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(54) MACHINE FOR WASHING AND DRYING LAUNDRY

MASCHINE ZUM WASCHEN UND TROCKNEN VON WÄSCHE

MACHINE À LAVER ET À SÉCHER LE LINGE

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Description

Field of the invention

[0001] The present invention relates to household laundry washing and drying machines and has been developed with particular reference to front-loading machines that have a drying circuit that comprises a heat pump.

Prior art

[0002] Front-loading machines of the type referred to above typically have a cabinet housed within which is an oscillating assembly. The oscillating assembly comprises a treatment tub, rotatably mounted within which is a drum, designed to contain the laundry to be washed and dried. The axis of rotation of the drum, and hence of the oscillating assembly, may be substantially horizontal (indicatively comprised between 0° and 15° with respect to the horizontal), or else markedly inclined (indicatively higher than 15° with respect to the horizontal, for example with an inclination comprised between 30° and 40°).

[0003] The machines referred to moreover have a drying circuit, for generating and conveying a forced flow of air and for heating the air of the forced flow. In machines of the condensation type, the drying circuit is substantially closed, i.e., configured for drawing in the moist air from the treatment tub and sending it back into the tub, after prior dehumidification and heating: for this purpose, also provided along the circuit is a device for causing condensation of the humidity present in the air extracted from the tub.

[0004] In recent years, there has been a widespread use - chiefly for reasons of energy efficiency - of heat pumps in washer-dryers. Heat-pump machines envisage two substantially closed circuits: the first circuit is that of the drying air, whereas the second circuit is that of the cooling fluid, which passes into a compressor operatively set between an evaporator and a condenser. In operation, the temperature of the cooling fluid increases following upon compression by the compressor. The cooling fluid is made to pass into a condenser, where it yields heat to the flow of air, which is thus heated. From the condenser, the cooling fluid first passes into a lamination valve, constituted, for example, by a simple capillary tube, which expands and cools the fluid, and then into an evaporator, to return once more to the compressor. In this way, the condenser of the heat pump performs the function of heating the drying air, whereas the evaporator performs the function of condensation of the humidity present in the air extracted from the tub. The condenser and the evaporator hence generally comprise a respective cooling fluid-drying air heat exchanger.

[0005] In some known solutions, certain components of the heat pump, such as the condenser and the evaporator, are mounted above the oscillating assembly, i.e., above the treatment tub.

[0006] In the case of front-loading laundry-washing machines in which the axis of the oscillating assembly is markedly inclined, for example with an inclination greater than 30°, between the rear-upper portion of the tub and the upper wall of the cabinet it is possible to provide a significant space for housing various components of the heat pump, such as the condenser, the evaporator, and possibly also the compressor (see, for example, EP 2436818 A).

[0007] Instead, in the case of machines with horizontal or substantially horizontal axis, positioning of components of the heat pump above the tub is more problematic. From EP 2270274 A there is known a front-loading laundry washer-dryer with a substantially horizontal axis, having a cabinet, the upper wall of which is configured as an equipped panel, including two heat exchangers that make up one the condenser and the other the evaporator of a heat pump. The heat exchangers are mounted horizontally in a central position of the panel within a channel for passage of the drying air, defined by the body of the panel itself. This solution is relatively complex, in view of the need to integrate the heat exchangers in the so-called "top" of the machine.

[0008] EP 2143839 A1 discloses a cloth dryer including a heat-pump having a heat radiator and a heat absorber integrated into one finned body, which is arranged at a lower section of the rear wall of the machine's housing. In one embodiment, the heat absorber and the heat radiator are placed slantingly, such that the lowest portion of the heat absorber is located somewhat lower than the lowest portion of the heat radiator.

[0009] WO 2014/083503 A, discloses a washer-dryer machine in which the heat exchangers that make up the condenser and the evaporator are mounted directly above the treatment tub, in a central position with respect thereto. In this case, the heat exchanger of the condenser is mounted horizontal, whereas the heat exchanger of the evaporator is mounted slightly inclined. With this solution, the assembly integrating the heat exchangers is potentially subject to impact with the upper wall of the cabinet, due to the vibrations of operation proper to the oscillating assembly of the machine, typically during spinning of the load of laundry, in particular in conditions of unbalanced load.

[0010] EP 3026168 A1 discloses a washer-dryer machine comprising a heat pump at an upper side of the casing and is prior art falling under the provision of Article 54(3) EPC.

Summary of the invention

[0011] The object of the present invention is basically to overcome the drawbacks referred to above and to provide a front-loading laundry washing and drying machine with a substantially horizontal axis that is simple to produce and reliable.

[0012] The above object is achieved, according to the present invention, by a laundry washing and drying ma-

chine having the characteristics specified in Claim 1. Preferred embodiments of the invention are specified in the dependent claims. The claims form an integral part of the technical teaching provided herein in relation to the invention.

Brief description of the drawings

[0013] Further purposes, characteristics, and advantages of the invention will emerge clearly from the ensuing detailed description, with reference to the annexed drawings, which are provided purely by way of explanatory and non-limiting example and in which:

- Figure 1 is a schematic perspective view from the front side of a laundry washing and drying machine;
- Figure 2 is a schematic perspective view from the rear side of a machine falling outside the scope of the invention, with some elements of the corresponding cabinet removed;
- Figure 3 is a partial and schematic perspective view of a treatment tub of a machine falling outside the scope of the invention, with a heat-pump assembly;
- Figure 4 is a partial and schematic rear elevation of the tub of Figure 3;
- Figure 5 is a schematic top plan view of the tub of Figure 3;
- Figure 6 is a partial and schematic side elevation of the tub of Figure 3;
- Figures 7, 8, 9, and 10 are schematic views, respectively a perspective view, a top plan view, a front elevation, and a side elevation, of a machine falling outside the scope of the invention, with some internal components of a heat-pump assembly highlighted;
- Figures 11 and 12 are schematic perspective views, from different angles, of a treatment tub of a laundry washing and drying machine, with a part of a heat-pump assembly;
- Figures 13 and 14 are schematic views, respectively a perspective view and a front elevation, of a machine falling outside the scope of the invention, with just the heat exchangers of a heat-pump assembly highlighted;
- Figures 15 and 16 are views similar to those of Figures 13 and 14 but regard an embodiment of the invention;
- Figure 17 is a view similar to that of Figure 10, but regarding the embodiment of the invention of Figures 15-16, with just the heat exchangers highlighted; and
- Figure 18 is a schematic perspective view from the rear side of the tub according to the embodiment of Figures 15-17, with just the heat exchangers of the heat-pump assembly highlighted.

Description of embodiments of the invention

[0014] Reference to "an embodiment" or "one embodiment" in the framework of the present description is intended to indicate that a particular configuration, structure, or characteristic described in relation to the embodiment is comprised in at least one embodiment. Hence, phrases such as "in an embodiment" or "in one embodiment" and the like that may be present in various points of this description do not necessarily all refer to one and the same embodiment. Furthermore, the particular configurations, structures, or characteristics may be combined in any adequate way in one or more embodiments. The references used in what follows are provided merely for convenience and do not define the sphere of protection or the scope of the embodiments. In the figures, the same references are used to designate elements that are similar or technically equivalent.

[0015] It is pointed out that in the sequel of the present description, only the elements useful for an understanding of the invention will be described in particular detail, it being taken for granted that the machine forming the subject of the invention comprises all the other elements in themselves known for normal operation of a common machine designed for carrying out washing and drying operations.

[0016] With initial reference to Figure 1, designated as a whole by 1 is a front-loading laundry washing and drying machine. The machine has a cabinet 2, comprising a front wall 3, where a door 4 is mounted, as well as two opposite side walls, one of which is designated by 5a, an upper wall or top 6, and a rear wall, not visible. Located preferentially in the upper area of the front wall 3 is a drawer container 7 forming part of a dispenser of washing agents, as well as a control panel 8, both of a conception in itself known.

[0017] Visible in Figure 2, where the representation of the front wall 3 and of the upper wall 6 has been omitted, are both of the side walls 5a and 5b, as well as the rear wall of the cabinet, designated by 9. Mounted inside the cabinet is an oscillating assembly 10, comprising a treatment tub provided with a front opening, in a position corresponding to the door 4 of Figure 1, a laundry drum being rotatably mounted in said tub.

[0018] Set at least partially inside the cabinet 2, above the oscillating assembly 10, and hence above the aforesaid tub, is a heat-pump assembly, designated as a whole by 20. Preferentially, a casing body of the assembly 20, which may be seen in Figure 2 and in the subsequent Figures 3-6, is fixed to the cabinet 2, for example to the side walls 5a, 5b and possibly to the rear wall 9, but not ruled out is the case of at least part of the assembly 20 being fixed to the tub, or else both to the tub and to the cabinet.

[0019] In various embodiments, and as highlighted in Figure 2, mounted inside the cabinet 2, above the oscillating assembly, is a hopper-shaped container 12, forming part of the dispenser of washing agents referred to previously, which houses - preferably in a slidable way - the drawer container 7 of Figure 1. In various embodiments (see Figure 5) the hopper-shaped container 12 has a supply duct 12a, preferably performing also func-

tions of air-break, bearing at its distal end one or more solenoid valves 12b for control of filling of the machine with water, for carrying out the washing cycles, and/or for cleaning possible filters present on the machine.

[0020] Highlighted moreover in Figure 2 is a cross member, designated by 13, which connects the two side walls 5a, 5b together in order to strengthen the structure of the cabinet 2 and/or prevent caving-in of its top wall. In possible embodiments, the cross member 13 may be conveniently exploited also for local anchorage of the assembly 20.

[0021] In Figures 3-6, the treatment tub, designated by 14, is represented in isolation, together with the heat-pump assembly 20. In various embodiments, the assembly 20 comprises a casing body, designated as a whole by 21, which is hollow in order to define a channel for a flow of drying air. Set inside said body 21, which may be conveniently formed in a number of box-shaped parts assembled together in a fluid-tight way, are some components of the assembly, in order to obtain with the same body 21 an evaporator device 22, a condenser device 23 (which are referred hereinafter for simplicity as "evaporator" and "condenser"), and a fan 24. The assembly 20 moreover comprises the other elements normally known for operation of a heat pump, such as a compressor 25, at least one lamination valve or a capillary tube (not represented), and the necessary control circuitry.

[0022] As will emerge clearly hereinafter, the casing body 21 houses at least the heat exchangers of the evaporator 22 and of the condenser 23, and preferably also the impeller of the fan 24. The motor of the fan 24 may be conveniently positioned on the outside of the casing body 21, in a position isolated with respect to the flow of the drying air.

[0023] In the embodiment illustrated in Figures 3-6, the body 21 has a generally L-shaped configuration, i.e., with a portion that extends longitudinally along a side wall 5a of the cabinet 2, this portion including the condenser 23 and the fan 24. A second portion of the body 21 extends transversely, in a position corresponding to a rear-upper area of the tub 14, the evaporator 22 being included in this second portion.

[0024] In various embodiments, the casing body 21 defines, at its two ends, respective mouths for fluid connection with the inside of the tub 14. In the case exemplified, an end portion 22a of the body 21 defines an attachment - not indicated - for the first end of a duct 26, here in the form of a bellows-type tube, the second end of which is connected to a respective opening provided in the tub 14. In one embodiment, the aforesaid opening is provided in the peripheral wall of the tub 2: such an opening is, for example, designated by 14a in Figures 8 and 10. In the example illustrated, the air is drawn in from the tub 14 through the opening 14a, with the hollow portion 22a of the body 21, upstream of the evaporator 22, which thus provides an inlet portion of the body 21.

