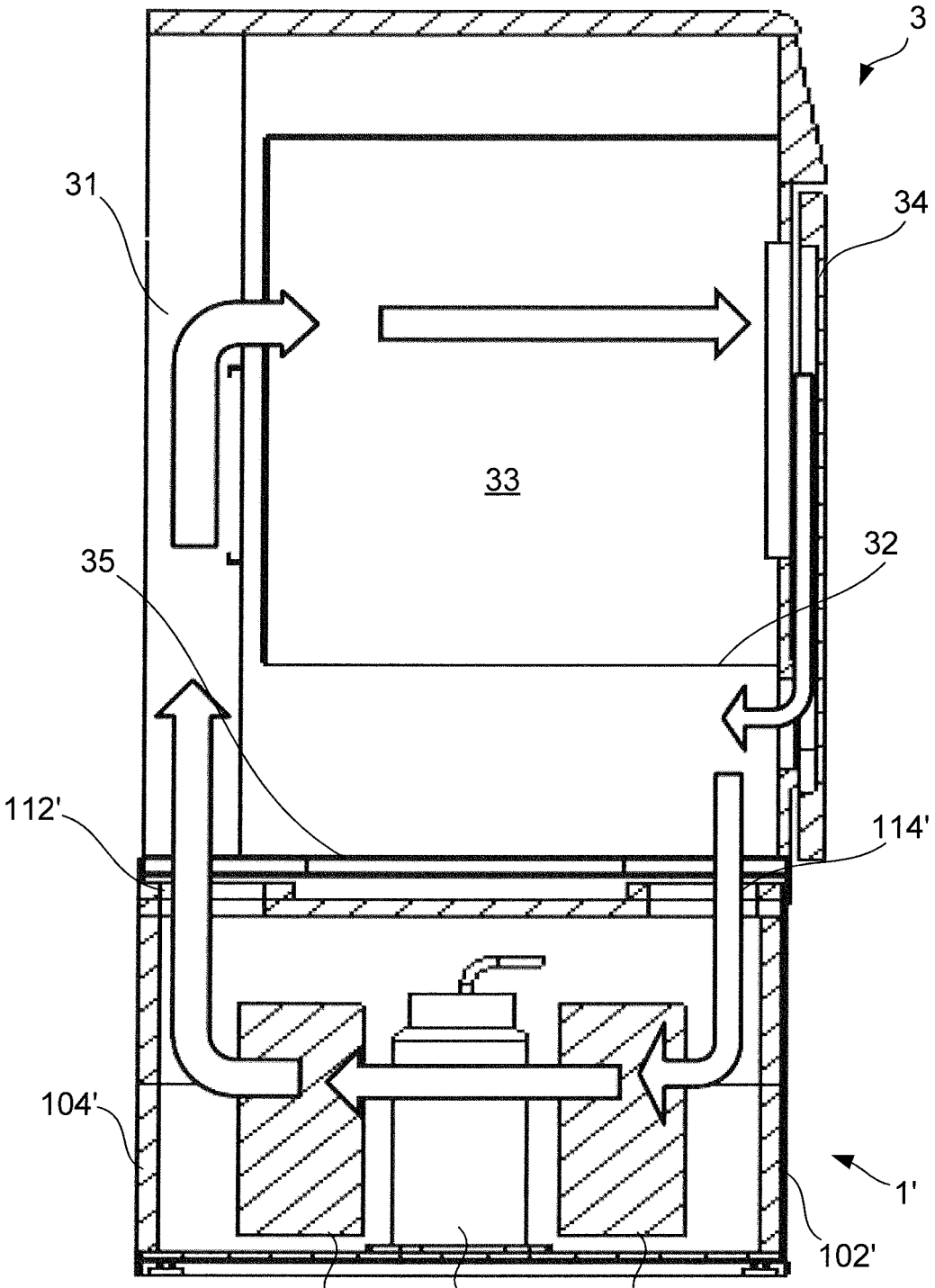

Fig 4

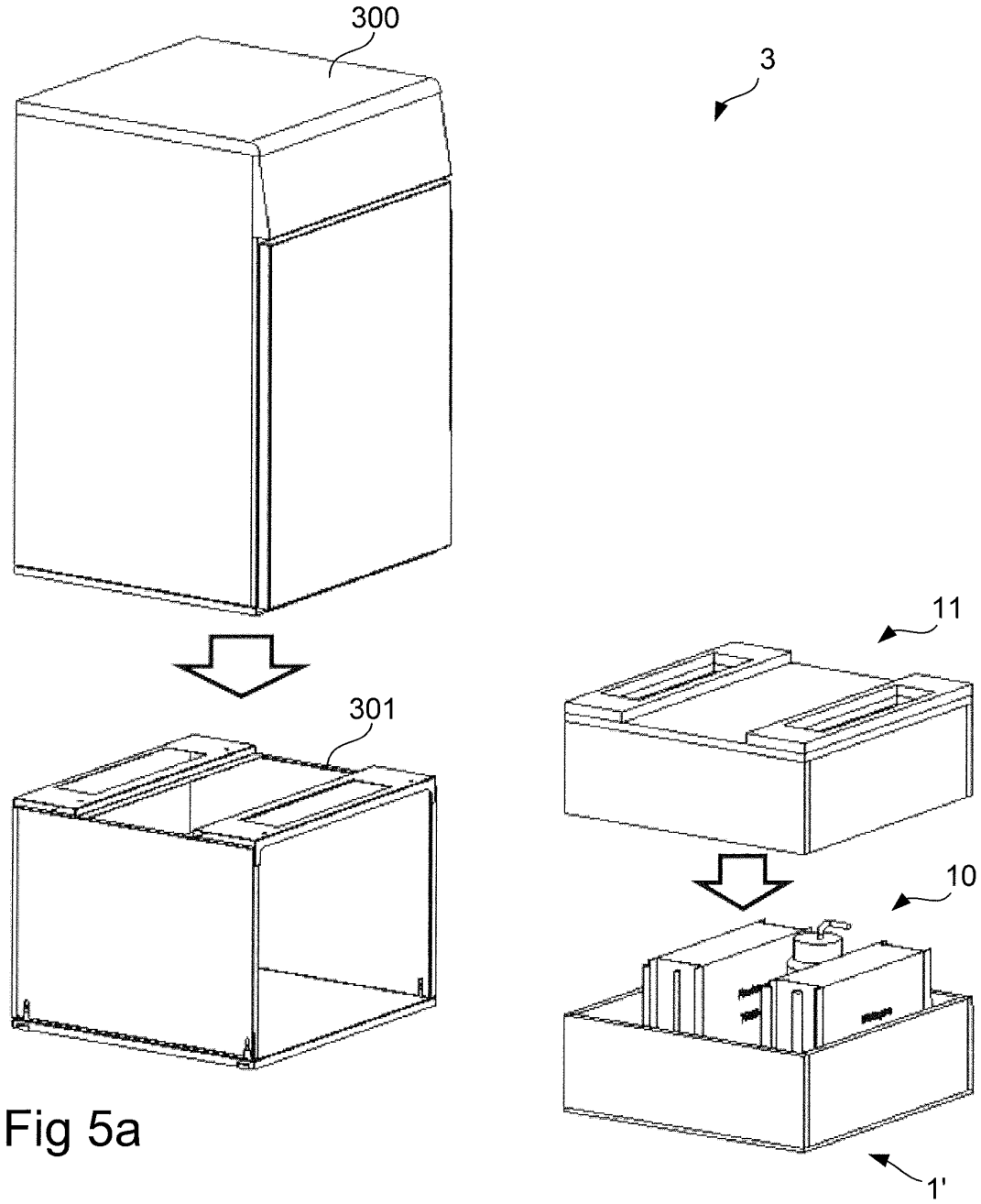

Fig 5a

