(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 3 182 022 B1**

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
21.08.2019 Bulletin 2019/34

(51) Int Cl.:
F24F 1/10 *(2011.01)* ***F24F 1/44*** *(2011.01)*
F24F 1/46 *(2011.01)* ***F24F 1/56*** *(2011.01)*

(21) Application number: **16202116.6**

(22) Date of filing: **05.12.2016**

(54) OUTDOOR UNIT FOR AIR CONDITIONER AND AIR CONDITIONER

AUSSENEINHEIT EINER KLIMAANLAGE SOWIE KLIMAANLAGE

UNITÉ EXTÉRIEURE DE CLIMATISEUR D'AIR ET CLIMATISEUR D'AIR

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR

(30) Priority: **14.12.2015 JP 2015242808**
20.07.2016 JP 2016142665

(43) Date of publication of application:
21.06.2017 Bulletin 2017/25

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Description

BACKGROUND

1. Technical Field

[0001] The present disclosure relates to improvement in operation reliability in an outdoor unit for an air conditioner and the air conditioner, the outdoor unit including a gas engine and a motor, which are two power sources, and a compressor.

2. Description of the Related Art

[0002] Hitherto, from the viewpoints of reducing energy costs and stably supplying energy, a gas heat pump air conditioner using, as a power source, an internal combustion engine, which uses gas fuel, that is, a so-called gas engine, has been put into practical use. In an outdoor unit for the gas heat pump air conditioner, the interior of a housing is divided into an upper portion and a lower portion by a partition plate. The upper portion is a heat exchanger room and the lower portion is a machine room. The heat exchanger room accommodates a fan. The machine room accommodates therein a compressor that is driven with a driving shaft of a gas engine and a driving shaft of a motor coaxially linked to each other. An air conditioner that is capable of optimizing operation efficiency by separately transmitting driving force of the gas engine and driving force of the motor to the compressor is proposed (see, for example, Japanese Unexamined Patent Application Publication No. 2002-228295).
From EP 2 908 061 A1 an outdoor unit of an air conditioner is known that includes a body housing defining therein a heat exchanger room and a machine room that further defines two portions divided by a substantially vertical plane that includes a straight line passing a center of a bottom plate provided on a bottom of the machine room and extending in a depth direction of the machine room, and a power-supply driving compressor being driven by an electric power, and a non-power-supply driving compressor unit containing a driving source other than the electric power and a non-power-supply driving compressor being driven by the driving source other than the electric power. A substantially central position of the non-power-supply driving compressor unit is disposed in one of the two portions of the machine room and a substantially central position of the power-supply driving compressor is disposed in the other one of the two portions of the machine room.

SUMMARY

[0003] However, in the above-described technology, as shown in Fig. 3, a rotating shaft 340 of a gas engine 301, a rotating shaft 320 of a compressor 102, and a rotating shaft 330 of a motor 303 are coaxially linked to each other. That is, the gas engine 301, the compressor 102, and the motor 303 are disposed close to each other, as a result of which exhaust heat that is generated at the gas engine 301 is transmitted to the motor 303 via the rotating shafts 340 and 330. In addition, compared to the motor 303, the gas engine 301 is very large; and the exhaust heat of the gas engine 301 spreads in the entire machine room 310 and heats the motor 303 located in the vicinity of the gas engine 301, as a result of which the motor 303 cannot operate properly.

[0004] One non-limiting and exemplary embodiment provides an outdoor unit for an air conditioner and the air conditioner, the outdoor unit having a structure that makes it possible to suppress temperature rise of a motor that is, along with a gas engine, accommodated in a machine room.

[0005] In one general aspect, the techniques disclosed here feature an outdoor unit for an air conditioner, including a housing that defines therein a machine room and a heat exchanger room, the heat exchanger room located above the machine room; a fan that is located at the heat exchanger room and that is adapted to generate an airflow from the machine room towards the heat exchanger room; a motor that is disposed in the machine room; a gas engine that is disposed in the machine room; and a compressor that is disposed in the machine room and that is driven by the motor or the gas engine, wherein a rotating shaft of the motor is located below a rotating shaft of the gas engine wherein a rotating shaft of the compressor is located below the rotating shaft of the gas engine.

