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(54) **LAUNDRY TREATMENT APPARATUS**

(57) A laundry treatment apparatus (100) includes a cabinet (10), a washing system (20) and a heat pump system (30). The washing system (20) is disposed in the cabinet (10), includes a washing tub (21), and is formed with a drying gas inlet (201) and a drying gas outlet (202) communicated with the washing tub (21) respectively. The heat pump system (30) is provided integrally and connected to the cabinet (10), and defines an entry communicated with the drying gas outlet (202) and an exit (301) communicated with the drying gas inlet (201).

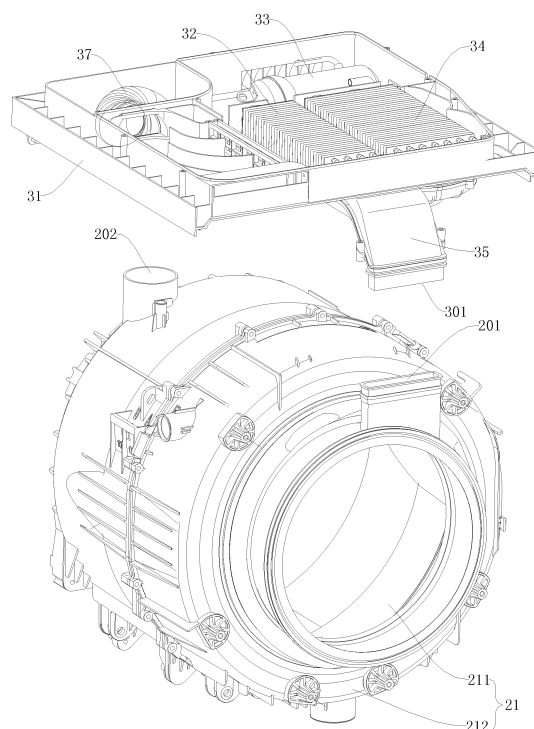


Fig. 4

Description

FIELD

[0001] The present invention relates to a field of laundry treatment technology, and more particularly to a laundry treatment apparatus.

BACKGROUND

[0002] In the related art, a washing and drying all-in-one machine, such as a drum washing and drying all-in-one machine, generally performs water or air condensation to dry the clothes, and the drying efficiency is low and the energy consumption is high (efficiencies of water condensation and air condensation belong to class A in EN standard). Most of drum-type heat pump washing and drying all-in-one machines are inclined drum washing and drying all-in-one machines of Japanese style and drum washing and drying all-in-one machines of European style. However, for both the machines of Japanese style and European style, general assembly of the heat pump system from the production line is complex and the production efficiency is low. Moreover, the installation of the machine is complicated and the maintenance of the machine is difficult. The height of the all-in-one machine of Japanese style is high, resulting in an inconvenient operation.

SUMMARY

[0003] Embodiments of the present invention seek to solve at least one of the problems existing in the related art to at least some extent. Accordingly, a laundry treatment apparatus is provided according to the present invention. The laundry treatment apparatus has a high drying efficiency, and it is more convenient to disassemble or assemble the laundry treatment apparatus and to examine and repair the laundry treatment apparatus.

[0004] The laundry treatment apparatus according to embodiments of the present invention may include: a cabinet, a washing system and a heat pump system. The washing system is disposed in the cabinet, includes a washing tub, and is formed with a drying gas inlet and a drying gas outlet communicated with the washing tub respectively. The heat pump system is provided integrally and connected to the cabinet, and defines an entry communicated with the drying gas outlet and an exit communicated with the drying gas inlet.

[0005] The laundry treatment apparatus according to embodiments of the present invention has a high drying efficiency, and it is more convenient to disassemble or assemble the laundry treatment apparatus and to examine and repair the laundry treatment apparatus. Moreover, an efficiency of general assembly on the production line is high.

[0006] In addition, the laundry treatment apparatus according to embodiments of the present invention may

further have additional technical features as follows:

In some embodiments of the present invention, the heat pump system is disposed on an upper end of the cabinet.

[0007] In some embodiments of the present invention, the upper end of the cabinet is open and the heat pump system is configured to cover the cabinet.

[0008] In some embodiments of the present invention, the heat pump system includes: a heat pump base, an evaporator, a compressor, a condenser and a throttle device. The heat pump base is disposed on the upper end of the cabinet. The evaporator, the compressor, the condenser and the throttle device are disposed on the heat pump base respectively and connected to each other sequentially to form a heat pump loop. The condenser and the washing tub are connected to the evaporator sequentially to form a drying gas loop.

[0009] In some embodiments of the present invention, the laundry treatment apparatus further includes a fan component connected to the cabinet and located between the condenser and the washing tub so as to drive the drying gas to flow.

