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

(11) EP 4 113 019 A1

(12) # EUROPEAN PATENT APPLICATION

published in accordance with Art. 153(4) EPC

(43) Date of publication:
04.01.2023 Bulletin 2023/01

(21) Application number: **21779502.0**

(22) Date of filing: **16.03.2021**

(51) International Patent Classification (IPC):
F24F 1/12 *(2011.01)* ***F24F 11/42*** *(2018.01)*
F25B 31/00 *(2006.01)*

(52) Cooperative Patent Classification (CPC):
F24F 1/12; F24F 11/42; F25B 31/00

(86) International application number:
PCT/JP2021/010684

(87) International publication number:
WO 2021/200129 (07.10.2021 Gazette 2021/40)

(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
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

(30) Priority: **31.03.2020 JP 2020063763**

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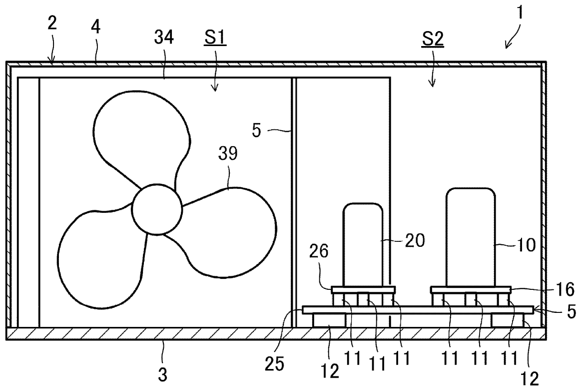
(54) **REFRIGERATION CYCLE DEVICE**

(57) An intermediate plate (5) is supported by a bottom member (3) through a plurality of second elastic members (12). A first compressor (10) is supported by the intermediate plate (5) through a plurality of first elastic members (11). A second compressor (20) is supported by the same intermediate plate (5) through a plurality of first elastic members (11).

FIG.2



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Description

TECHNICAL FIELD

[0001] The present disclosure relates to a refrigeration cycle apparatus.

BACKGROUND ART

[0002] Patent Document 1 discloses a heat pump outdoor unit with a first anti-vibration mount on a bottom plate of a machine chamber, and an intermediate base including a second anti-vibration mount, which is supported by the first mount and to which legs of a compressor are to be attached.

CITATION LIST

PATENT DOCUMENT

[0003] PATENT DOCUMENT 1: Japanese Unexamined Patent Publication No. 2010-243033

SUMMARY OF THE INVENTION

TECHNICAL PROBLEM

[0004] In a case where the refrigeration cycle is performed with a refrigerant compressed through two-stage compression or in a case where the compressor's capacity needs to be increased, it is required that a heat pump outdoor unit include a plurality of compressors.

[0005] However, in general, a machine chamber does not have much space inside, and therefore a degree of freedom of a layout for arranging two or more compressors in the machine chamber.

[0006] An object of the present disclosure is to attain a more compact implementation area for a plurality of compressors.

SOLUTION TO THE PROBLEM

[0007] A first aspect of the present disclosure is directed to a refrigeration cycle apparatus including: a housing (2) having a bottom member (3); and a plurality of compressors accommodated in the housing (2), the plurality of compressors at least including a first compressor (10) and a second compressor (20), the first compressor (10) and the second compressor (20) being supported by a same intermediate plate (5) through a plurality of first elastic members (11), and the intermediate plate (5) being supported by the bottom member (3) through second elastic members (12).

[0008] According to the first aspect, the intermediate plate (5) is supported by the bottom member (3) through the second elastic members (12). The first compressor (10) and the second compressor (20) are supported by the same intermediate plate (5) through the plurality of first elastic members (11).

[0009] This configuration facilitates attaining a more compact implementation area for the first compressor (10) and the second compressor (20), compared with the case where the first compressor (10) and the second compressor (20) are placed separately from each other. In addition, since the overall weight of the structure supported by the second elastic members (12) is increased, the vibration isolation effect improves.

[0010] A second aspect of the present disclosure is directed to the refrigeration cycle apparatus of the first aspect, wherein the intermediate plate (5) includes a first intermediate plate (15) supporting the first compressor (10) and a second intermediate plate (25) supporting the second compressor (20), the first intermediate plate (15) and the second intermediate plate (25) being coupled integrally.