[0025] The opposite end portion of the body 21 defines, instead, an outlet mouth 27 (Figures 3 and 6) that generally faces a front opening of the tub 14 (such a front opening is, for example, designated by 14b in Figure 9). In various embodiments, the mouth 27 is connected in fluid communication with an annular conveying and air-tight member, of a conception in itself known, which surrounds the opening 14b and extends between the front wall of the tub and the front wall 3 of the cabinet, at the corresponding door.

[0026] In various embodiments, the casing body 21 has, in its rear part, a hollow portion 22b, for fluid connection between the evaporator 22 and the fan 24, in particular its intake branch. In a particularly advantageous embodiment, the body 21 defines a support 28 for the compressor 25, with the latter that is preferably supported behind the rear wall of the tub 14. Advantageously, the aforesaid support 28 can be obtained via a suitable shaping of the rear side of the connection portion 22b of the body 21.

[0027] In particular, from Figures 4 and 6 it may be noted how, in a particularly advantageous embodiment, the body portion 22b is shaped so as to facilitate off-flow of the water deriving from condensation of the humidity of the drying air towards a discharge connector 22c, defined in the lowest point of the duct inside the hollow portion 22b itself.

[0028] In Figures 7-10, the tub 14 is represented in isolation, with just the heat exchangers that make up the evaporator 22 and the condenser 23, as well as the impeller of the fan 24. Moreover highlighted in these figures is the longitudinal axis of the tub 14, designated by A, which substantially corresponds to the axis of rotation of the corresponding laundry drum. The machine according to the invention is a machine in which the axis A is horizontal or substantially horizontal, i.e., having an inclination comprised between 0° and 15°, with respect to a horizontal plane.

[0029] In the case exemplified, the evaporator includes a single heat exchanger 122, whilst the condenser includes two distinct heat exchangers, designated by 123a and 123b, set one after the other along the channel defined by the housing body. In various alternative embodiments, instead of two heat exchangers, the condenser may comprise a single heat exchanger. The heat exchangers used for implementation of the invention are preferentially selected from between finned-pack heat exchangers and micro-channel heat exchangers: the heat exchangers of the second type referred to guarantee greater efficiency and smaller overall dimensions. The impeller of the fan is designated by 124 in Figures 7-10. The fan is preferentially a centrifugal one.

[0030] According to a technique in itself known, each heat exchanger has a body configured for being traversed by the flow of air forced by the impeller 124 of the fan. Preferentially, the body of the heat exchangers has a generally parallelepipedal or prismatic shape, with an inlet end and an outlet end opposite to one another for the forced flow of air, as well as two lateral ends opposite to one another and set transversely with respect to the

inlet end and the outlet end. With reference to the example illustrated in Figure 7, the white arrows indicate the direction followed by the flow of air, which traverses the heat exchangers from the corresponding inlet end to the corresponding outlet end.

[0031] It should be noted that in the attached figures the body of the heat exchangers - here represented as finned-pack heat exchangers - has been deliberately represented schematically with a respective box-shaped casing merely for reasons of clarity and to provide an intuitive representation of their generally parallelepipedal or prismatic shape. In actual fact, the heat exchangers are formed by a series of finned packs or micro-channel batteries, assembled together so as to provide an overall shape that is generally parallelepipedal or prismatic.

[0032] Operation of the heat pump is of a type in itself known, and consequently will not be described in detail. In extreme synthesis, the impeller 124 brings about intake of the flow of air from the tub 14 (through the opening 14a of Figures 8 and 10, the tube 26 of Figures 3-5, and the body portion 22a of Figures 3 and 5). The air traverses the heat exchanger 122, to be dehumidified, and then travels, downstream of the impeller 124 of the fan, through the heat exchangers 123a and 123b, thereby heating up. At outlet from the housing body, the dehumidified and heated air is redirected towards the inside of the tub 14, via the mouth 27 and the annular air-conveying and air-tight member already referred to, which surrounds the front opening 14b of the tub 14.

[0033] At least one of the evaporator device 22 and the condenser device 23 is set inside the cabinet 2 in a lateral area that is comprised between a side wall 5a and a median vertical plane of the tub 14 that contains the axis A. The vertical plane referred to is represented in Figures 5 and 9 by the dashed line designated by P1, whereas the aforesaid lateral area is designated by S in Figure 9. In the case exemplified, then, the heat exchangers 123a and 123b, with the corresponding portion of the casing body 21 that houses them, are set in the aforesaid lateral area S.

[0034] As may be appreciated, with such a positioning, one of the aforesaid lateral ends of each heat exchanger 123a, 123b is closer to the vertical plane P1, whereas the other lateral end of the same heat exchanger is closer to the aforesaid side wall 5a of the cabinet 2.

[0035] The heat exchanger or each heat exchanger that is located in the lateral area S - here the heat exchangers 123a and 123b - is set according to a plane of lie that is generally inclined with respect to a horizontal plane (this horizontal plane may be, for example, identified intuitively with the plane of lie of the upper wall 6 of the cabinet 2).

[0036] The above characteristic may be appreciated in particular in Figure 9, where it may be noted how the heat exchanger 123b (which, like the heat exchanger 123a, is not visible, in so far as it occupies a position behind the heat exchanger 123b), is set according to a plane of lie - represented schematically by the dashed line P2 - that is inclined with respect to the horizontal. In the case exemplified, the planes P1 and P2 form between them an angle of less than 90°. It will be appreciated that, with this positioning, a lateral end of the heat exchanger 123a, 123b (here the end closer to the vertical plane P1) is located at a greater height than the other lateral end (here the end closer to the corresponding side wall of the cabinet).

[0037] The other heat exchanger of the heat-pump assembly - here represented by the heat exchanger 122 of the evaporator - is set at a rear-upper area of the tub 14, this heat exchanger being also preferably set according to a respective plane of lie that is generally inclined. The inclined plane of lie of the bottom face of the heat exchanger 122 is represented schematically by the dashed line designated by P3 in Figure 10. As may be appreciated, with this positioning, the inlet end of the heat exchanger 122 is located higher up than the corresponding outlet end, one being closer to the upper wall and the other being closer to the rear wall of the cabinet.

[0038] In various embodiments, also the fan 24 is advantageously housed in the lateral area S inside the cabinet 2, above the tub 14, with the casing body 21 that defines the housing for the impeller 124 and the corresponding intake and delivery sections. In the case of the embodiments illustrated in Figures 1-10, the casing body 21 defines the housing for the impeller 124 in a position generally intermediate with respect to the heat exchanger 122 of the evaporator 22 and the heat exchanger 123a of the condenser 23. Other choices of positioning for the fan are on the other hand possible, for example upstream of the condenser or downstream of the evaporator.

[0039] Lateral positioning of a substantial part of the heat-pump assembly 20 also facilitates positioning of the hopper-shaped container 12 (as may be appreciated from Figures 2 and 5), which can be set inside the cabinet 2 in a lateral area opposite to the one in which the heat exchangers 123a and 123b are located, i.e., in an area comprised between the side wall 5b of the cabinet and the median plane P1.

[0040] The heat-pump assembly moreover includes a system for filtering the forced air. In a preferred embodiment, a filter is set in the drying circuit upstream of the evaporator 22, for instance immediately downstream of the bellows-type tube 26.

[0041] Figures 11-14 refer to a variant embodiment according to which the heat exchanger - here designated by 123 - of the condenser 23 and the heat exchanger 122 of the evaporator 22 can both be housed inside the cabinet 2 in the aforesaid lateral area S, between the median plane P1 and a corresponding side wall 5a of the cabinet, as is clearly visible in Figure 14. In the example, both of the heat exchangers 122 and 123 are set according to one and the same plane of lie P2, illustrated in Figure 14, but not excluded is the case of a different inclination for the two heat exchangers. As may be seen in Figures 11 and 12, in embodiments of this type the casing body 21 prevalently extends in the longitudinal

direction of the lateral area S, with the casing for the impeller 124 in an end region of the body 21 that is generally opposite to the end region in which the mouth 27 is located. In embodiments of this type, a duct, for example a hose, may be provided for connection of the intake branch of the fan 24 to the corresponding opening 14a provided in the peripheral wall of the tub 14. It will be appreciated on the other hand that, with simple variations of the geometry of the casing body 21 and/or of the corresponding tube for drawing off the air, in all the embodiments provided herein the air can be extracted from the tub 14 through an opening made in the rear wall of the tub itself, such as, for example, the opening designated by 14c in Figures 12 or 16. Furthermore, the fan could also be set, instead of in one of the two end regions of the body 21 (i.e., in the proximity of the front wall or in the proximity of the rear wall of the cabinet), in an intermediate position between the two heat exchangers 122 and 123.

[0042] In one embodiment of the type referred to in Figures 11-14, a filter of the drying circuit can be located immediately downstream of the opening for intake of the air from the tub, for example the opening 14a or the opening 14c, or else immediately upstream of the fan, or else again immediately downstream of the fan (namely, in an intermediate position between the fan and to the evaporator).

[0043] In various embodiments, the body 20 illustrated in Figures 11-12 is preferentially shaped in its lower part so as to facilitate off-flow of the water deriving from condensation of the humidity of the drying air, towards a suitable discharge connector (not shown).

[0044] The plane of lie of the heat exchangers set in the aforesaid lateral area, inside the cabinet 2, may be inclined in such a way that the inlet end and the outlet end of each heat exchanger are located at different heights.

[0045] In accordance with the invention, the bodies of the heat exchangers 122, 123 of the evaporator device and the condenser device are set in the lateral area S with the respective inlet ends that are at a lower height than the respective outlet ends. An example of such an embodiment is exemplified in Figures 15-18, according to which the heat exchangers 122 and 123 are set according to respective inclined planes of lie, represented schematically by the dashed lines P4 and P5 in Figure 17. Hence, in the example illustrated the planes of lie of the heat exchangers 122 and 123 have a different inclination, but not excluded from the scope of the invention is the case of one and the same angle of the planes P4 and P5 inclined with respect to the horizontal. In embodiments of the type represented in Figures 15-18, the casing body of the assembly 20 may have a general configuration and arrangement similar to the one illustrated and described with reference to Figures 11 and 12, with the fan in one of the two end regions of the casing body (i.e., in the proximity of the front wall or in the proximity of the rear wall of the cabinet) or in an intermediate position between the heat exchangers 122 and 123.

[0046] As may be seen, in the embodiment of Figures 15-18, the plane of lie of the heat exchanger 122 and/or of the heat exchanger 123 is inclined with respect to the horizontal both in a lateral direction (i.e., in the direction between the median plane P1 and the side wall of the cabinet) and in the longitudinal direction (i.e., in the direction between the rear wall and the front wall of the cabinet). In other embodiments, the plane of lie of each heat exchanger set in the lateral area S could be inclined even only in the longitudinal direction, i.e., in the direction of the depth of the cabinet.

[0047] The embodiments of Figures 15-18 may advantageously envisage an arrangement of at least one filter of the drying circuit similar to what has already been explained with reference to the embodiment of Figures 11-14.