[0006] Therefore, in an air passage in the machine room, the motor is installed closer to an upwind side than the gas engine is; and exhaust heat of the gas engine is no longer directly transmitted to the motor via the rotating shafts.

[0007] In the outdoor unit for the air conditioner according to the present disclosure, outside air cools the motor to suppress thermal effects of the exhaust heat of the gas engine on the motor. Therefore, the outdoor unit prevents demagnetization caused by temperature rise of the motor, and, thus, can improve operation reliability of the air conditioner.

[0008] Vibration from the gas engine, which is the greatest vibration source, is prevented from being transmitted directly to the rotating shaft of the motor, so that the reliability of the motor is improved.

[0009] It should be noted that general or specific embodiments may be implemented as a system, a method, an integrated circuit, a computer program, a storage medium, or any selective combination thereof.

[0010] Additional benefits and advantages of the disclosed embodiments will become apparent from the specification and drawings. The benefits and/or advantages may be individually obtained by the various embodiments and features of the specification and drawings, which need not all be provided in order to obtain one or more of such benefits and/or advantages.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011]

Fig. 1 is a refrigeration circuit diagram of an air conditioner according to an aspect of the present disclosure;

Fig. 2 illustrates an arrangement of power sources and a compressor in an outdoor unit according to the aspect of the present disclosure; and

Fig. 3 illustrates an arrangement of power sources and a compressor in an existing outdoor unit.

DETAILED DESCRIPTION

[0012] According to a first disclosure, there is provided an outdoor unit for an air conditioner, including a housing that defines therein a machine room and a heat exchanger room, the heat exchanger room located above the machine room; a fan that is located at the heat exchanger room and that is adapted to generate an airflow from the machine room towards the heat exchanger room; a motor that is disposed in the machine room; a gas engine that is disposed in the machine room; and

a compressor that is disposed in the machine room and that is driven by the motor or the gas engine, wherein a rotating shaft of the motor is located below a rotating shaft of the gas engine.

[0013] Therefore, since the rotating shaft of the motor is located below the rotating shaft of the gas engine, it is possible to prevent exhaust heat of the gas engine from being directly transmitted to the motor via the rotating shafts. In addition, since, in an air passage in the machine room, the compressor and the motor are installed closer to an upwind side than the gas engine is, the effects of exhaust heat of the gas engine are suppressed, so that cooling of the motor is accelerated. Therefore, by suppressing temperature rise of the motor, failures caused by demagnetization of the motor are prevented, so that it is possible to improve operation reliability of the air conditioner.

[0014] The outdoor unit for the air conditioner is such that a rotating shaft of the compressor is located below the rotating shaft of the gas engine.

[0015] Therefore, since the rotating shaft of the compressor and the rotating shaft of the motor are located below the rotating shaft of the gas engine, it is possible to prevent exhaust heat of the gas engine from being directly transmitted to the motor via the rotating shafts. In addition, since, in the air passage in the machine room, the compressor and the motor are installed closer to the upwind side than the gas engine is, the effects of exhaust heat of the gas engine are suppressed, so that cooling of the motor is accelerated. Therefore, by suppressing temperature rise of the motor, failures caused by demagnetization of the motor are prevented, so that it is possible to improve operation reliability of the air conditioner.

[0016] According to a second disclosure based on the first disclosure, the outdoor unit for the air conditioner further includes a first heat exchanger that is located in the heat exchanger room.

[0017] Therefore, the fan causes air subjected to heat exchange at the heat exchanger room to flow to an upper side of the heat exchanger room, so that it is possible to suppress temperature rise of the motor to prevent failures caused by demagnetization of the motor, and to, thus, improve operation reliability of the air conditioner.

[0018] According to a third disclosure, there is provided an air conditioner including the outdoor unit according to any one of the first to second disclosures; an indoor unit that accommodates a second heat exchanger; and an inter-unit pipe that connects the outdoor unit with the indoor unit and that defines a passage in which a refrigerant flows.