[0011] According to the second aspect, the intermediate plate (5) includes the first intermediate plate (15) and the second intermediate plate (25) which are coupled integrally. The first compressor (10) and the second compressor (20) are supported by the first intermediate plate (15) and the second intermediate plate (25), respectively.

[0012] This configuration facilitates attaining a more compact implementation area for the first intermediate plate (15) and the second intermediate plate (25), compared with the case where the first intermediate plate (15) and the second intermediate plate (25) are placed separately from each other.

[0013] A third aspect of the present disclosure is directed to the refrigeration cycle apparatus of the second aspect, wherein the plurality of compressors further include a third compressor (70), the third compressor (70) is supported by a third intermediate plate (75) through a first elastic member (11), and the intermediate plate (5) includes the first intermediate plate (15), the second intermediate plate (25), and the third intermediate plate (75) which are coupled integrally.

[0014] According to the third aspect, the intermediate plate (5) includes the first intermediate plate (15), the second intermediate plate (25), and the third intermediate plate (75) which are coupled integrally. The third compressor (70) is supported by the third intermediate plate (75).

[0015] Thus, the third compressor (70) can be added by making a minimum design change in which the third intermediate plate (75) is added and coupled integrally to the other intermediate plates.

[0016] A fourth aspect of the present disclosure is directed to the refrigeration cycle apparatus of the second aspect, wherein the plurality of compressors further include a third compressor (70), and the third compressor (70) is supported by the second intermediate plate (25) through a first elastic member (11).

[0017] According to the fourth aspect, the third compressor (70) is supported by the second intermediate plate (25) through the first elastic member (11). Thus, the third compressor (70) can be added by making a minimum design change in which the second compressor (20) and the third compressor (70) are supported by the second intermediate plate (25).

[0018] A fifth aspect of the present disclosure is directed to the refrigeration cycle apparatus of any one of the second to fourth aspects, wherein the first intermediate plate (15) and the second intermediate plate (25) are coupled integrally, with the first intermediate plate (15) and the second intermediate plate (25) partially overlapped with each other in plan view.

[0019] According to the fifth aspect, the first intermediate plate (15) and the second intermediate plate (25) are coupled integrally, with parts of the first intermediate plate (15) and the second intermediate plate (25) overlapped with each other in plan view.

[0020] This configuration allows the first intermediate plate (15) and the second intermediate plate (25) to overlap each other in a greater area, thereby making it possible to ensure the rigidity of the intermediate plate (5).

[0021] A sixth aspect of the present disclosure is directed to the refrigeration cycle apparatus of any one of the second to fifth aspects, wherein the first intermediate plate (15) and the second intermediate plate (25) are coupled integrally by brazing or welding.

[0022] According to the sixth aspect, the first intermediate plate (15) and the second intermediate plate (25) are coupled integrally by brazing or welding.

[0023] The first intermediate plate (15) and the second intermediate plate (25) are therefore melted and joined to each other, thereby improving a joint strength of the intermediate plate (5).

[0024] A seventh aspect of the present disclosure is directed to the refrigeration cycle apparatus of any one of the second to fifth aspects, wherein the first intermediate plate (15) and the second intermediate plate (25) are coupled integrally with a rivet or bolt.

[0025] According to the seventh aspect, the first intermediate plate (15) and the second intermediate plate (25) are coupled integrally with a rivet or bolt.

[0026] This configuration can make it easy to perform the operation of coupling the first intermediate plate (15) and the second intermediate plate (25) integrally to each other.

[0027] An eighth aspect of the present disclosure is directed to the refrigeration cycle apparatus of any one of the second to fifth aspects, wherein the first intermediate plate (15) and the second intermediate plate (25) are coupled integrally via a third elastic member (13).

[0028] According to the eighth aspect, the first intermediate plate (15) and the second intermediate plate (25) are coupled integrally via the third elastic member (13).

[0029] In this configuration, the third elastic member (13) can ease the differences in the displacement of the first intermediate plate (15) and the second intermediate plate (25) caused by the vibrations in the first intermediate plate (15) and the second intermediate plate (25).

[0030] A ninth aspect of the present disclosure is directed to the refrigeration cycle apparatus of any one of the first to eighth aspects, wherein the second compressor (20) is lighter in weight than the first compressor (10).