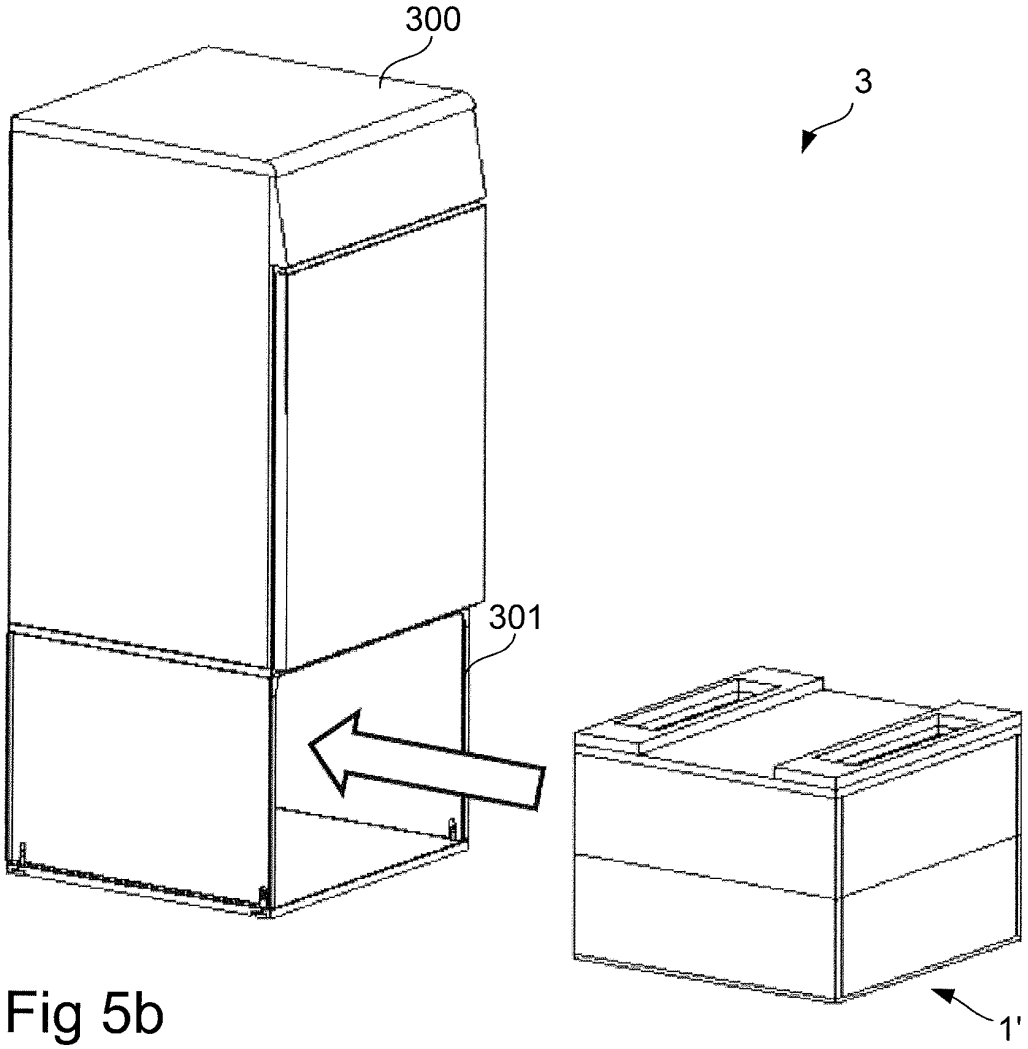

Fig 5b

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2005230324 A **[0003]**