[0048] Embodiments have previously been described in which the air is drawn off in a region corresponding to the peripheral wall or the rear wall of the tub. It will be appreciated, however, that the drying circuit could be reversed with respect to what has been exemplified, where the moist air is drawn off through the front opening of the tub and the dehumidified and heated air is re-introduced through one or more openings provided in the peripheral wall and/or in the rear wall of the tub. For these variant embodiments, also the positions of the heat exchangers of the evaporator 122 and of the condenser 123 will be consequently reversed with respect to what has been exemplified previously.

[0049] In the attached figures provided by way of example, the area S is defined in the right-hand part of the cabinet 2, when this is observed from the front, but in other variant embodiments the lateral area for housing at least one of the heat exchangers according to one of the inclined arrangements described could be in the left-hand part of the cabinet.

[0050] From the foregoing description, the characteristics of the present invention emerge clearly.

[0051] The arrangement proposed for the heat exchangers enables housing of the heat-pump assembly in cabinets of washer-dryer machines of substantially standardized dimensions, i.e., in cabinets of machines provided with more traditional drying systems, which do not use a heat pump. Positioning of the evaporator and the condenser in a lateral area moreover enables a reduction of the risks of impact between the tub and parts of the assembly, for example during spinning steps performed by the machine. Arrangement of the heat exchangers according to inclined planes enables concentration of a larger surface of heat exchange, as compared to a heat exchanger set horizontally, as well as favouring off-flow of the condensation water from the body of the heat exchangers so that it can then be removed.

[0052] It is clear that numerous variants may be made by the person skilled in the art to the washing and drying machine described by way of example, without thereby departing from the scope of the invention, as defined by

the annexed claims.

[0053] As mentioned previously, in possible variant embodiments the casing body of the heat-pump assembly can be fixed either to the cabinet of the machine or to the oscillating assembly. In a possible embodiment of this type, for example, two different parts of the casing body are fixed one to the cabinet and the other to the tub, with said parts that are connected together in fluid communication via a flexible duct, for example a bellows-type duct.

[0054] In one embodiment, which may be applied, for example, to the machines of Figures 15-18, a substantially rigid duct is fixed to the rear wall 14 of the tub, the aforesaid rigid duct having one end connected to the opening 14c provided in said rear wall. The opposite end of the duct is connected in fluid communication with the body that houses at least one of the heat exchangers 122 and 123 via a flexible duct, for example a bellows-type duct. With reference, for example, to a body 20 of the type visible in Figures 11 and 12, the aforesaid flexible duct thus connects the aforesaid outlet end of the duct fixed to the tub with the intake section of the fan 24 defined by the body 20.

Claims

1. A front-loading laundry washing and drying machine, comprising:

a cabinet (2) having a front wall (3), a rear wall (9), two side walls (5a, 5b), and an upper wall (6), the cabinet (2) housing an oscillating assembly (10) that comprises a treatment tub (14) having a substantially horizontal longitudinal axis (A);

a drying circuit comprising a heat pump (20) inside the cabinet (2), the heat pump (20) including an evaporator device (22), a condenser device (23), a compressor (25), and a fan (24) for forcing a flow of air through the evaporator device (22) and the condenser device (23),

wherein at least the evaporator device (22) and the condenser device (23) are housed inside the cabinet (2) above the treatment tub (14), the evaporator device (22) and the condenser device (23) each including a heat exchanger (122, 123) having a body configured for being traversed by the forced flow of air, the body of each heat exchanger having an inlet end and an outlet end opposite to one another, for the forced flow of air, and a first lateral end and a second lateral end opposite to one another and set transversely with respect to the inlet end and outlet ends;

wherein the heat exchangers (122, 123) of the evaporator device (22) and the condenser device (23) are set inside the cabinet (2) in a lateral area (S) that is comprised between a first side wall (5a) of the cabinet (2) and a median vertical plane (P1) of the treatment tub (14) that contains the corresponding longitudinal axis (A), with the first lateral end of each heat exchanger (122, 123) that is closer to the aforesaid median vertical plane (P1) and the second lateral end of each heat exchanger (122, 123) that is closer to the aforesaid first side wall (5a);

wherein the heat exchangers (122, 123) of the evaporator device (22) and the condenser device (23) are set in the aforesaid lateral area (S) according to a plane of lie (P2; P4, P5) inclined with respect to a horizontal plane;

wherein the bodies of the heat exchangers (122, 123) of the evaporator device (22) and of the condenser device (23) are set in the aforesaid lateral area (S) with the inlet end and the outlet end at different heights, and wherein the bodies of the heat exchangers (122, 123) of the evaporator device (22) and of the condenser device (23) are set in the aforesaid lateral area (S) with the respective inlet ends that are at a lower height than the respective outlet ends.

2. The machine according to Claim 1, wherein the bodies of the heat exchangers (122, 123) of the evaporator device (22) and of the condenser device (23) are set in the aforesaid lateral area (S) with the first lateral end that is at a greater height than the second lateral end.

3. The machine according to Claim 1 or Claim 2, wherein also the fan (24) is set in the aforesaid lateral area (S), above the treatment tub (14).

4. The machine according to any one of Claims 1-3, wherein the heat exchanger (122) of the evaporator device (22) and the heat exchanger (123) of the condenser device (23) are both housed in the aforesaid lateral area (S) each according to a respective plane of lie (P4, P5) inclined with respect to the horizontal.

5. The machine according to any one of Claims 1-4, wherein the heat exchangers (122, 123) of the evaporator device (22) and of the condenser device (23) are housed within one and the same generally hollow casing body (21).

6. The machine according to Claims 4 and 5, wherein the hollow casing body (21) extends longitudinally in the aforesaid lateral area (S).

7. The machine according to Claim 5 or Claim 6, wherein the hollow casing body (21) moreover defines a housing for an impeller (124) of the fan (24).

8. The machine according to any one of Claims 5-7, wherein the hollow casing body (21) has, in a first

end region, a mouth (27) generally facing a front opening (14b) of the treatment tub (14).

9. The machine according to Claims 7 and 8, wherein the hollow casing body (21) defines the housing for the impeller (124) of the fan (14) in a second end region thereof, opposite to the corresponding first end region.

Patentansprüche

1. Frontlader-Wäschewasch- und Trocknermaschine, umfassend:

ein Gehäuse (2) mit einer Vorderwand (3), einer Rückwand (9), zwei Seitenwänden (5a, 5b) und einer oberen Wand (6), wobei das Gehäuse (2) eine oszillierende Anordnung (10) aufnimmt, die eine Behandlungswanne (14) mit einer im Wesentlichen horizontalen Längsachse (A) aufweist;
einen Trocknungskreislauf mit einer Wärmepumpe (20) im Inneren des Gehäuses (2), wobei die Wärmepumpe (20) eine Verdampfereinrichtung (22), eine Kondensatoreinrichtung (23), einen Kompressor (25) und einen Ventilator (24) aufweist, um einen Luftstrom durch die Verdampfereinrichtung (22) und die Kondensatoreinrichtung (23) zu erzwingen,
wobei zumindest die Verdampfereinrichtung (22) und die Kondensatoreinrichtung (23) innerhalb des Gehäuses (2) oberhalb der Behandlungswanne (14) untergebracht sind, wobei die Verdampfereinrichtung (22) und die Kondensatoreinrichtung (23) jeweils einen Wärmetauscher (122, 123) mit einem Körper aufweisen, der derart eingerichtet ist, dass er von dem erzwungenen Luftstrom durchquert wird, wobei der Körper jedes Wärmetauschers ein Einlassende und ein Auslassende aufweist, die für den erzwungenen Luftstrom zueinander gegenüberliegend sind, und ein erstes seitliches Ende und ein zweites seitliches Ende, die zueinander gegenüberliegend sind und die transversal in Bezug auf das Einlassende und die Auslassenden angeordnet sind;
wobei die Wärmetauscher (122, 123) der Verdampfereinrichtung (22) und der Kondensatoreinrichtung (23) innerhalb des Gehäuse (2) in einem seitlichen Bereich (S) angeordnet sind, der zwischen einer ersten Seitenwand (5a) des Gehäuses (2) und einer vertikalen Mittelebene (P1) der Behandlungswanne (14), die die entsprechende Längsachse (A) umfasst, liegt, wobei das erste seitliche Ende jedes Wärmetauschers (122, 123) näher an der vertikalen Mittelebene (P1) und das zweite seitliche Ende jedes Wärmetauschers (122, 123) näher an der ersten Seitenwand (5a) liegt;
wobei die Wärmetauscher (122, 123) der Verdampfereinrichtung (22) und der Kondensatoreinrichtung (23) in dem vorgenannten seitlichen Bereich (S) entsprechend einer Liegeebene (P2; P4, P5), die bezüglich einer horizontalen Ebene geneigt ist, angeordnet sind;
wobei die Körper der Wärmetauscher (122, 123) der Verdampfereinrichtung (22) und der Kondensatoreinrichtung (23) in dem vorgenannten seitlichen Bereich (S) mit dem Einlassende und dem Auslassende in unterschiedlichen Höhen angeordnet sind,
und wobei die Körper der Wärmetauscher (122, 123) der Verdampfereinrichtung (22) und der Kondensatoreinrichtung (23) in dem vorgenannten seitlichen Bereich (S) mit den entsprechenden Einlassenden in einer geringeren Höhe als die entsprechenden Auslassenden angeordnet sind.

2. Maschine nach Anspruch 1, wobei die Körper der Wärmetauscher (122, 123) der Verdampfereinrichtung (22) und der Kondensatoreinrichtung (23) in dem vorgenannten seitlichen Bereich (S) mit dem ersten seitlichen Ende auf einer größeren Höhe als das zweite seitliche Ende angeordnet sind.

3. Maschine nach Anspruch 1 oder Anspruch 2, wobei auch der Ventilator (24) in dem vorgenannten seitlichen Bereich (S) oberhalb der Behandlungswanne (14) angeordnet ist.

4. Maschine nach einem der Ansprüche 1 bis 3, wobei der Wärmetauscher (122) der Verdampfereinrichtung (22) und der Wärmetauscher (123) der Kondensatoreinrichtung (23) beide in dem vorgenannten seitlichen Bereich (S) jeweils entsprechend einer jeweiligen Liegeebene (P4, P5), die geneigt zu einer horizontalen Ebene ist, untergebracht sind.

5. Maschine nach einem der Ansprüche 1 bis 4, wobei die Wärmetauscher (122, 123) der Verdampfereinrichtung (22) und der Kondensatoreinrichtung (23) innerhalb eines und des gleichen im Wesentlichen hohlen Gehäusekörpers (21) untergebracht sind.

6. Maschine nach Anspruch 4 und 5, wobei sich der hohle Gehäusekörper (21) im vorgenannten seitlichen Bereich (S) in Längsrichtung erstreckt.

7. Maschine nach Anspruch 5 oder 6, wobei der hohle Gehäusekörper (21) außerdem ein Gehäuse für einen Impeller (124) des Ventilators (24) definiert.

8. Maschine nach einem der Ansprüche 5 bis 7, wobei der hohle Gehäusekörper (21) in einem ersten End-

bereich eine Mündung (27) aufweist, die einer Frontöffnung (14b) der Behandlungswanne (14) generell gegenübersteht.

9. Maschine nach Anspruch 7 und 8, wobei der hohle Gehäusekörper (21) ein Gehäuse für den Impeller (124) des Ventilators (14) in einem zweiten Endbereich davon definiert, der gegenüber dem entsprechenden ersten Endbereich liegt.