[0019] Therefore, since the rotating shaft of the motor is located below the rotating shaft of the gas engine, it is possible to prevent exhaust heat of the gas engine from being directly transmitted to the motor via the rotating shafts. In addition, since, in the air passage in the machine room, the compressor and the motor are installed closer to the upwind side than the gas engine is, the effects of exhaust heat of the gas engine are suppressed, so that cooling of the motor is accelerated. Therefore, by suppressing temperature rise of the motor, failures caused by demagnetization of the motor are prevented, so that it is possible to improve operation reliability of the air conditioner.

[0020] According to a fourth disclosure, there is provided an air conditioner including a passage in which a refrigerant flows, the outdoor unit according to any one of the first to second disclosures, and an indoor unit that includes a second heat exchanger, wherein the compressor, the first heat exchanger, and the second heat exchanger are disposed in the passage.

[0021] An embodiment according to the present disclosure is described in detail below with reference to the drawings. The embodiment that is described below is merely one embodiment. The present disclosure is not limited to this embodiment.

Embodiment

[0022] Fig. 1 is a refrigeration circuit diagram of a structure of an air conditioner 100 according to an embodiment of the present disclosure.

[0023] The air conditioner 100 includes an outdoor unit 101, two indoor units 111a and 111b, and a refrigerant pipe that connects these units. The outdoor unit 101 includes a compressor 102, an oil separator 103, an accumulator 104, a four-way valve 105, a first heat exchanger (outdoor heat exchanger) 106, and a refrigerant pipe that connects these components.

[0024] The indoor unit 111a includes a second heat exchanger (indoor heat exchanger) 112a, and the indoor unit 111b includes a second heat exchanger (indoor heat exchanger) 112b. An indoor fan 114a is disposed near

the second heat exchanger 112a, and an indoor fan 114b is disposed near the second heat exchanger 112b.

[0025] The outdoor unit 101 and the two indoor units 111a and 111b are connected to each other by an inter-unit pipe 10 that forms a passage in which a refrigerant flows.

[0026] Fig. 2 illustrates an arrangement of power sources and the compressor 102 in the outdoor unit 101 according to the embodiment of the present disclosure.

[0027] As shown in Fig. 2, the outdoor unit 101 includes a box-shaped casing 110. At a substantially central portion of the outdoor unit 101 in a height direction, the outdoor unit 101 is divided into an upper portion and a lower portion by a partition plate 120. A machine room 150 is located below the partition plate 120. A heat exchanger room 160 is located above the partition plate 120. The partition plate 120 has a first slit 154 through which air can pass.

[0028] The compressor 102, a motor 303, and a gas engine 301 are provided in the machine room 150. By a first supporting member 307, the compressor 102 is disposed above a bottom plate 130 of the outdoor unit 101. By a second supporting member 306, the motor 303 is disposed above the bottom plate 130. A second slit 155 through which air flows is provided in the box-shaped casing 110 that forms the side walls of the machine room 150.

[0029] The motor 303 and the compressor 102 are disposed side by side. The motor 303 and the compressor 102 are linked to each other by a motor rotating shaft 330 extending in a substantially horizontal direction.

[0030] The gas engine 301 is provided above the motor 303 and the compressor 102. A gas-engine rotating shaft 340 extending in a substantially horizontal direction is linked to the gas engine 301.

[0031] The rotating shaft 330 of the motor 303 and the rotating shaft 340 of the gas engine 301 are linked to each other via transmitting means 302. The transmitting means 302 includes a pulley 308 of the motor rotating shaft 330, a pulley 309 of the rotating shaft of the gas engine 301, and a belt 310 placed upon the pulleys 308 and 309.

[0032] The rotating shaft 330 of the motor 303 is located below the rotating shaft 340 of the gas engine 301 in the height direction. That is, the motor rotating shaft 330, which is the rotating shaft of the motor 303, is located below the gas-engine rotating shaft 340, which is the rotating shaft of the gas engine 301, in the height direction. The motor rotating shaft 330, which is also the rotating shaft of the compressor 102, is located below the gas-engine rotating shaft 340, which is the rotating shaft of the gas engine 301.

[0033] The first heat exchanger 106 is provided in the heat exchanger room 160 so as to cover the side surfaces of the first heat exchanger 106. Two outdoor fans 107 are provided at the heat exchanger room 160.