[0010] In some embodiments of the present invention, a seal is disposed at the drying gas inlet to allow the drying gas to flow in a one-way direction.

[0011] In some embodiments of the present invention, the laundry treatment apparatus further includes a filter disposed between the evaporator and the washing tub.

[0012] In some embodiments of the present invention, the drying gas inlet and the drying gas outlet are formed at two ends of the washing system, respectively.

[0013] In some embodiments of the present invention, the drying gas inlet is communicated with the exit via a hose. In some embodiments of the present invention, the drying gas outlet is communicated with the entry via a hose. In some embodiments of the present invention, the drying gas inlet is communicated with the exit via a hose and the drying gas outlet is communicated with the entry via a hose.

[0014] In some embodiments of the present invention, the washing tub includes an outer tub and an inner tub extended in a horizontal direction, respectively, and the inner tub is rotatably disposed in the outer tub.

[0015] Additional aspects and advantages of embodiments of present invention will be given in part in the following descriptions, become apparent in part from the following descriptions, or be learned from the practice of the embodiments of the present invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0016]

Fig. 1 is a schematic view of a laundry treatment apparatus according to an embodiment of the present invention;

Fig. 2 is a top view of a laundry treatment apparatus according to an embodiment of the present invention;

Fig. 3 is a schematic view of a laundry treatment apparatus according to an embodiment of the present invention, in which a washing system is to be assembled onto a heat pump system;

Fig. 4 is a schematic view of a laundry treatment apparatus according to an embodiment of the present invention, in which a washing system is disassembled from a heat pump system.

Reference numerals:

[0017]

laundry treatment apparatus 100;
cabinet 10;
washing system 20; washing tub 21; inner tub 211;
outer tub 212; drying gas inlet 201; drying gas outlet 202;
heat pump system 30; exit 301; heat pump base 31;
evaporator 32; compressor 33; condenser 34; fan component 35; filter 36; hose 37.

DETAILED DESCRIPTION

[0018] Embodiments of the present invention will be described in detail below and examples of the embodiments are shown in the drawings. The embodiments described herein with reference to drawings are explanatory, illustrative, and used to generally understand the present invention. The embodiments shall not be construed to limit the present invention.

[0019] A laundry treatment apparatus 100 according to embodiments of the present invention will be described below with reference to drawings.

[0020] With reference to Fig. 1 to Fig. 4, the laundry treatment apparatus 100 according to embodiments of the present invention may include: a cabinet 10, a washing system 20 and a heat pump system 30.

[0021] The washing system 20 may be disposed in the cabinet 10, including a washing tub 21. The cabinet 10 is formed with a drying gas inlet 201 and a drying gas outlet 202 therein, which are communicated with the washing tub 21 respectively.

[0022] Here, the drying gas inlet 201 is an inlet for the drying gas to enter into the washing tub 21 to dry the clothing and the drying gas outlet 202 is an outlet for the drying gas to flow out of the washing tub 21 after drying the clothing. Typically, the gas passing through the drying gas inlet 201 is generally dry gas at a high temperature and the gas flowing out from the drying gas outlet 202 is generally wet gas at a high temperature.

[0023] The heat pump system 30 is provided integrally and connected to the cabinet 10, and defines an entry communicated with the drying gas outlet 202 and an exit 301 communicated with the drying gas inlet 201. In other

words, the heat pump system 30 is separated from the washing system 20, and the heat pump system 30 and the washing system 20 may be produced separately and then assembled. During the assembly, components of the heat pump system 30 may be preassembled together to form an integral system at first, and then arranged on the cabinet 10 as a whole. Moreover, the only need for assembling is to communicate the drying gas inlet 201 with the exit 301 and to communicate the drying gas outlet 202 with the entry.

[0024] In the related art, components of the heat pump system are disposed separately and some of the components are incorporated into the washing system. During the assembly, each component of the heat pump system needs to be assembled independently and the steps of the connecting operations are complicated. Moreover, the heat pump system cannot be used until the whole assembly is completed. In this case, the heat pump system may be unable to run due to some inappropriate operation during the assembly, so that abilities of assembling and disassembling, as well as repairing of the heat pump system are poor.

[0025] However, in the laundry treatment apparatus 100 according to embodiments of the present invention, the heat pump system 30 is provided integrally and all the components of the heat pump system 30 may have been preassembled before they are assembled onto the cabinet 10, and the heat pump system 30 can be assembled onto the cabinet 10 in one-time during the assembly by a few sequential operations, so that the heat pump system 30 is connected to the washing system 20. These operations are simple and the rate of the general assembly line is fast, thus extremely reducing modification of the present production line and effect on task difficulty. In the meantime, the heat pump system 30 is independent from the washing system 20, and may be checked for its operation properties independently before it is assembled onto the cabinet 10, so that assembly and disassembly, as well as maintenance of the laundry treatment apparatus 100 are more convenient, resulting in a low production cost and a high manufacturability.