[0031] According to the ninth aspect, the second compressor (20) is lighter in weight than the first compressor (10), so that the vibration of the second compressor (20) can be reduced by the weight of the first compressor (10).

[0032] A tenth aspect of the present disclosure is directed to the refrigeration cycle apparatus of any one of the first to ninth aspects, wherein assuming that P1 is a center of gravity of a combination of the intermediate plate (5) and the plurality of compressors in plan view, that Q1 is a center of gravity of layout of the second elastic members (12) in plan view, and that r1 is a distance from the center of gravity P1 to a center of gravity of a nearest one of the plurality of compressors to the center of gravity P1, the center of gravity Q1 of the layout is located in an area having the center of gravity P1 as a center and the distance r1 as a radius.

[0033] According to the tenth aspect, the center of gravity Q1 of the layout is located in an area whose radius is the distance r1 from the center of gravity P1 to the center of gravity of the nearest compressor to the center of gravity P1 in plan view.

[0034] It is thus possible to obtain a double anti-vibration structure having a high vibration control effect in consideration of the position of the center of gravity, while ensuring the degree of freedom of the layout for arranging a plurality of compressors.

[0035] An eleventh aspect of the present disclosure is directed to the refrigeration cycle apparatus of the tenth aspect, wherein the center of gravity P1 substantially coincides with the center of gravity Q1 of the layout in plan view.

[0036] According to the eleventh aspect, the center of gravity P1 substantially coincides with the center of gravity Q1 of the layout in plan view. It is thus possible to obtain a double anti-vibration structure having a high vibration control effect in consideration of the position of the center of gravity, while ensuring the degree of freedom of the layout for arranging a plurality of compressors.

[0037] A twelfth aspect of the present disclosure is directed to the refrigeration cycle apparatus of any one of the first to ninth aspects, wherein assuming that P2 is a center of gravity of a combination of the intermediate plate (5), the plurality of compressors, and a refrigerant circuit component part (31) placed on the intermediate plate (5) in plan view, that Q1 is a center of gravity of layout of the second elastic members (12) in plan view, and that r2 is a distance from the center of gravity P2 to a center of gravity of a nearest one of the plurality of compressors to the center of gravity P2, the center of gravity Q1 of the layout is located in an area having the center of gravity P2 as a center and the distance r2 as a radius.

[0038] According to the twelfth aspect, the center of gravity Q1 of the layout is located in an area whose radius is the distance r2 from the center of gravity P2 to the center of gravity of the nearest compressor to the center of gravity P2 in plan view.

[0039] It is thus possible to obtain a double anti-vibration structure having a high vibration control effect in consideration of the position of the center of gravity, while ensuring the degree of freedom of the layout for arranging a plurality of compressors.

[0040] A thirteenth aspect of the present disclosure is directed to the refrigeration cycle apparatus of the twelfth aspect, wherein the center of gravity P2 substantially coincides with the center of gravity Q1 of the layout in plan view.

[0041] According to the thirteenth aspect, the center of gravity P2 substantially coincides with the center of gravity Q1 of the layout in plan view. It is thus possible to obtain a double anti-vibration structure having a high vibration control effect in consideration of the position of the center of gravity, while ensuring the degree of freedom of the layout for arranging a plurality of compressors.

[0042] A fourteenth aspect of the present disclosure is directed to the refrigeration cycle apparatus of the tenth or eleventh aspect, wherein a fourth elastic member (14) is provided between the intermediate plate (5) and the bottom member (3), the fourth elastic member (14) being provided in a position overlapping the center of gravity P1 in plan view.

[0043] According to the fourteenth aspect of the present disclosure, the fourth elastic member (14) is provided between the intermediate plate (5) and the bottom member (3). The fourth elastic member (14) is provided in a position overlapping the center of gravity P1 in the plan view.

[0044] The fourth elastic member (14) provided in a position where the center of gravity is located can reduce warping of the intermediate plate (5) due to vibrations of the compressor.

[0045] A fifteenth aspect of the present disclosure is directed to the refrigeration cycle apparatus of the twelfth or thirteenth aspect, wherein a fourth elastic member (14) is provided between the intermediate plate (5) and the bottom member (3), the fourth elastic member (14) being provided in a position overlapping the center of gravity P2 in plan view.