[0034] By operating the outdoor fans 107, heat exchange is performed between outside air and a refrigerant that flows in the first heat exchanger 106 (see arrow 304), and outside air is introduced from the second slit 155 provided in a side surface of the machine room 150. Thereafter, the outside air flows into the heat exchanger room 160 from the machine room 150 via the first slit 154 provided in the partition plate 120. In this way, the operation of the outdoor fans 107 causes an air passage 305 to be provided.

[0035] Although, in the present embodiment, the outdoor unit 101 is divided into the machine room 150 and the heat exchanger room 160 by the partition plate 120, the outdoor unit 101 may be one that is not divided by the partition plate 120 or the like.

[0036] The operation and working of the outdoor unit 101, which has the above-described structure, for the air conditioner 100 are described below.

[0037] First, in the present embodiment, during the operation of the outdoor unit 101, in order to rotate the compressor 102, the gas engine 301 and the motor 303 separately control their respective driving forces and transmit the driving forces. The gas engine 301 in operation becomes very hot and generates radiant heat (exhaust heat) around the gas engine 301. The ambient temperature of the gas engine 301 increases. However, since the outdoor fans 107 cause the air passage 305 to be provided from the machine room 150 to the heat exchanger room 160, the exhaust heat of the gas engine 301 is exhausted to a location above the gas engine 301. As a result, temperature rise at a location where the compressor 102 and the motor 303 are installed, that is, a location below the gas engine 301 is suppressed.

[0038] As described above, in the present embodiment, by installing the compressor 102 and the motor 303 below the gas engine 301, it is possible to suppress temperature rise of the motor 303. As a result, failures caused by demagnetization of the motor 303 are prevented, so that it is possible to improve operation reliability of the air conditioner 100.

[0039] In the present embodiment, during the operation of the outdoor unit 101, the gas engine 301 operates while largely vibrating at all times. Since the gas engine 301 is indirectly linked to the compressor 102 via the transmitting means 302, the transmission of the vibration of the gas engine 301 to the compressor 102 and the motor 303 is suppressed.

[0040] As described above, in the present embodiment, by linking the gas engine 301 to the compressor 102 and the motor 303 via the transmitting means 302, it is possible to prevent the vibration of the gas engine 301 from being directly transmitted to the compressor 102 and the motor 303. As a result, it is possible to prevent shaft misalignment failures caused by vibration between the compressor 102 and the motor 303, and, thus, improve operation reliability of the air conditioner 100.

[0041] In the present embodiment, the structure in which the compressor 102 and the motor 303 are coaxially linked to each other is described. When the compressor 102 and the motor 303 are linked to each other

via similar transmitting means differing from the transmitting means 302, or when the motor 303 exists in the compressor 102, it is also possible to similarly provide the same effects by similarly installing the compressor 102 and the motor 303 below the rotating shaft 340 of the gas engine 301.

[0042] Although, in the present embodiment, an air conditioner device including one indoor unit or two or more indoor units is described, an air conditioner device including a plurality of indoor units may be used.

[0043] As described above, the outdoor unit for the air conditioner according to the present disclosure is suitably used as an air conditioner device that, by suppressing temperature rise of the motor, prevents failures caused by demagnetization of the motor and, thus, improves operation reliability of the air conditioner.

Claims

1. An outdoor unit (101) for an air conditioner (100), comprising:

   a housing that defines therein a machine room (150) and a heat exchanger room (160), the heat exchanger room (160) located above the machine room (150);
   a fan (107) that is located at the heat exchanger room (160) and that is adapted to generate an airflow from the machine room (150) towards the heat exchanger room (160);
   a motor (303) that is disposed in the machine room (150);
   a gas engine (301) that is disposed in the machine room (150); and
   a compressor (102) that is disposed in the machine room (150) and that is driven by the motor (303) or the gas engine (301), wherein
   a rotating shaft (330) of the motor (303) is located below a rotating shaft (340) of the gas engine (301)
   characterized in that
   a rotating shaft (330) of the compressor (102) is located below the rotating shaft (340) of the gas engine (301).

2. The outdoor unit (101) for the air conditioner (100) according to claim 1, further comprising
   a first heat exchanger (106) that is located in the heat exchanger room (160).