Revendications

1. Machine à laver et sécher le linge à chargement frontal, comprenant :

une carrosserie (2) ayant une paroi avant (3), une paroi arrière (9), deux parois de côté (5a, 5b), et une paroi supérieure (6), la carrosserie (2) logeant un ensemble oscillant (10) qui comprend une cuve de traitement (14) ayant un axe longitudinal sensiblement horizontal (A) ;
un circuit de séchage comprenant une pompe à chaleur (20) à l'intérieur de la carrosserie (2), la pompe à chaleur (20) comportant un dispositif évaporateur (22), un dispositif condenseur (23), un compresseur (25), et un ventilateur (24) pour forcer un flux d'air à travers le dispositif évaporateur (22) et le dispositif condenseur (23),
dans laquelle au moins le dispositif évaporateur (22) et le dispositif condenseur (23) sont logés à l'intérieur de la carrosserie (2) au-dessus de la cuve de traitement (14), le dispositif évaporateur (22) et le dispositif condenseur (23) comportant chacun un échangeur de chaleur (122, 123) ayant un corps configuré pour être traversé par le flux d'air forcé, le corps de chaque échangeur de chaleur ayant une extrémité d'entrée et une extrémité de sortie opposées l'une à l'autre, pour le flux d'air forcé, et une première extrémité latérale et une seconde extrémité latérale opposées l'une à l'autre et installées transversalement par rapport à l'extrémité d'entrée et aux extrémités de sortie ;
dans laquelle les échangeurs de chaleur (122, 123) du dispositif évaporateur (22) et du dispositif condenseur (23) sont installés à l'intérieur de la carrosserie (2) dans une zone latérale (S) qui est comprise entre une première paroi de côté (5a) de la carrosserie (2) et un plan vertical médian (P1) de la cuve de traitement (14) qui contient l'axe longitudinal (A) correspondant, avec la première extrémité latérale de chaque échangeur de chaleur (122, 123) qui est plus près du plan vertical médian (P1) mentionné ci-dessus et la seconde extrémité latérale de chaque échangeur de chaleur (122, 123) qui est plus près de la première paroi de côté (5a) mentionnée ci-dessus ;
dans laquelle les échangeurs de chaleur (122, 123) du dispositif évaporateur (22) et du dispositif condenseur (23) sont installés dans la zone latérale (S) mentionnée ci-dessus selon un plan de configuration (P2 ; P4, P5) incliné par rapport à un plan horizontal ;
dans laquelle les corps des échangeurs de chaleur (122, 123) du dispositif évaporateur (22) et du dispositif condenseur (23) sont installés dans la zone latérale (S) mentionnée ci-dessus avec l'extrémité d'entrée et l'extrémité de sortie à des hauteurs différentes,
et dans laquelle les corps des échangeurs de chaleur (122, 123) du dispositif évaporateur (22) et du dispositif condenseur (23) sont installés dans la zone latérale (S) mentionnée ci-dessus avec les extrémités d'entrée respectives qui sont à une hauteur plus basse que les extrémités de sortie respectives.

2. Machine selon la revendication 1, dans laquelle les corps des échangeurs de chaleur (122, 123) du dispositif évaporateur (22) et du dispositif condenseur (23) sont installés dans la zone latérale (S) mentionnée ci-dessus avec la première extrémité latérale qui est à une hauteur plus importante que la seconde extrémité latérale.

3. Machine selon la revendication 1 ou la revendication 2, dans laquelle le ventilateur (24) est également installé dans la zone latérale (S) mentionnée ci-dessus, au-dessus de la cuve de traitement (14).

4. Machine selon l'une quelconque des revendications 1 à 3, dans laquelle l'échangeur de chaleur (122) du dispositif évaporateur (22) et l'échangeur de chaleur (123) du dispositif condenseur (23) sont tous deux logés dans la zone latérale (S) mentionnée ci-dessus chacun selon un plan de configuration (P4, P5) respectif incliné par rapport à l'horizontale.

5. Machine selon l'une quelconque des revendications 1 à 4, dans laquelle les échangeurs de chaleur (122, 123) du dispositif évaporateur (22) et du dispositif condenseur (23) sont logés au sein d'un seul et même corps de carter généralement creux (21).

6. Machine selon les revendications 4 et 5, dans laquelle le corps de carter creux (21) s'étend longitudinalement dans la zone latérale (S) mentionnée ci-dessus.

7. Machine selon la revendication 5 ou la revendication 6, dans laquelle le corps de carter creux (21) définit en outre un logement pour un rouet (124) du ventilateur (24).

8. Machine selon l'une quelconque des revendications 5 à 7, dans laquelle le corps de carter creux (21) comporte, dans une première région d'extrémité, un orifice (27) généralement en regard d'une ouverture avant (14b) de la cuve de traitement (14).

9. Machine selon les revendications 7 et 8, dans laquelle le corps de carter creux (21) définit le logement pour le rouet (124) du ventilateur (14) dans une seconde région d'extrémité de celui-ci, opposée à la première région d'extrémité correspondante.