[0046] According to the fifteenth aspect, the fourth elastic member (14) is provided between the intermediate plate (5) and the bottom member (3). The fourth elastic member (14) is provided in a position overlapping the center of gravity P2 in the plan view.

[0047] The fourth elastic member provided in a position where the center of gravity is located can reduce warping of the intermediate plate (5) due to vibrations of the compressor.

[0048] A sixteenth aspect of the present disclosure is directed to the refrigeration cycle apparatus of the first to fifteenth aspects, including: a control unit (100) configured to control operations of the plurality of compressors, wherein the control unit (100) is configured to control rotations of the plurality of compressors so that centrifugal forces generated in the plurality of compressors cancel out each other.

[0049] According to the sixteenth aspect, the centrifugal forces generated in the plurality of compressors cancel out with each other by the control of the rotations of the plurality of compressors.

[0050] Thus, the vibrations generated in the plurality of compressors cancel out each other, which makes it possible to further enhance the vibration isolation effect.

BRIEF DESCRIPTION OF THE DRAWINGS

[0051]

FIG. 1 is a piping diagram illustrating an example of a configuration of a refrigeration cycle apparatus of a first embodiment.

FIG. 2 is a front view illustrating the configuration of the refrigeration cycle apparatus.

FIG. 3 is a plan view illustrating the configuration of the refrigeration cycle apparatus.

FIG. 4 is a plan view for explaining layout of a first compressor and a second compressor.

FIG. 5 is a view illustrating a variation of the first embodiment, and is equivalent to FIG. 4.

FIG. 6 is a front view illustrating a configuration of a refrigeration cycle apparatus of a second embodiment.

FIG. 7 is a front view illustrating a configuration of a refrigeration cycle apparatus of a third embodiment.

FIG. 8 is a front view illustrating a configuration of a refrigeration cycle apparatus of a fourth embodiment.

FIG. 9 is a front view illustrating a configuration of a refrigeration cycle apparatus of a fifth embodiment.

FIG. 10 is a plan view illustrating a configuration of a refrigeration cycle apparatus.

FIG. 11 is a plan view illustrating layout of devices on an intermediate plate in a refrigeration cycle apparatus of a sixth embodiment.

FIG. 12 is a plan view illustrating layout of devices on an intermediate plate in a refrigeration cycle apparatus of a seventh embodiment.

FIG. 13 is a plan view illustrating layout of devices on an intermediate plate in a refrigeration cycle apparatus of an eighth embodiment.

DESCRIPTION OF EMBODIMENTS

«First Embodiment»

[0052] As illustrated in FIG. 1, a refrigeration cycle apparatus (1) is configured to heat a target fluid. The target fluid is water. The refrigeration cycle apparatus (1) is configured to supply the heated water to an apparatus utilizing the heated water, such as a hot water tank, a coil for indoor heating, or a coil for floor heating. The refrigeration cycle apparatus (1) is configured to cool the target fluid. The target fluid is water. The refrigeration cycle apparatus (1) is configured to supply the cooled water to an apparatus utilizing the cooled water, such as a coil for indoor cooling. The refrigeration cycle apparatus (1) includes a refrigerant circuit (30) and a control unit (100).

[Refrigerant Circuit]

[0053] The refrigerant circuit (30) includes a first compressor (10), a second compressor (20), a four-way switching valve (33), a heat-source-side heat exchanger (34), a check valve bridge (35), an expansion valve (36), a utilization-side heat exchanger (37), an accumulator (38), and an intermediate heat exchanger (45).

[0054] The refrigerant circuit (30) is filled with a refrigerant. The refrigerant circuit (30) performs a refrigeration cycle by circulating the refrigerant therein. The refrigerant is, for example, a refrigerant R410A, R32, or R407C.

<First Compressor>

[0055] The first compressor (10) is, for example, a scroll compressor. The first compressor (10) is provided on a discharge side of the second compressor (20). The first compressor (10) is connected with a first suction pipe (51) and a first discharge pipe (52). The first compressor (10) is configured to compress the refrigerant sucked therein and to discharge the refrigerant thus compressed. The first compressor (10) has a greater capacity than the second compressor (20).