[0026] The laundry treatment apparatus 100 according to embodiments of the present invention is configured as a kind of washing and drying all-in-one machine. Clothing may be washed by the washing system 20 and dried by the drying system. The laundry treatment apparatus 100 is loaded with the heat pump system 30, thus improving the drying efficiency. The washing system 20 may be a system in the related art or an improved system and the structure of the washing system 20 should be understood and easily achieved by the skilled person in the art, which is no more described in detail here.

[0027] The heat pump system 30 will be described in detail as follows. Alternatively, as shown in Fig. 1, according to some embodiments of the present invention, the heat pump system 30 may be disposed on an upper end of the cabinet 10. Thus, components of the heat pump system 30 may be integrated on the upper end of

the cabinet 10 so as to better facilitate the assembly of the heat pump system 30 and may not affect the assembly of the washing system 20 below, and therefore it is very convenient for assembly and disassembly. Alternatively, the washing system 20 may be snap-fitted with the cabinet 10, and the operation of the connection is simple, accurate, quick and firm, so as to facilitate the assembly and disassembly.

[0028] Further, the upper end of the cabinet 10 may be open and the heat pump system 30 may cover the upper end of the cabinet 10. In other words, the cabinet 10 may have an upper opening so as to better facilitate the assembly of the washing system 20, and the heat pump system 30 may be used as a cover for the cabinet 10 so as to reduce the number of the components of the laundry treatment apparatus 110, thus improving the production efficiency and lower the cost. Meanwhile, without obstructing of a cover body, the washing system 20 may be connected to the heat pump system 30 more easily.

[0029] According to some embodiments of the present disclosure, the heat pump system 30 may include: a heat pump base 31, an evaporator 32, a compressor 33, a condenser 34 and a throttle device. The heat pump base 31 is disposed on the upper end of the cabinet 10. More specifically, the heat pump system 30 may be connected, such as snap-fitted, with the cabinet 10. The evaporator 32, the compressor 33, the condenser 34 and the throttle device are disposed on the heat pump base 31 respectively and connected to each other sequentially to form a heat pump loop. The condenser 34 and the washing tub 21 are connected to the evaporator 32 sequentially to form a drying gas loop.

[0030] Specifically, the heat pump system 30 predominantly consists of the heat pump base 31, the evaporator 32, the compressor 33, the condenser 34 and the throttle device. The heat pump base 31 is used to preassemble components such as the evaporator 32, the condenser 34 and the compressor 33, in a form of integration and may be directly supported on the top of the cabinet 10. The condenser 34 and the washing tub 21 are connected to the evaporator 32 sequentially to form a drying gas loop, i.e., an outside loop. The drying gas may be recycled in the drying gas loop to perform the drying of the clothing. The evaporator 32, the compressor 33, the condenser 34 and the throttle device are disposed on the heat pump base 31 respectively and connected to each other sequentially to form a heat pump loop, i.e., an internal circulation.

[0031] The evaporator 32 may be used for cooling the recycled drying gas and condensing the moisture contained in the recycled drying gas to separate the moisture from the recycled drying gas. The condenser 34 may be used for heating the recycled drying gas after the separation of the moisture. The heated drying gas may be used for heating the clothing in the washing tub 21 and taking away the moisture of the clothing. The compressor 33 may be used for driving the internal circulation of the heat pump system 30.

[0032] Furthermore, the laundry treatment apparatus 100 may further include a fan component 35 connected to the cabinet 10 and located between the condenser 34 and the washing tub 21 so as to drive the drying gas to flow. The fan component 35 may provide power to gas for the external circulation and blow the heated drying gas more quickly to the inner tub 211 of the washing machine, so as to improve the drying efficiency. Specifically, during assembly, the fan component 35 may be connected to the cabinet 10 at first, and then butt joined to the heat pump base 31 to form an external circulation channel for the recycled drying gas.

[0033] Alternatively, a seal may be disposed at the drying gas inlet 201 for making the drying gas flow in a one-way direction. Specifically, the drying gas heated in the condenser 34 may flow into the washing tub 21 through the seal, on the contrary, the drying gas cannot flow out from the drying gas inlet 201, and thus the fluidity of the external circulation is good and the drying result is good.

[0034] As shown in Fig. 3, the drying gas inlet 201 and the drying gas outlet 202 are formed in two ends of the washing system 20, respectively. Thus, the recycled drying gas may pass through the entire washing tub 21 more easily, thus ensuring that clothes at different positions may all be dried. Here, two ends of the washing system 20 should be understood broadly, that is, it may be understood as two end parts of the washing system 20, or it may also be understood as two positions close to the end parts, such as a position 5 cm, 10 cm or 15 cm away from the end parts.