Fig. 1

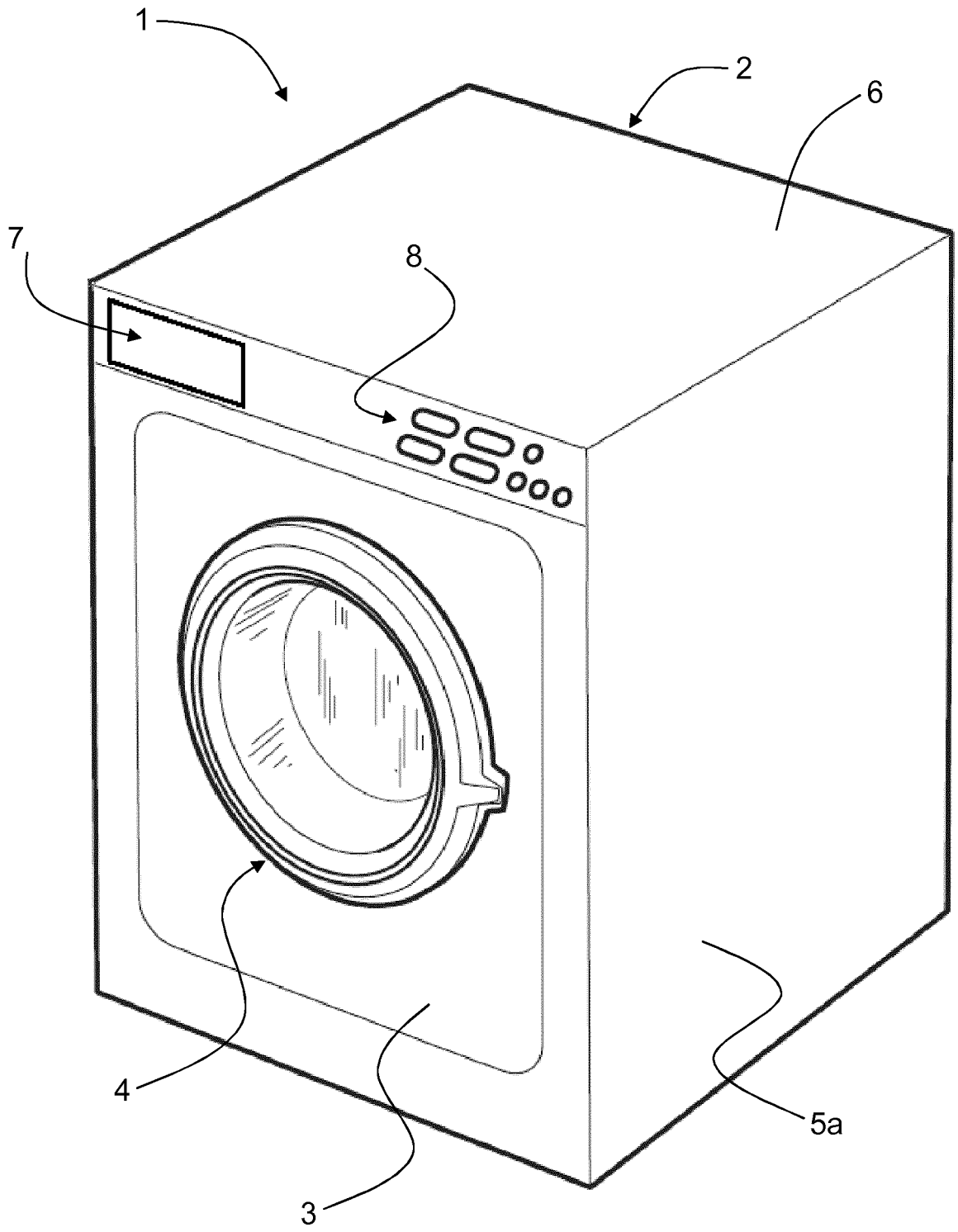


Fig. 2

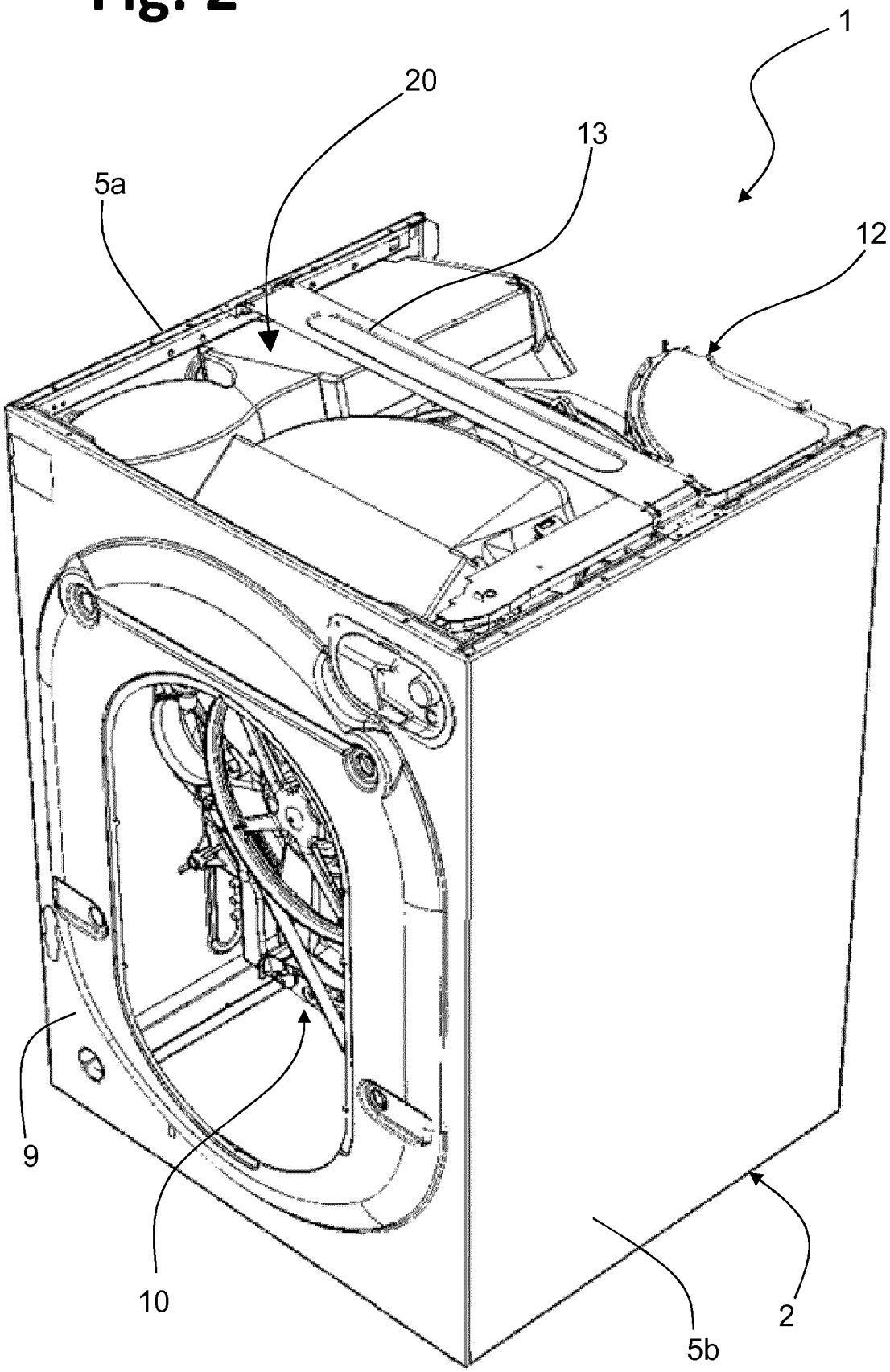


Fig. 3

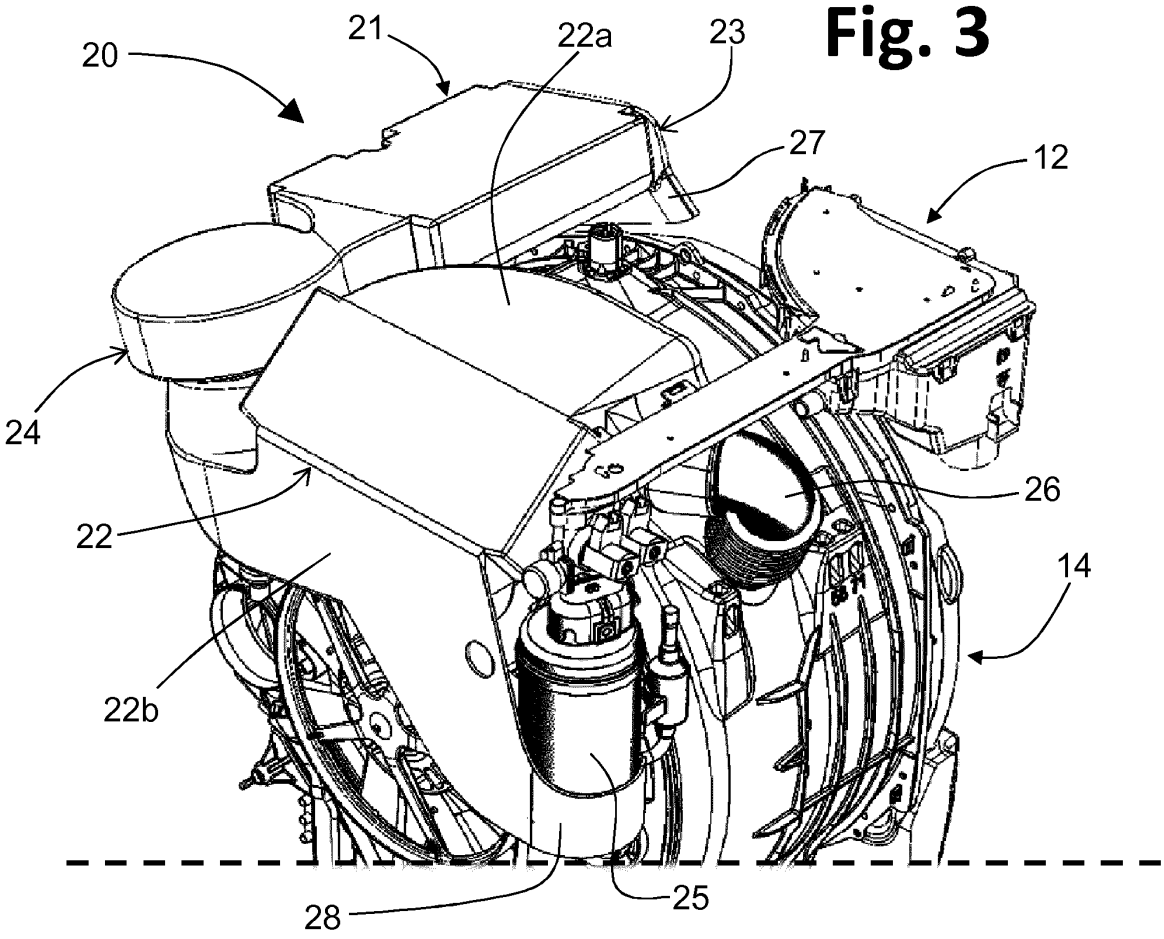
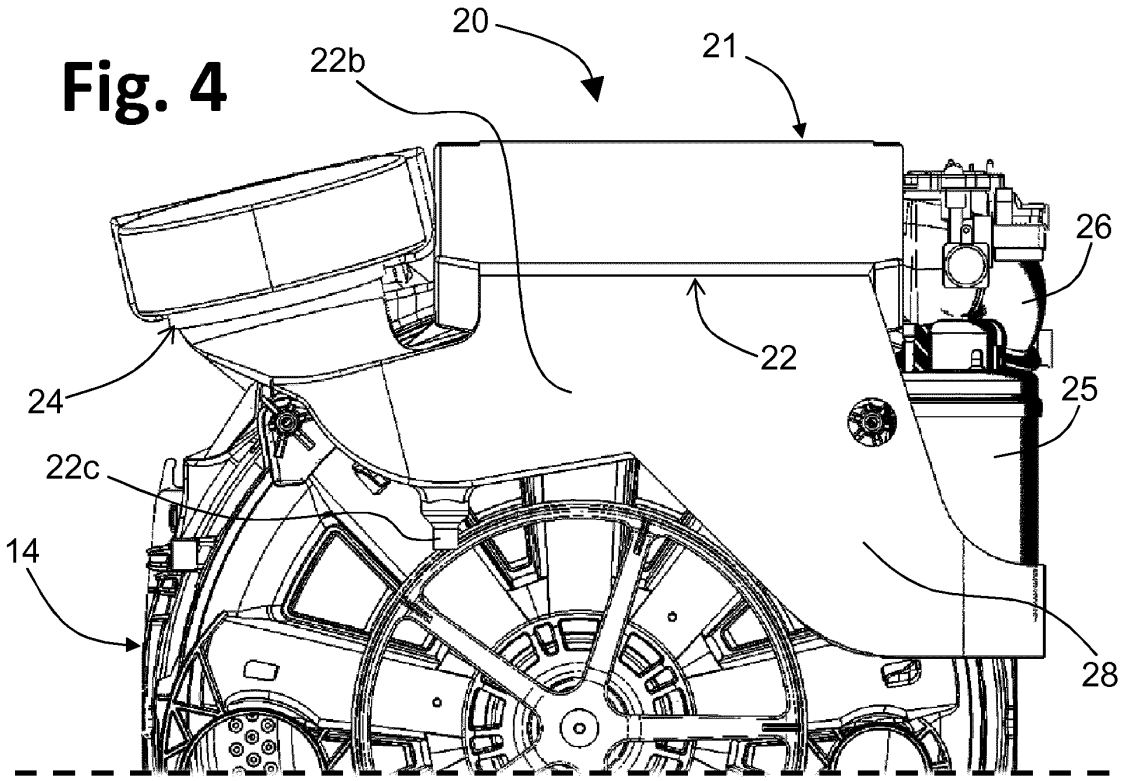

20
21
22a
23
27
12
24
26
22
14
22b
25
28

Fig. 4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22b
21
26
22
24
25
22c
14
28