3. An air conditioner (100) comprising:

   the outdoor unit (101) according to any one of claims 1 to 2;
   an indoor unit (111a, 111b) that accommodates a second heat exchanger (112a, 112b); and
   an inter-unit pipe (10) that connects the outdoor unit (101) with the indoor unit (111a, 111b) and that defines a passage in which a refrigerant flows.

4. An air conditioner (100) comprising:

   a passage in which a refrigerant flows;
   the outdoor unit (101) according to any one of claims 1 to 2; and
   an indoor unit (111a, 111b) that includes a second heat exchanger (112a, 112b), wherein
   the compressor (102), the first heat exchanger (106), and the second heat exchanger (112a, 112b) are disposed in the passage.

Patentansprüche

1. Außeneinheit (101) einer Klimaanlage (100), umfassend:

   ein Gehäuse, das darin einen Maschinenraum (150) und einen Wärmetauscherraum (160) definiert, wobei sich der Wärmetauscherraum (160) über dem Maschinenraum (150) befindet;
   ein Gebläse (107), das sich bei dem Wärmetauscherraum (160) befindet und geeignet ist, um einen Luftstrom vom Maschinenraum (150) zum Wärmetauscherraum (160) zu erzeugen;
   einen Motor (303), der im Maschinenraum (150) angeordnet ist;
   einen Gasmotor (301), der im Maschinenraum (150) angeordnet ist; und
   einen Kompressor (102), der im Maschinenraum (150) angeordnet ist und von dem Motor (303) oder dem Gasmotor (301) angetrieben wird, wobei
   sich eine Drehwelle (330) des Motors (303) unterhalb einer Drehwelle (340) des Gasmotors (301) befindet,
   dadurch gekennzeichnet, dass
   sich eine Drehwelle (330) des Kompressors (102) unterhalb der Drehwelle (340) des Gasmotors (301) befindet.

2. Außeneinheit (101) einer Klimaanlage (100) nach Anspruch 1, ferner umfassend
   einen ersten Wärmetauscher (106), der sich in dem Wärmetauscherraum (160) befindet.

3. Klimaanlage (100), umfassend:

   die Außeneinheit (101) nach einem der Ansprüche 1 bis 2;
   eine Inneneinheit (111a, 111b) die einen zweiten Wärmetauscher (112a, 112b) beherbergt; und
   ein Einheiten-Zwischenrohr (10), das die Au-

ßeneinheit (101) mit der Inneneinheit (111a, 111b) verbindet und einen Durchgang definiert, in dem ein Kältemittel fließt.

4. Klimaanlage (100), umfassend:

einen Durchgang, in dem ein Kältemittel fließt;
die Außeneinheit (101) nach einem der Ansprüche 1 bis 2; und
eine Inneneinheit (111a, 111b), die einen zweiten Wärmetauscher (112a, 112b) umfasst, wobei
der Kompressor (102), der erste Wärmetauscher (106) und der zweite Wärmetauscher (112a, 112b) in dem Durchgang angeordnet sind.

Revendications

1. Unité extérieure (101) pour un climatiseur d'air (100), comprenant :

une enveloppe qui définit en son sein une chambre de machines (150) et une chambre d'échangeur de chaleur (160), la chambre d'échangeur de chaleur (160) étant située au-dessus de la chambre de machines (150) ;
un ventilateur (107) qui est situé au niveau de la chambre d'échangeur de chaleur (160) et qui est conçu pour générer un écoulement d'air à partir de la chambre de machines (150) vers la chambre d'échangeur de chaleur (160) ;
un moteur (303) qui est disposé dans la chambre de machines (150) ;
un moteur à gaz (301) qui est disposé dans la chambre de machines (150) ; et
un compresseur (102) qui est disposé dans la chambre de machines (150) et qui est entraîné par le moteur (303) ou par le moteur à gaz (301), un arbre rotatif (330) du moteur (303) étant situé en dessous d'un arbre rotatif (340) du moteur à gaz (301),
caractérisée en ce qu
un arbre rotatif (330) du compresseur (102) est situé en dessous de l'arbre rotatif (340) du moteur à gaz (301).

2. Unité extérieure (101) pour le climatiseur d'air (100) selon la revendication 1, comprenant en outre un premier échangeur de chaleur (106) qui est situé dans la chambre d'échangeur de chaleur (160).