[0035] As shown in Fig. 3 and Fig. 4, the washing tub 21 may include an outer tub 212 and an inner tub 211 extended in a horizontal direction respectively, and the inner tub 211 is rotatably disposed in the outer tub 212. In other words, the laundry treatment apparatus 100 according to embodiments of the present invention may be configured as a kind of drum washing and drying all-in-one machine, whose structure is properly designed, so as to facilitate the assembly and the disassembly as well as examination and repairing.

[0036] Alternatively, at least one of communications between the drying gas inlet 201 and the exit 301 and between the drying gas outlet 202 and the entry is carried out by a hose 37. In other words, the drying gas inlet 201 may be communicated with the exit 301 via a hose 37, or the drying gas outlet 202 may be communicated with the entry via a hose 37, or both the communications between the drying gas inlet 201 and the exit 301 and between the drying gas outlet 202 and the entry may be carried out by hoses 37, i.e. the drying gas inlet 201 may be communicated with the exit 301 via a hose 37 and the drying gas outlet 202 may be communicated with the entry via a hose 37. As shown in Fig. 1 to Fig. 4, the drying gas outlet 202 may be communicated with the entry via a hose 37. The hose 37 has a good deformability and may be disposed at different positions based on needs. The operation of connection is easy and a good sealability is obtained. Alternatively, the hose 37 may be

a rubber hose with a low cost, a good deformability and no corrosion.

[0037] In some embodiments of the present invention, as shown in Fig. 2, the laundry treatment apparatus 100 may further include a filter 36 disposed between the evaporator 32 and the washing tub 21. The filter 36 may filter out soft flocks and large dust particles in the recycled drying gas to prevent them from aggregating inside the evaporator 32 and the condenser 34, thus ensuring a normal operation of the heat pump system 30. Alternatively, the filter 36 may be a filter mesh, e.g., a multi-layered filter mesh, so as to improve the filter result. The filter 36 may be detachably connected to the heat pump base 31 so as to wash the filter 36.

[0038] The working principle of the heat pump system 30 is described below.

[0039] Internal circulation of heat pump system 30: a low-temperature low-pressure liquid refrigerant may absorb heat in the evaporator 32 and may be vaporized to form low-pressure vapour. Subsequently, the low-pressure vapour is compressed into high-temperature high-pressure vapour in the compressor 33 and the high-temperature high-pressure vapour may be condensed into high-pressure liquid in the condenser 34 with heat release. The high-pressure liquid may be throttled in the throttle device to form low-temperature low-pressure liquid, which enters into the evaporator 32, so that a circulation is completed.

[0040] External circulation of heat pump system 30: low-temperature dry air is heated in the condenser 34 and blown into the inner tub 211 via the seal by the fan, so as to obtain high-temperature dry air, which may heat the wet clothing in the inner tub 211, so that the moisture of the clothing may be vaporized to high-temperature wet air. The high-temperature wet air enters into the evaporator 32 via an air duct of the inner tub 211, the hose 37 and the filter 36, and is cooled to remove the moisture, so as to become low-temperature air, which enters into the condenser 34, so that a circulation is completed and the route of the circulation is indicated by arrows in Fig. 3.

[0041] The heat pump system 30 runs by electric power, so that it may obtain low-quality heat and transfer the heat to a high-temperature object, and at the same time, operations of heating and condensing during drying may be carried out, thus significantly reducing energy consumption. Moreover, the internal circulation and the external circulation both are self-closed, thus achieving effects of energy conservation and environmental protection. More importantly, after the heat pump system 30 is integrated in an overhead manner and preassembled as a component, the whole machine may be assembled on the general assembly line with only need of connecting to the external circulation pipe and electric components. This operation is simple and the rate of the general assembly line is hardly affected compared with that in the current state. The heat pump system 30 is designed in an overhead manner so as to facilitate assembly and maintenance. Meanwhile, the heat pump system 30 may

be used for drying, thus significantly improving energy efficiency of products (the energy efficiency of the heat pump drying belongs to Class A-40% of the EN standard)

[0042] Other constructions and operations of the laundry treatment apparatus 100 according to embodiments of the present invention are known by the person skilled in the art, which are no more described in detail herein.

[0043] In the specification, unless specified or limited otherwise, relative terms such as "up", "down", "front", "rear", "left", "right", "top", "inner" and "outer" should be construed to refer to the orientation as then described or as shown in the drawings under discussion. These relative terms are for convenience of description and do not require that the present invention be constructed or operated in a particular orientation, which should not be understood as a construction to the present invention.