[0056] The number of rotations of the first compressor (10) is variable. For example, the number of rotations of a motor is changed by changing an output frequency of an inverter (not illustrated) connected to the first compressor (10). As a result, the number of rotations (operation frequency) of the first compressor (10) changes.

<Second Compressor>

[0057] The second compressor (20) is, for example, a scroll compressor. The second compressor (20) is provided on a suction side of the first compressor (10). The second compressor (20) is connected with a second suction pipe (53) and a second discharge pipe (54). By connecting an inlet end of the first suction pipe (51) with an outlet end of the second discharge pipe (54), a connection pipe (50) is configured. The second compressor (20) and the first compressor (10) are connected with each other in series via the connection pipe (50). The second compressor (20) is configured to compress the refrigerant sucked therein and discharge the refrigerant thus compressed.

[0058] The number of rotations of the second compressor (20) is variable. For example, the number of rotations of a motor is changed by changing an output frequency of an inverter (not illustrated) connected to the second compressor (20). As a result, the number of rotations (operation frequency) of the second compressor (20) changes.

<Four-Way Switching Valve>

[0059] The four-way switching valve (33) is a solenoid-operated switching valve. The four-way switching valve (33) switches between a first state (the state indicated by the solid lines in FIG. 1) and a second state (the state indicated by the dotted lines in FIG. 1). A first port (P1) is connected to the outlet end of the first discharge pipe (52). A second port (P2) is connected to the inlet end of second suction pipe (53). A third port (P3) communicates with a gas-side end of the heat-source-side heat exchanger (34). A fourth port (P4) communicates with a gas-side end of the utilization-side heat exchanger (37).

<Heat-Source-Side Heat Exchanger>

[0060] The heat-source-side heat exchanger (34) is an outdoor heat exchanger. In the vicinity of the heat-source-side heat exchanger (34), a fan (39) is provided. As a result of operation of the fan (39), heat exchange takes place between the refrigerant of the heat-source-side heat exchanger (34) and the outdoor air.

<Check Valve Bridge>

[0061] The check valve bridge (35) includes four check valves (C). Each of the four check valves (C) allows the refrigerant to flow in the direction indicated by the arrows in FIG. 1, and restricts the refrigerant from flowing in the opposite direction. To an inlet side of the check valve bridge (35), one end of a main liquid pipe (55) is connected. To an outlet side of the check valve bridge (35), the other end of the main liquid pipe (55) is connected. The check valve bridge (35) communicates with a liquid-side end of the heat-source-side heat exchanger (34) and a liquid-side end of the utilization-side heat exchanger (37).

<Expansion Valve>

[0062] The expansion valve (36) expands the refrigerant to lower the pressure of the refrigerant. The expansion valve (36) is an electronic expansion valve whose opening degree is adjustable. The expansion valve (36) is connected to the main liquid pipe (55).

<Utilization-Side Heat Exchanger>

[0063] The utilization-side heat exchanger (37) causes heat exchange between the refrigerant and the water. The utilization-side heat exchanger (37) includes a first channel (37a) and a second channel (37b). The first channel (37a) is a channel through which the refrigerant flows. The second channel (37b) is a channel through which the water flows. The second channel (37b) is connected to an intermediate portion of a utilization-side circuit (65) included in the apparatus utilizing the water (not illustrated). The utilization-side heat exchanger (37) causes heat exchange between the refrigerant flowing through the first channel (37a) and the water flowing through the second channel (37b).

<Accumulator>

[0064] The accumulator (38) is connected to an intermediate portion of the second suction pipe (53). The accumulator (38) is a gas-liquid separator. Inside the accumulator (38), the refrigerant is separated into a liquid refrigerant and a gas refrigerant. The accumulator (38) is configured to allow only the gas refrigerant to flow out of the accumulator (38).

<Bypass Circuit>

[0065] A bypass circuit (60) includes a bypass piping (PB) and a bypass check valve (61). The bypass piping (PB) is connected between the second suction pipe (53) and the connection pipe (50). The bypass check valve (61) allows the refrigerant to flow in a direction from the second suction pipe (53) to the connection pipe (50), and restricts the refrigerant from flowing in the opposite direction.