Fig. 5

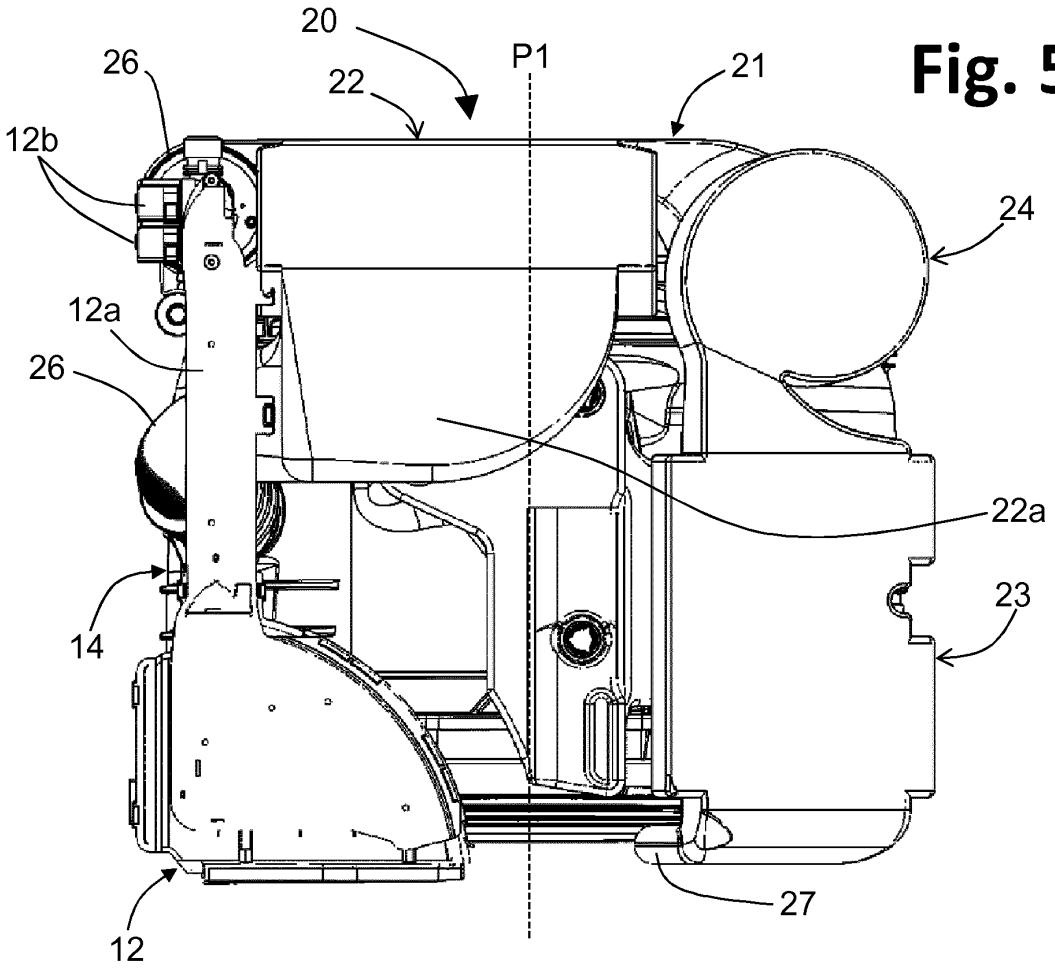


Fig. 6

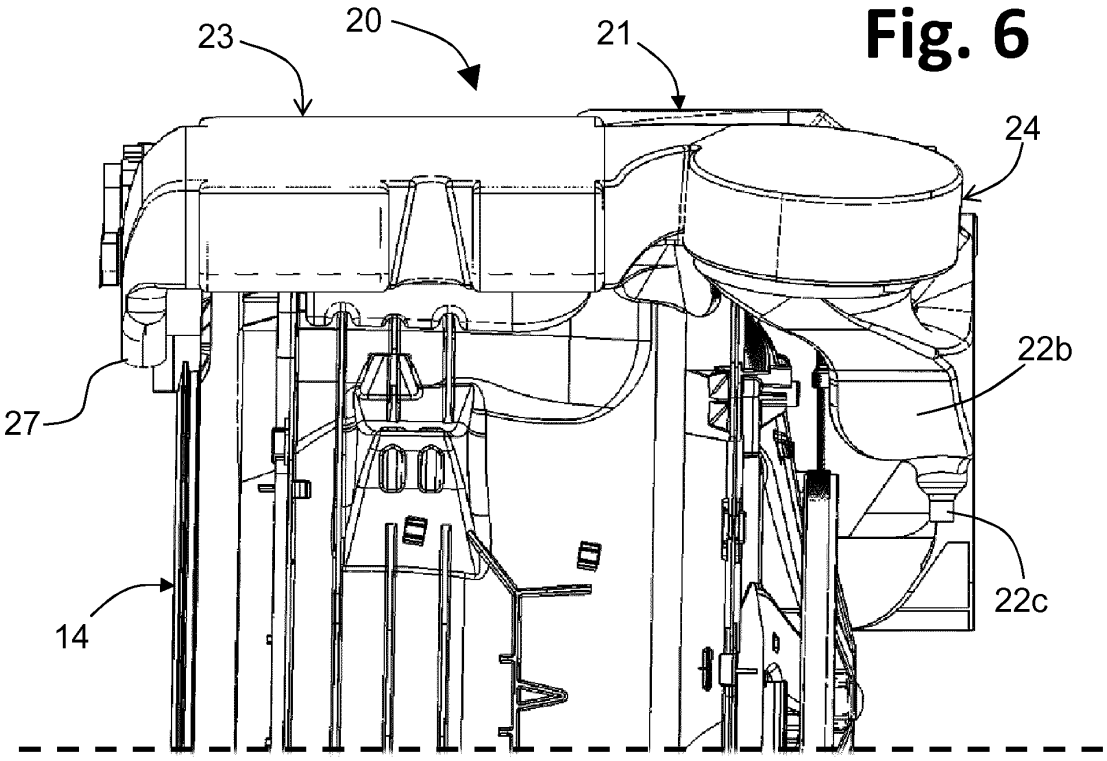


Fig. 7

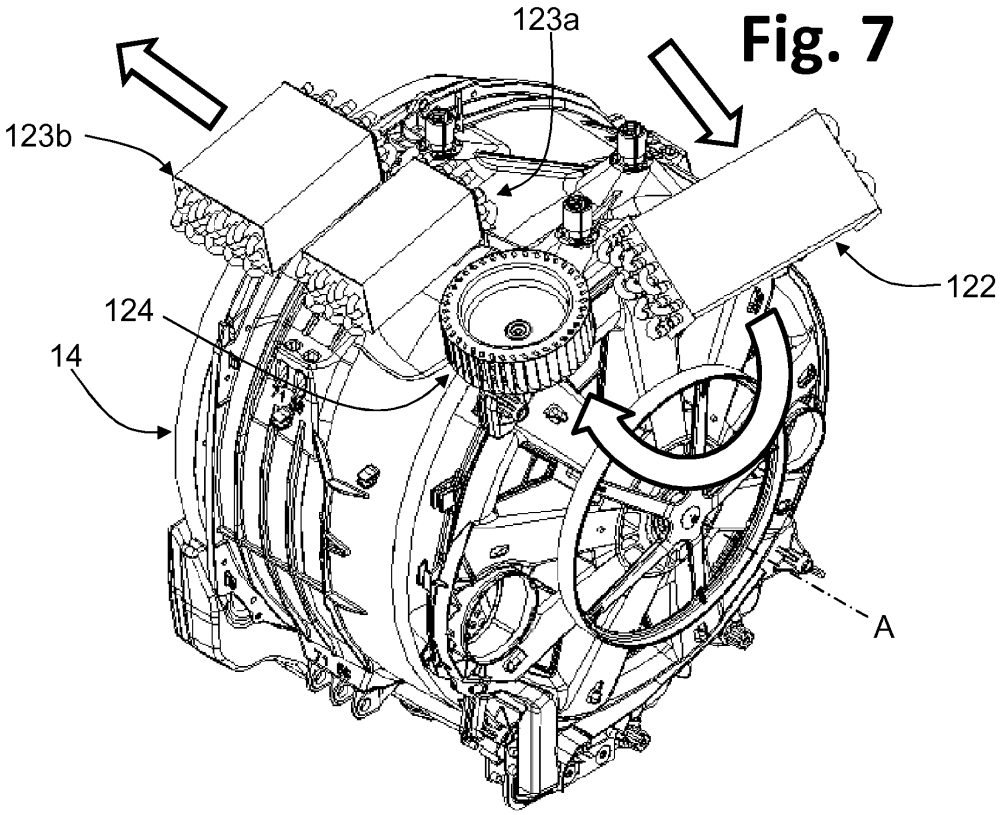
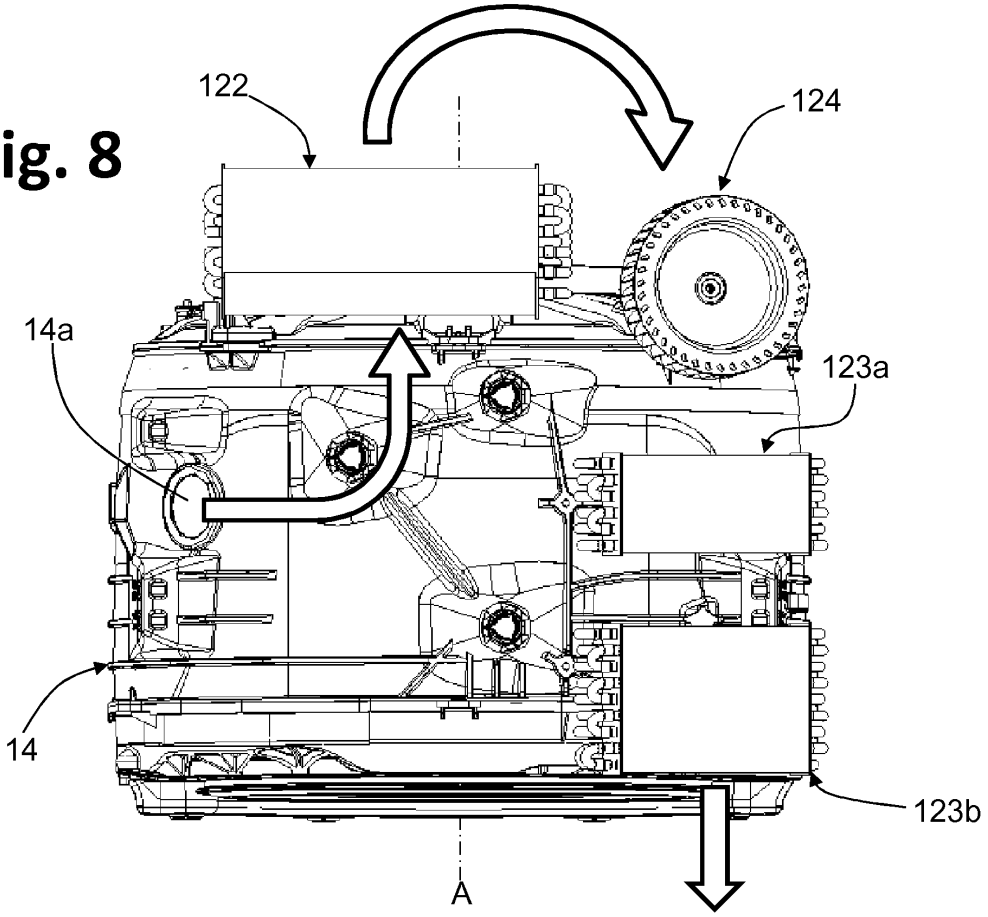