3. Climatiseur d'air (100) comprenant :

l'unité extérieure (101) selon l'une quelconque des revendications 1 à 2 ;
une unité intérieure (111a, 111b) qui loge un deuxième échangeur de chaleur (112a, 112b); et
un tuyau inter-unité (10) qui relie l'unité extérieure (101) à l'unité intérieure (111a, 111b) et qui définit un passage dans lequel s'écoule un fluide frigorigène.

4. Climatiseur d'air (100) comprenant :

un passage dans lequel s'écoule un fluide frigorigène ;
l'unité extérieure (101) selon l'une quelconque des revendications 1 à 2 ; et
une unité intérieure (111a, 111b) qui comprend un deuxième échangeur de chaleur (112a, 112b),
le compresseur (102), le premier échangeur de chaleur (106) et le deuxième échangeur de chaleur (112a, 112b) étant disposés dans le passage.

FIG. 1

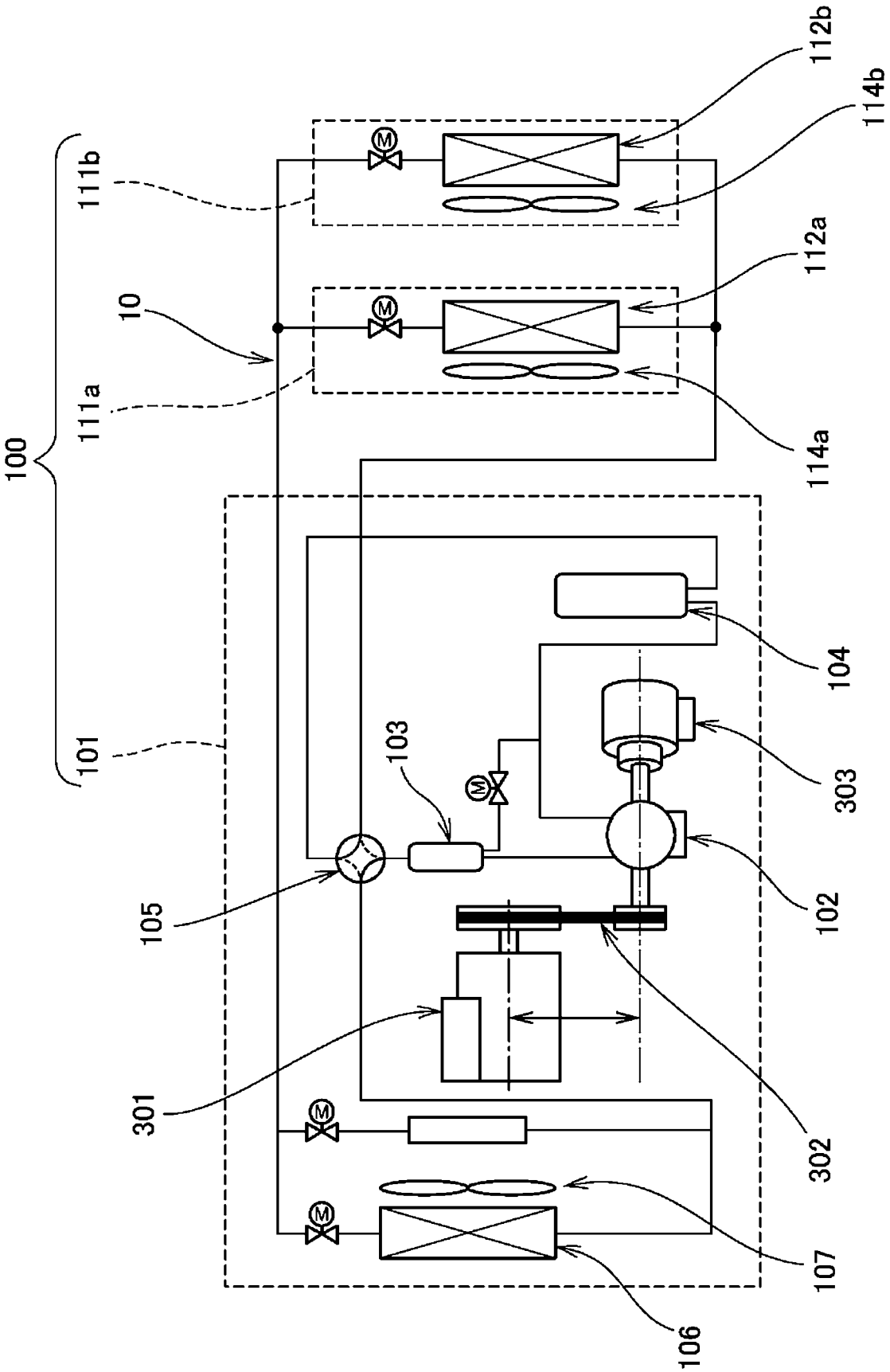

112b
114b
111b
112a
10
111a
114a
100
104
303
103
101
102
105
301
302
107
106

FIG. 2

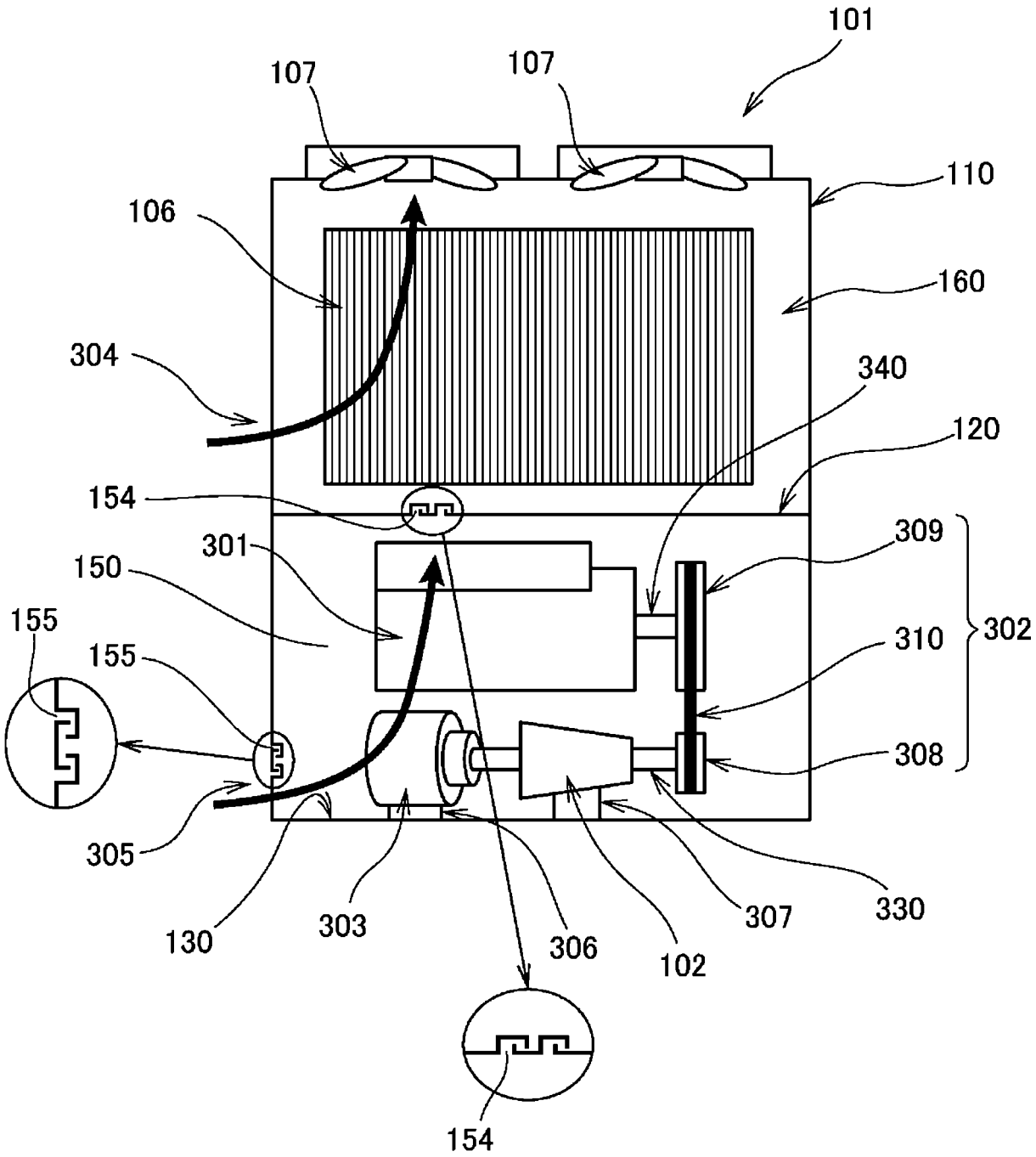
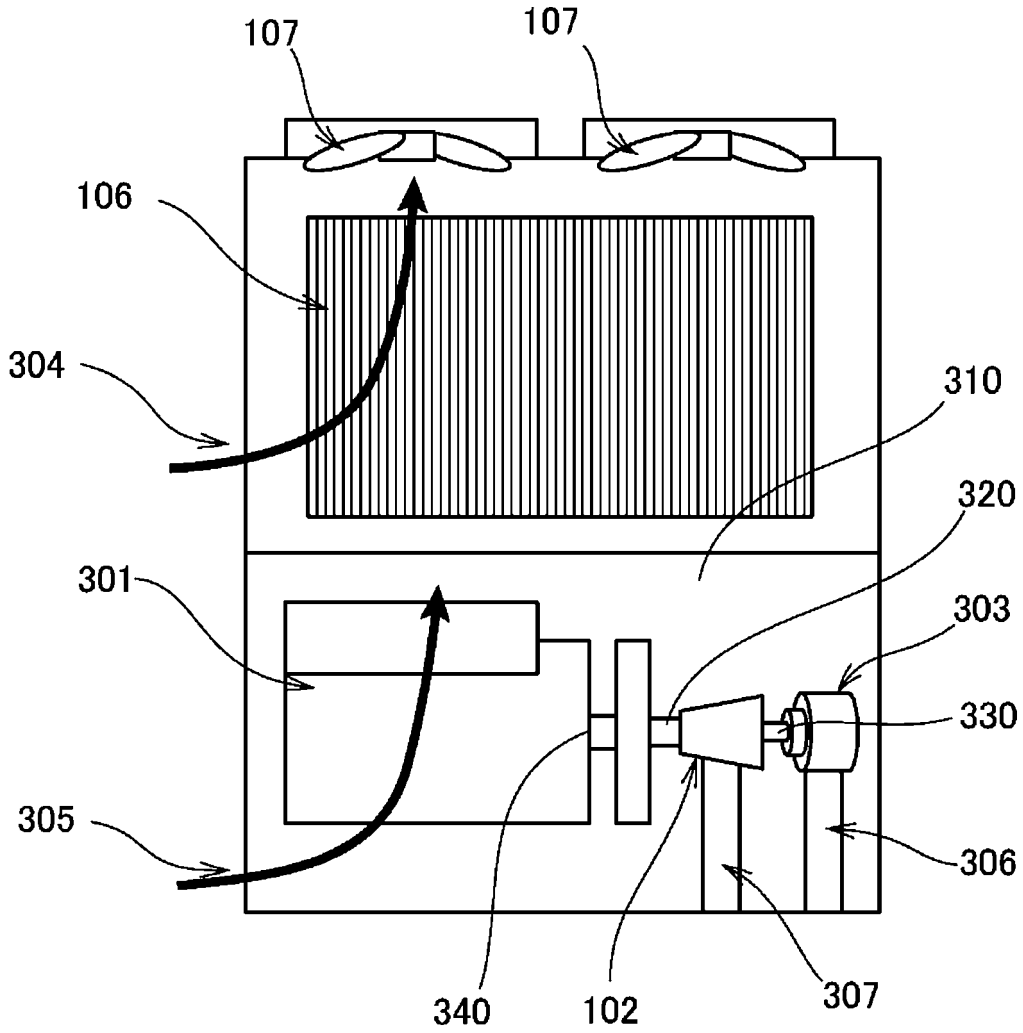

101
107
107
110
106
160
304
340
120
154
309
301
150
302
155
310
155
308
305
330
307
130
303
306
102
154

FIG. 3



REFERENCES CITED IN THE DESCRIPTION

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