<Injection Circuit>

[0066] An injection circuit (40) is a circuit for supplying part of the refrigerant flowing through the main liquid pipe (55) to the suction side of the first compressor (10). The injection circuit (40) includes an injection piping (PJ), an injection expansion valve (41), and an open/close valve (42).

[0067] The injection piping (PJ) has one end connected between the expansion valve (36) and the check valve bridge (35) in the main liquid pipe (55). The injection piping (PJ) has the other end branched into two ends, one of which is connected with the first suction pipe (51) and the other one of which is connected with a compression chamber in the course of compression of the first compressor (10).

[0068] The injection expansion valve (41) is connected to a portion of the injection piping (PJ) upstream of the intermediate heat exchanger (45). The injection expansion valve (41) decompresses the refrigerant flowing through the injection piping (PJ).

[0069] The open/close valve (42) is switchable between an open state and a closed state. When the open/close valve (42) is in the open state, part of the refrigerant flowing through the injection piping (PJ) is supplied to the suction side of the first compressor (10). When the open/close valve (42) is in the closed state, the refrigerant flowing through the injection piping (PJ) is supplied to the compression chamber in the course of compression of the first compressor (10).

<Intermediate Heat Exchanger>

[0070] The intermediate heat exchanger (45) includes a third channel (45a) and a fourth channel (45b). The third channel (45a) is connected to an intermediate portion of the main liquid pipe (55). The fourth channel (45b) is connected to an intermediate portion of the injection piping (PJ). The intermediate heat exchanger (45) causes heat exchange between the refrigerant flowing through the third channel (45a) and the refrigerant flowing through the fourth channel (45b).

[Sensor]

[0071] The refrigeration cycle apparatus (1) includes various sensors, such as temperature sensors for detecting temperatures of the refrigerant etc. and pressure sensors for detecting pressures of the refrigerant etc. Signals indicative of detection results of the sensors are sent to the control unit (100).

[Control Unit]

[0072] The refrigeration cycle apparatus (1) includes the control unit (100). The control unit (100) includes a microcomputer and a memory device storing software for operating the microcomputer.

[0073] The control unit (100) is configured to control the refrigerant circuit (30) based on the signals from the various sensors and external control signals. The control unit (100) is configured to output control signals to the first compressor (10), the second compressor (20), the four-way switching valve (33), the expansion valve (36), the injection expansion valve (41), the open/close valve (42), and the like. The control unit (100) receives values detected by the various sensors.

[Operation of Refrigeration Apparatus]

[0074] The refrigeration cycle apparatus (1) performs heating operation and cooling operation. The refrigeration cycle apparatus (1) is configured such that the first compressor (10) functions as a high-pressure compressor and the second compressor (20) functions as a low-pressure compressor.

<Heating Operation>

[0075] In the heating operation, a refrigeration cycle is performed in which the utilization-side heat exchanger (37) serves a condenser (a radiator) and the heat-source-side heat exchanger (34) serves as an evaporator. Specifically, the four-way switching valve (33) is placed in the first state.

[0076] The refrigerant discharged from the first compressor (10) passes through the four-way switching valve (33), and dissipates heat to water to condense in the utilization-side heat exchanger (37). The refrigerant that has flowed out of the utilization-side heat exchanger (37) passes through the check valve bridge (35), and circulates through the main liquid pipe (55). The refrigerant circulating through the main liquid pipe (55) dissipates heat to the refrigerant flowing through the fourth channel (45b), and is supercooled, in the third channel (45a) of the intermediate heat exchanger (45). Thereafter, part of the refrigerant flowing through the main liquid pipe (55) flows into the injection piping (PJ), and the remaining part of the refrigerant is decompressed at the expansion valve (36) in the main liquid pipe (55).

[0077] The refrigerant thus decompressed passes through the check valve bridge (35) and evaporates in the heat-source-side heat exchanger (34). The refrigerant that has flowed out of the heat-source-side heat exchanger (34) sequentially passes through the four-way switching valve (33) and the accumulator (38), and is sucked into the second compressor (20) and compressed. The refrigerant discharged from the second compressor (20) is sucked into the first compressor (10) and is compressed.

[0078] On the other hand, the refrigerant that has flowed into the injection piping (PJ) is decompressed at the injection expansion valve (41), and absorbs heat from the refrigerant flowing through the third channel (45a) and evaporates in the fourth channel (45b) of the intermediate heat exchanger (45). Thereafter, the refrigerant flowing through the injection piping (PJ) is introduced into the first suction pipe (51) to the first compressor (10).