Fig. 8



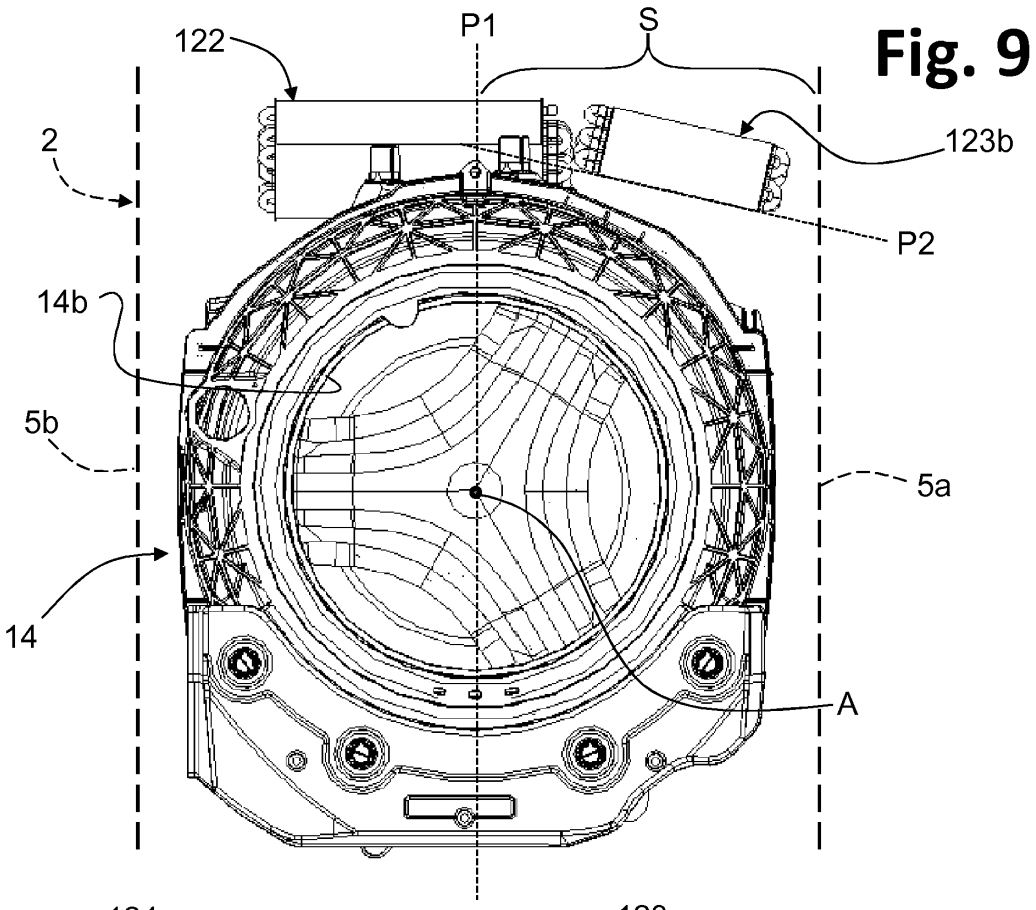


Fig. 9

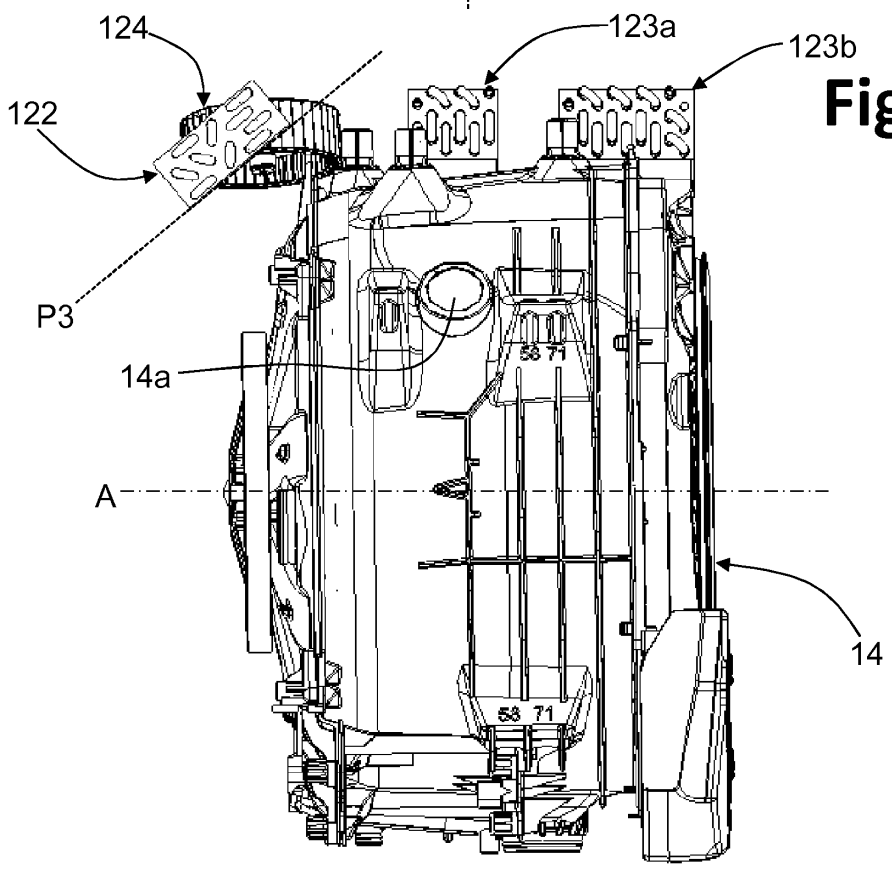
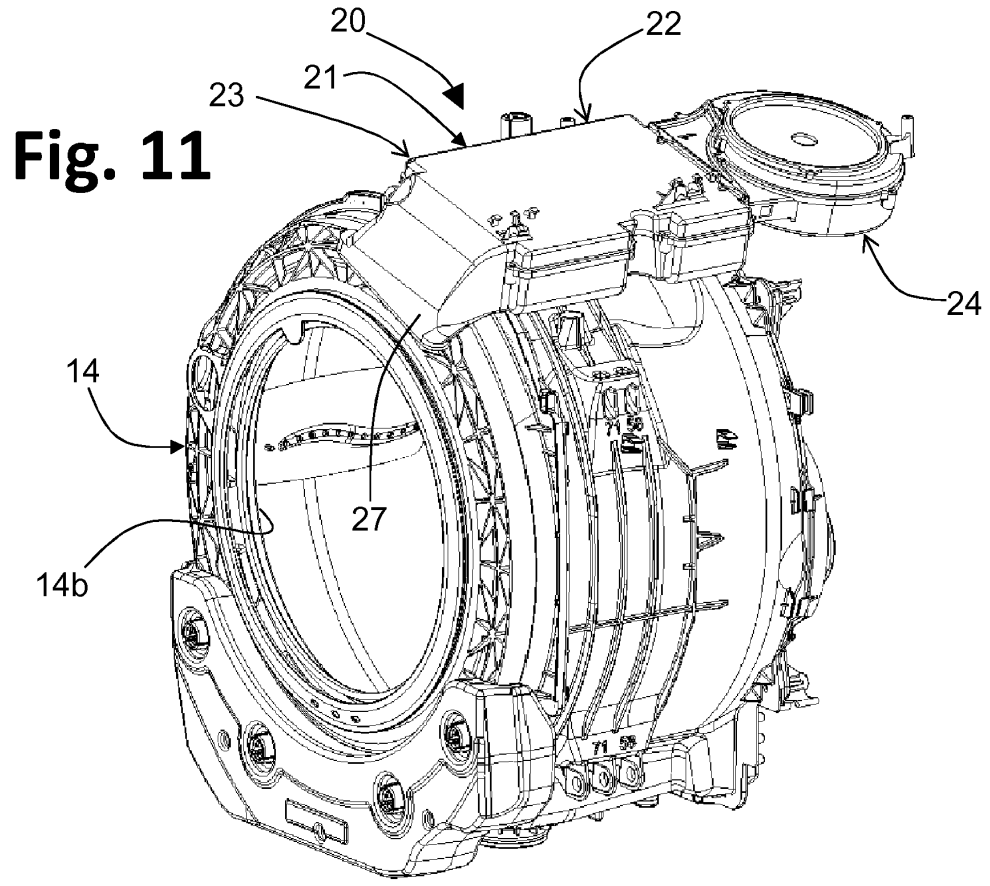