[0044] In the description of the present invention, unless specified or limited otherwise, it should be noted that, terms "mounted", "communicated", "connected" and "fixed" may be understood broadly, such as permanent connection or detachable connection, electronic connection or mechanical connection, direct connection or indirect connection via intermediary, inner communication or inter reaction between two elements. These having ordinary skills in the art should understand the specific meanings in the present invention according to specific situations.

[0045] In the description of the present invention, a structure in which a first feature is "above" or "below" a second feature may include an embodiment in which the first feature directly contacts the second feature, and may also include an embodiment in which an additional feature is formed between the first feature and the second feature so that the first feature does not directly contact the second feature, unless otherwise specified. Furthermore, a first feature is "beneath," "below," or "on bottom of" a second feature may include an embodiment in which the first feature is right "beneath," "below," or "on bottom of" the second feature, and may also include an embodiment in which the first feature is not right "beneath," "below," or "on bottom of" the second feature, or just means that the first feature has a sea level elevation smaller than the sea level elevation of the second feature.

[0046] Reference throughout this specification to "an embodiment," "some embodiments," "one embodiment," "another example," "an example," "a specific example," or "some examples," means that a particular feature, structure, material, or characteristic described in connection with the embodiment or example is included in at least one embodiment or example of the present invention. Thus, the appearances of the phrases such as "in some embodiments," "in one embodiment," "in an embodiment," "in another example," "in an example," "in a specific example," or "in some examples," in various places throughout this specification are not necessarily referring to the same embodiment or example of the present invention. Furthermore, the particular features, structures, materials, or characteristics may be com-

bined in any suitable manner in one or more embodiments or examples.

[0047] Although explanatory embodiments have been shown and described, it would be appreciated by those skilled in the art that the above embodiments cannot be construed to limit the present invention, and changes, alternatives, and modifications can be made in the embodiments without departing from spirit, principles and scope of the present invention.

Claims

1. A laundry treatment apparatus (100), comprising:

a cabinet (10);
a washing system (20) disposed in the cabinet (10), comprising a washing tub (21) and formed with a drying gas inlet (201) and a drying gas outlet (202) which are communicated with the washing tub (21) respectively;
a heat pump system (30) provided integrally and connected to the cabinet (10), and defining an entry communicated with the drying gas outlet (202) and an exit (301) communicated with the drying gas inlet (201).

2. The laundry treatment apparatus (100) according to claim 1, wherein the heat pump system (30) is disposed on an upper end of the cabinet (10).

3. The laundry treatment apparatus (100) according to claim 2, wherein the upper end of the cabinet (10) is open and the heat pump system (30) is configured to cover the cabinet (10).

4. The laundry treatment apparatus (100) according to claim 2 or 3, wherein the heat pump system (30) comprises: a heat pump base (31), an evaporator (32), a compressor (33), a condenser (34) and a throttle device,
wherein the heat pump base (31) is disposed on the upper end of the cabinet (10),
the evaporator (32), the compressor (33), the condenser (34) and the throttle device are disposed on the heat pump base (31) respectively and connected to each other sequentially to form a heat pump loop, and
the condenser (34) and the washing tub (21) are connected to the evaporator (32) sequentially to form a drying gas loop.

5. The laundry treatment apparatus (100) according to claim 4, further comprising:

a fan component (35) connected to the cabinet (10) and located between the condenser (34) and the washing tub (21) so as to drive the drying

gas to flow.

6. The laundry treatment apparatus (100) according to claim 5, wherein a seal is disposed at the drying gas inlet (201) to allow the drying gas to flow in a one-way direction.

7. The laundry treatment apparatus (100) according to claim 4, further comprising:

a filter (36) disposed between the evaporator (32) and the washing tub (21).

8. The laundry treatment apparatus (100) according to claim 1, wherein the drying gas inlet (201) and the drying gas outlet (202) are formed at two ends of the washing system (20), respectively.

9. The laundry treatment apparatus (100) according to claim 1,
wherein the drying gas inlet (201) is communicated with the exit (301) via a hose (37); or
wherein the drying gas outlet (202) is communicated with the entry via a hose (37); or wherein the drying gas inlet (201) is communicated with the exit (301) via a hose (37) and the drying gas outlet (202) is communicated with the entry via a hose (37).

10. The laundry treatment apparatus (100) according to any one of claims 1 to 9, wherein the washing tub (21) comprises an outer tub (212) and an inner tub (211) extended in a horizontal direction respectively, and the inner tub (211) is rotatably disposed in the outer tub (212).