Fig. 10

Fig. 11



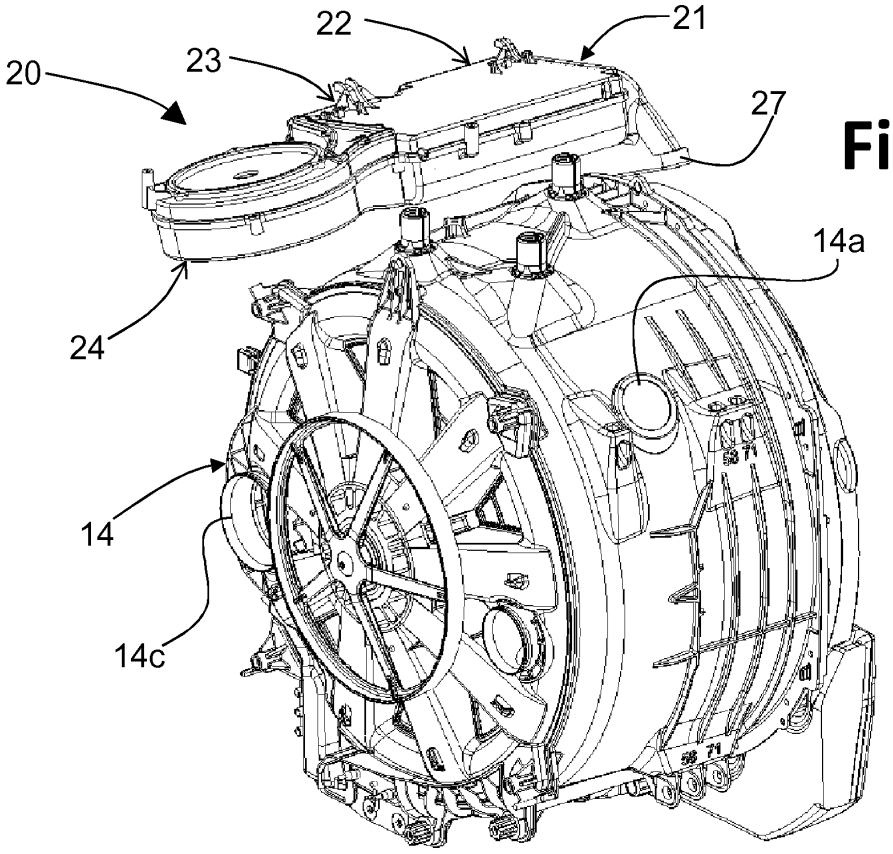


Fig. 12

Fig. 13

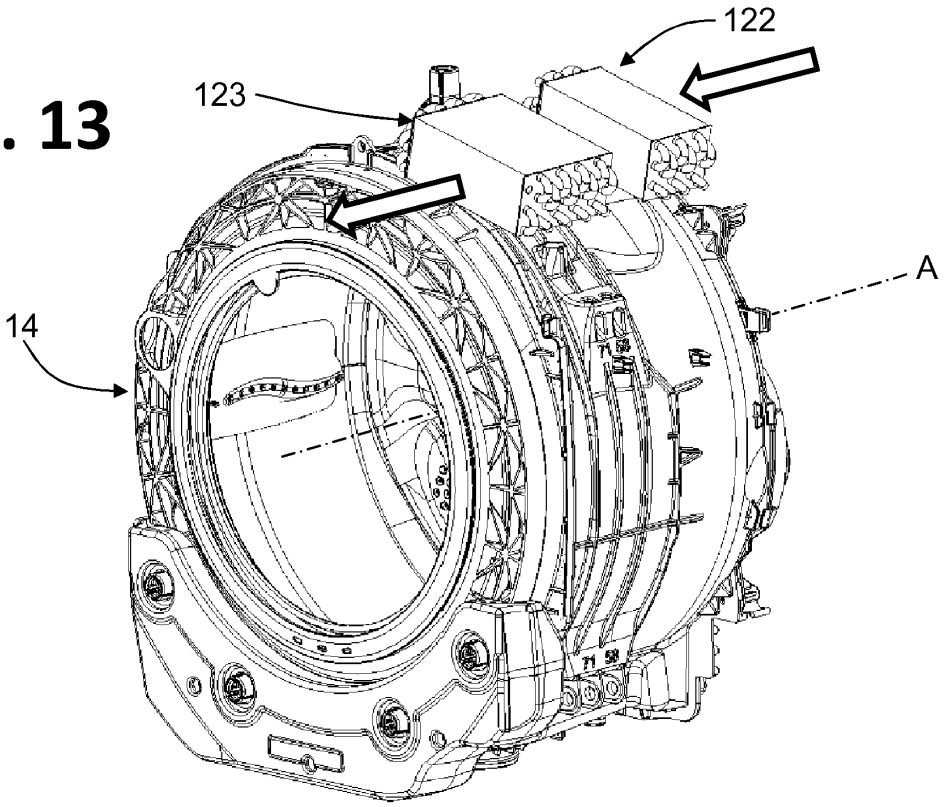


Fig. 14

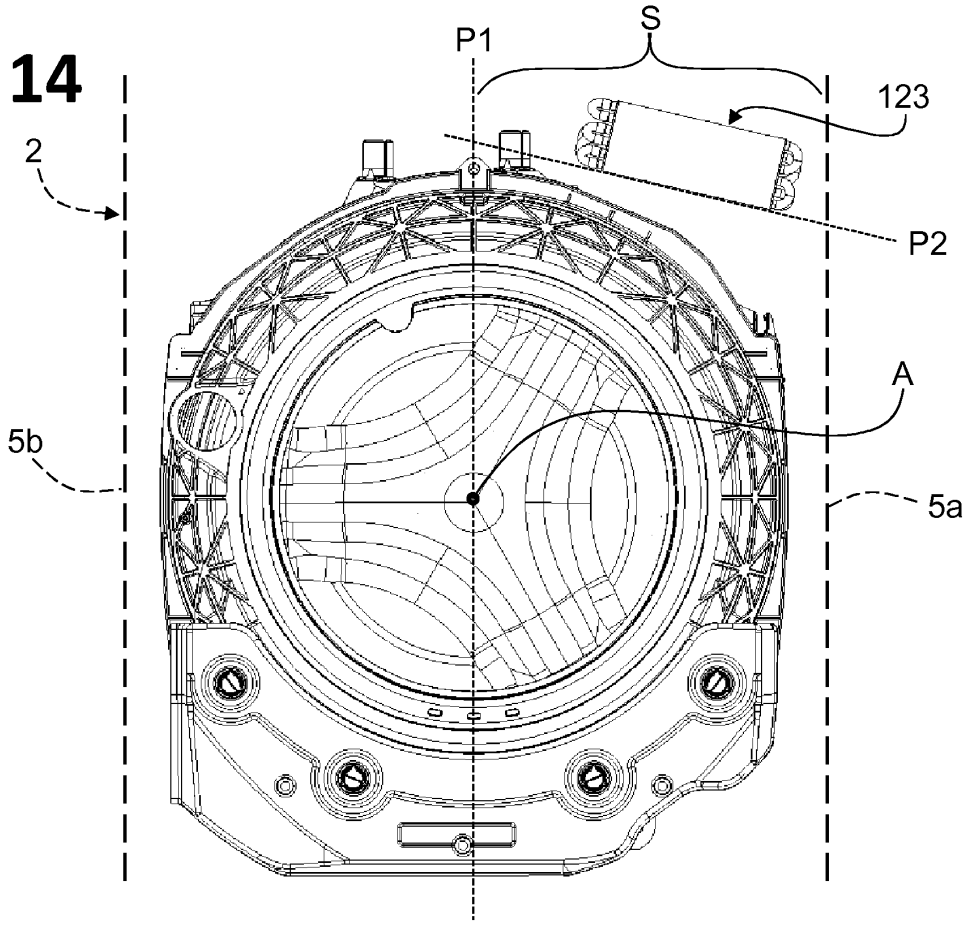


Fig. 15

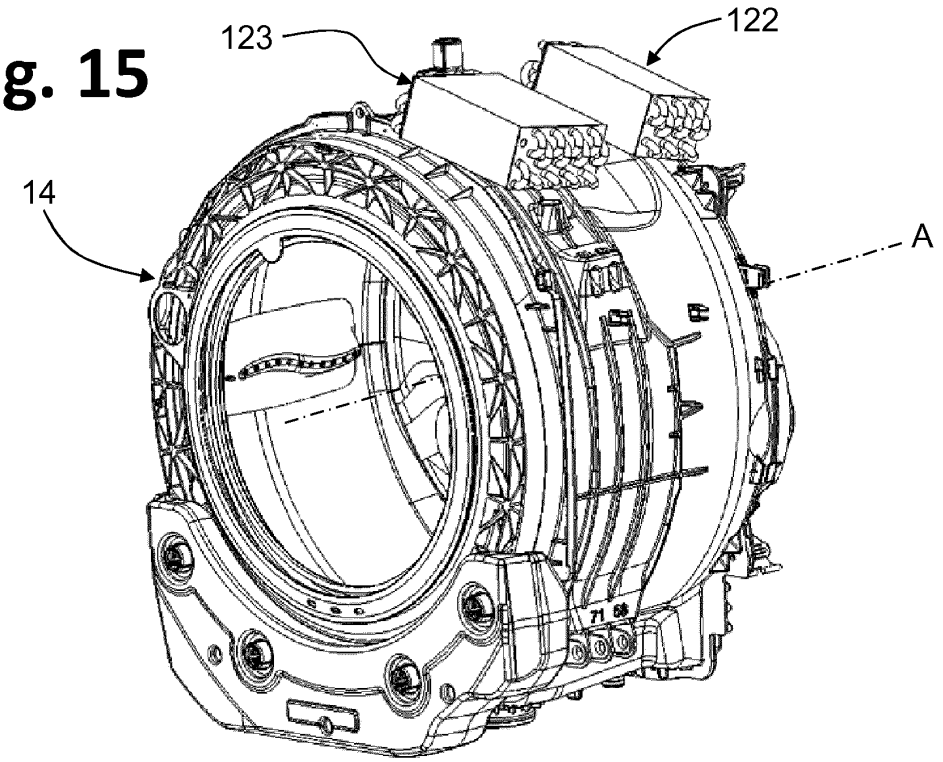


Fig. 16

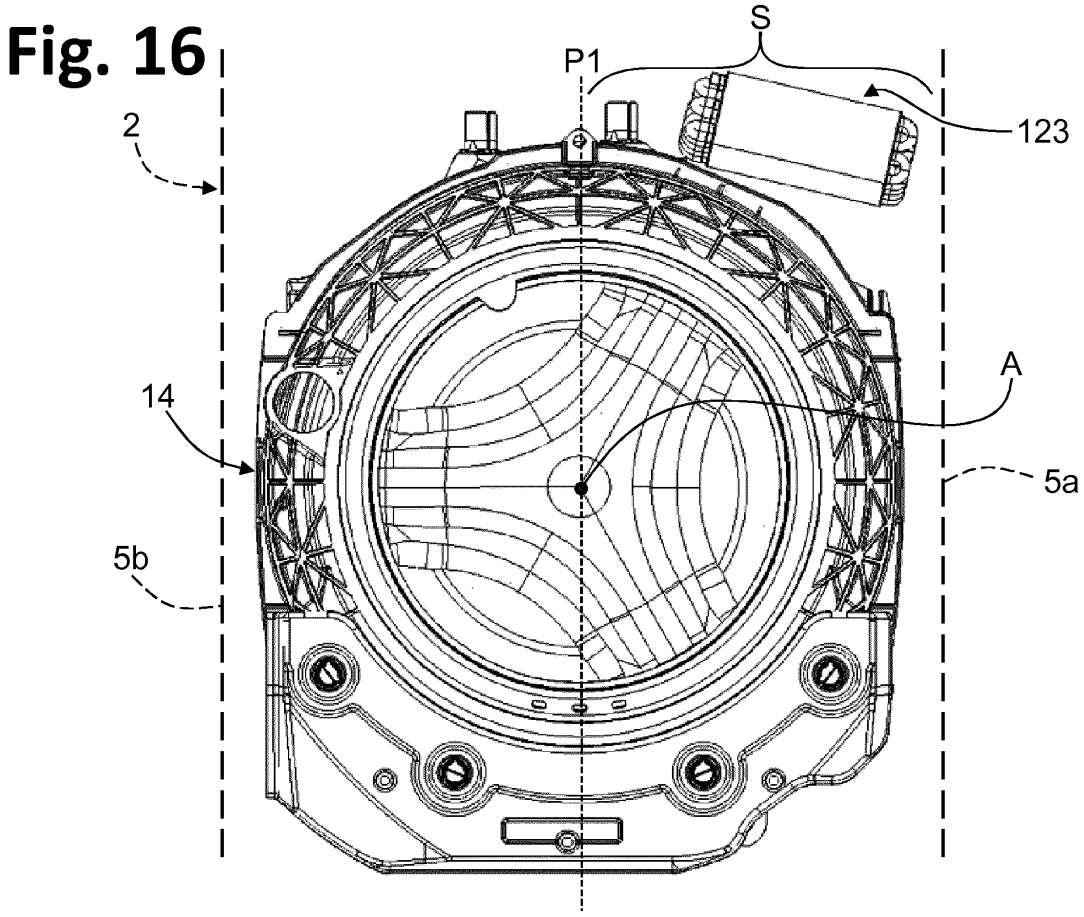


Fig. 17

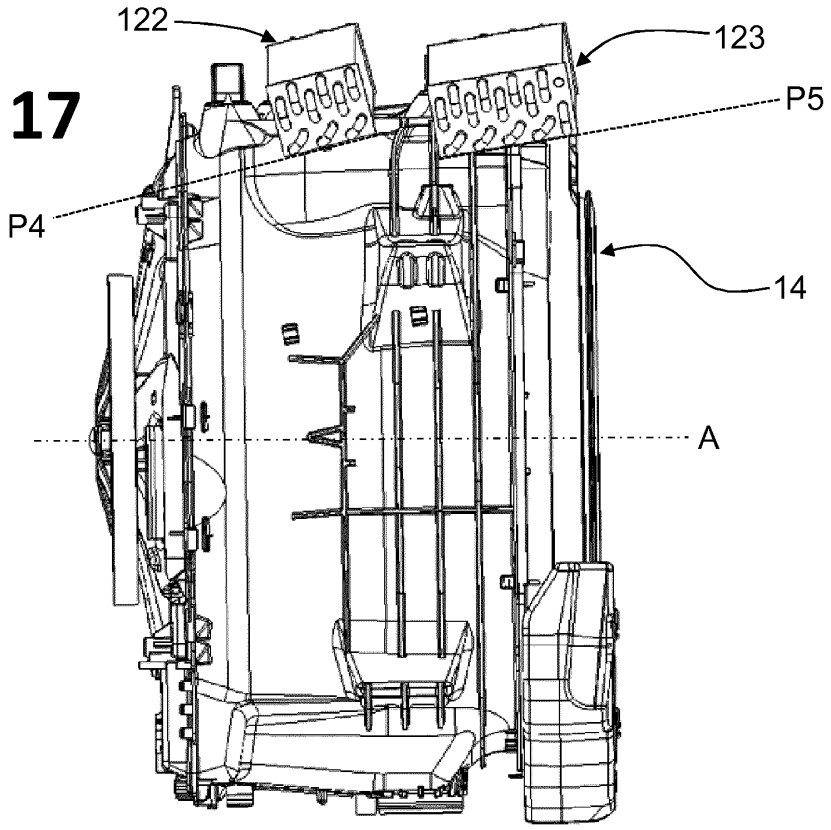
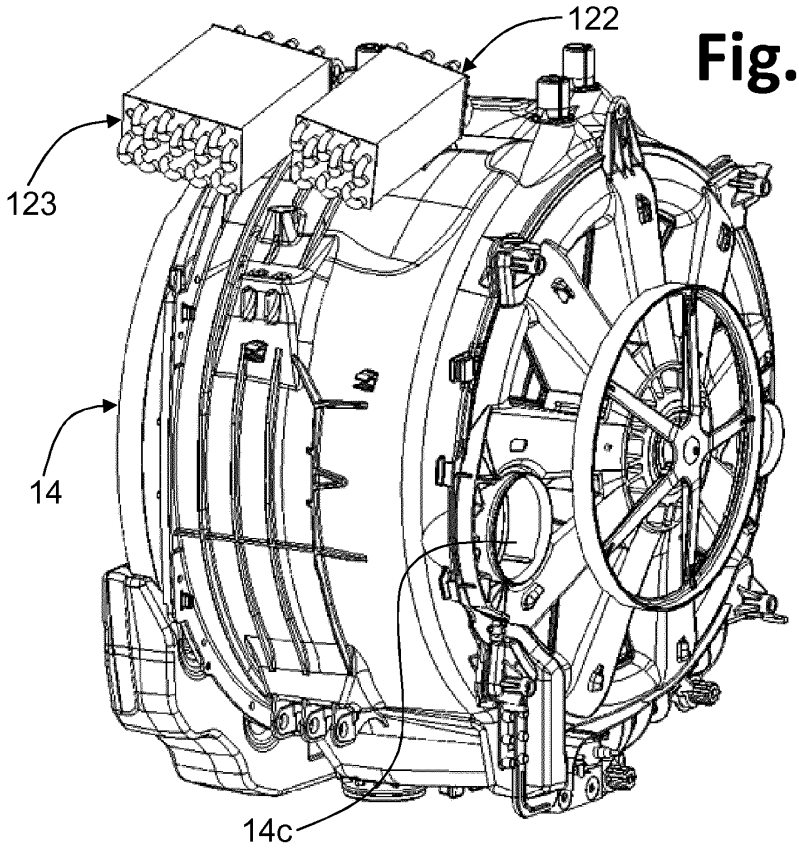


Fig. 18



REFERENCES CITED IN THE DESCRIPTION

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