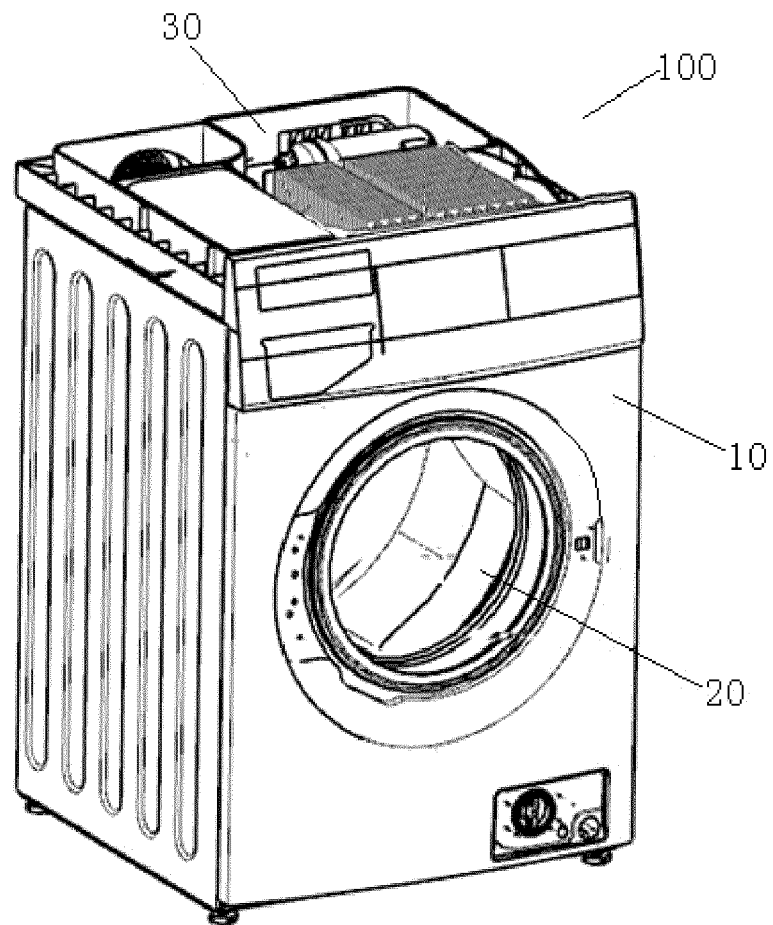


Fig. 1

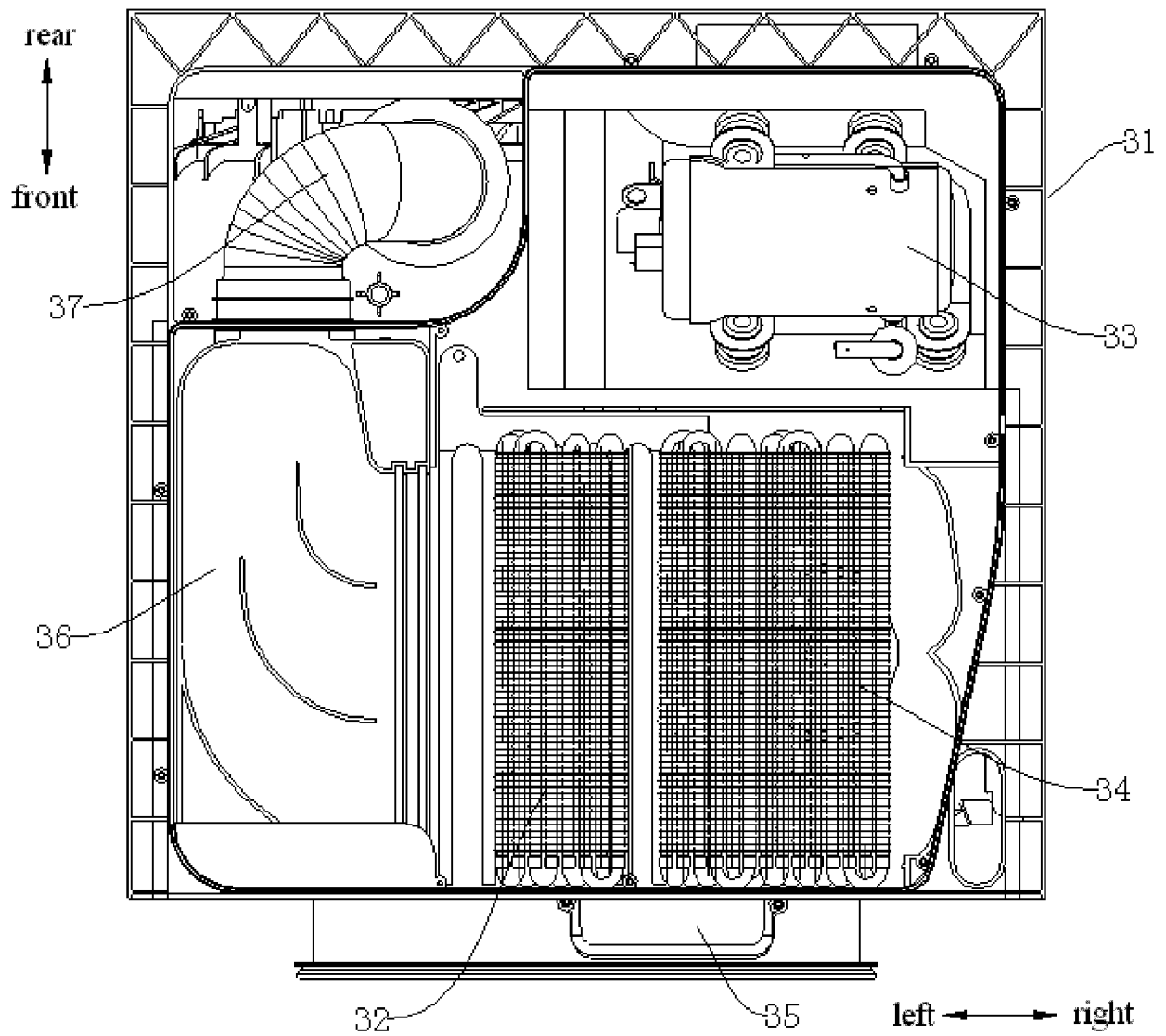


Fig. 2

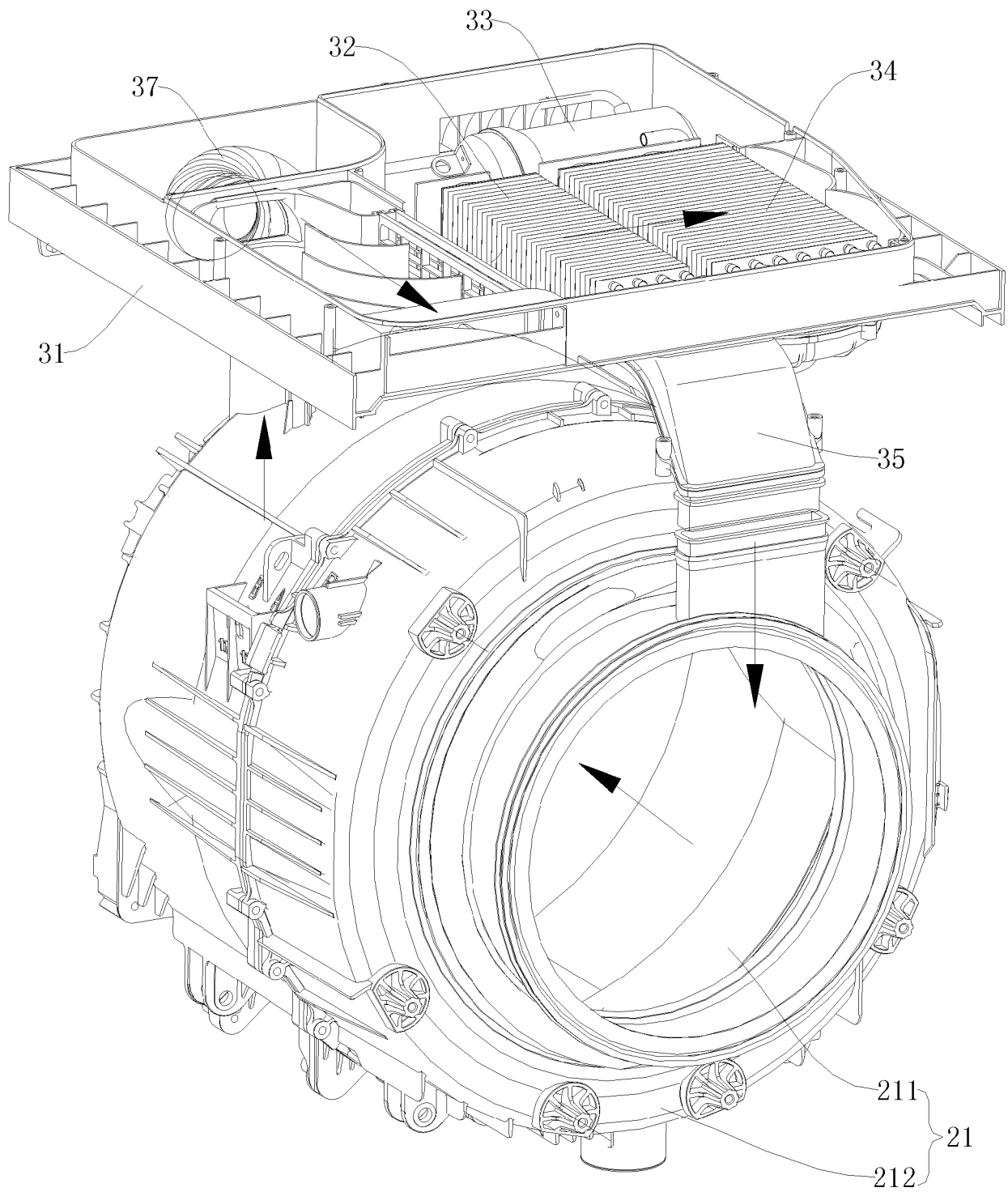


Fig. 3

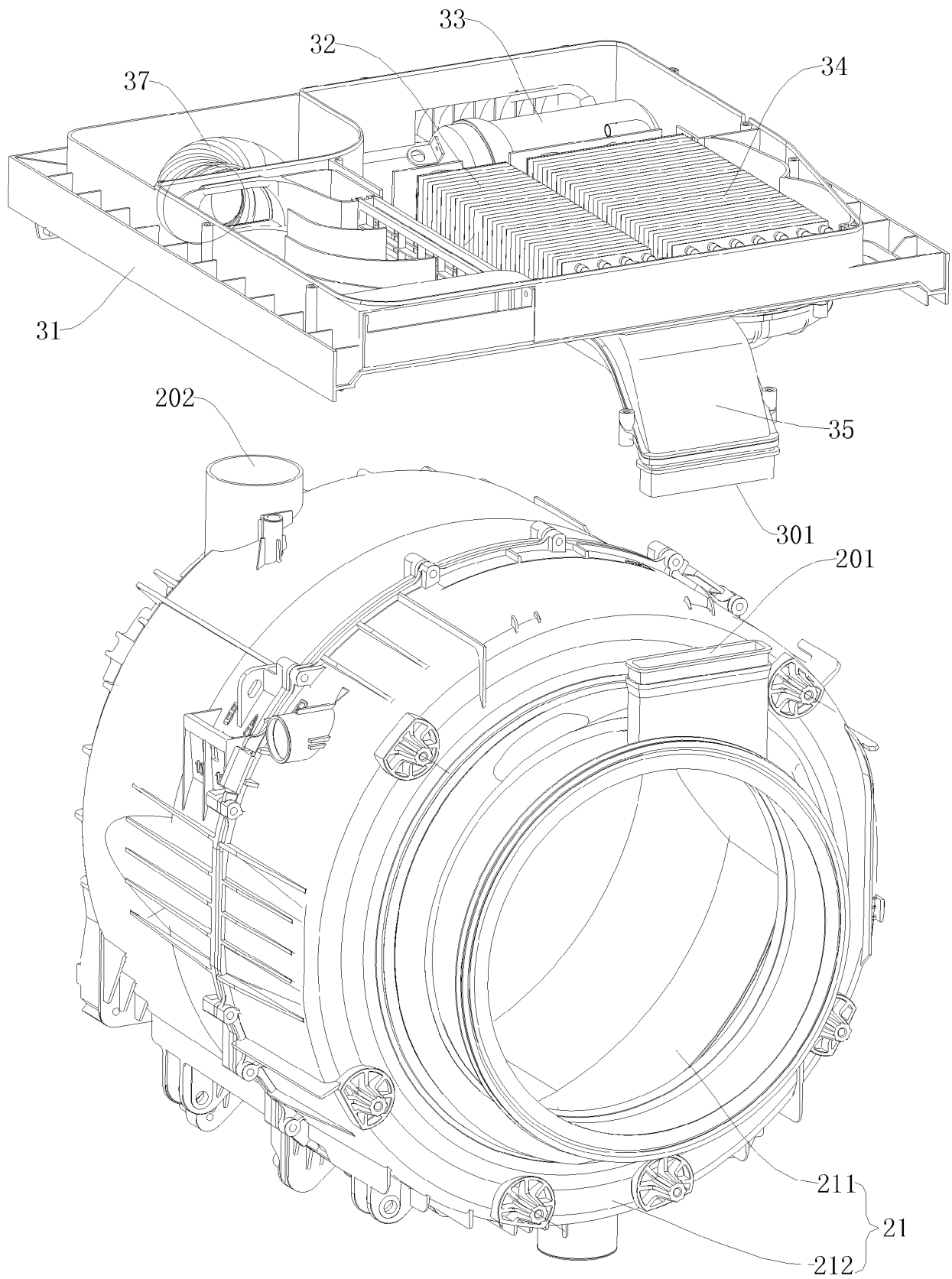


Fig. 4



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Application Number
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**ANNEX TO THE EUROPEAN SEARCH REPORT
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