<Cooling Operation>

[0079] In the cooling operation, a refrigeration cycle is performed in which the heat-source-side heat exchanger (34) serves as a condenser (a radiator) and the utilization-side heat exchanger (37) serves as an evaporator. Specifically, the four-way switching valve (33) is placed in the second state. An explanation of the flow of the refrigerant during the cooling operation is omitted.

[Layouts of the Devices inside the Refrigeration Cycle Apparatus]

[0080] As illustrated in FIGS. 2 and 3, the refrigeration cycle apparatus (1) includes a housing (2). The housing (2) has a bottom member (3) and a cover member (4).

[0081] An interior of the housing (2) is partitioned into a heat exchange chamber (S1) and a machine chamber (S2) by a partition (5). The cover member (4) covers the heat exchange chamber (S1) and the machine chamber (S2). In the heat exchange chamber (S1), the heat-source-side heat exchanger (34) and the fan (39) are provided. As a result of operation of the fan (39), heat exchange takes place between the refrigerant flowing through the heat-source-side heat exchanger (34) and the outdoor air.

[0082] In the machine chamber (S2), the devices illustrated within the virtual frame line in FIG. 1 are provided. Specifically, the machine chamber (S2) accommodates the first compressor (10), the second compressor (20), and refrigerant circuit component parts (31) constituting the refrigerant circuit (30). Although not illustrated, the control unit (100) is located in the machine chamber (S2).

[0083] The first compressor (10) is supported by an intermediate plate (5) through a plurality of first elastic members (11). Specifically, the first compressor (10) is provided with a first supporting leg (16). Between the first supporting leg (16) and the intermediate plate (5), three first elastic members (11) are provided.

[0084] The second compressor (20) is supported by the same intermediate plate (5) through a plurality of first elastic members (11). Specifically, the second compressor (20) is provided with second supporting legs (26). Between the second supporting leg (26) and the intermediate plate (5), three first elastic members (11) are provided.

[0085] The first elastic members (11) may be a single large piece or may be two or more separate pieces as long as the first elastic member (11) or the first elastic members (11) can support the first compressor (10) and the second compressor (20). The first elastic members (11) are made of rubber or urethan.

[0086] The intermediate plate (5) is supported by the bottom member (3) of the housing (2) through the plurality of second elastic members (12). Between the intermediate plate (5) and the bottom member (3), four second elastic members (12) are provided. The second elastic members (12) are provided at four corners of the intermediate plate (5), respectively.

[0087] The second elastic members (12) may be a single large piece or may be two or more separate pieces. The second elastic members (12) are made of rubber or urethan. The first elastic members (11) and the second elastic members (12) may be made from the same material or different materials, and may have the same spring constant or different spring constants.

[0088] The first compressor (10) and the second compressor (20) are placed on a double anti-vibration structure that includes the first elastic members (11), the intermediate plate (5), and the second elastic members (12). With this configuration, even if the first compressor (10) and the second compressor (20) vibrate during the operation of the refrigeration cycle apparatus (1), transmission of the vibration and noise generation are reduced.

[0089] The first compressor (10) and the second compressor (20) are supported by the same intermediate plate (5) through a plurality of first elastic members (11). This configuration facilitates attaining a more compact implementation area for the first compressor (10) and the second compressor (20), compared with the case where the first compressor (10) and the second compressor (20) are placed separately from each other. In addition, since the overall weight of the structure supported by the second elastic members (12) is increased, the vibration isolation effect improves.

[0090] Since the first compressor (10) has a greater capacity than the second compressor (20), the first compressor (10) is heavier than the second compressor (20).

Thus, the vibration of the second compressor (20), which has a relatively low weight, can be reduced by the weight of the first compressor (10).

<Center of Gravity of Layout>

[0091] The center of gravity of a layout is the point that is the center (middle point) of vibration of the intermediate plate (5). In other words, is the point where the amplitude is greatest when the intermediate plate (5) vibrates.

[0092] In the example illustrated in FIG. 4, the four second elastic members (12) are identical with each other in terms of the material, area, and thickness. Accordingly, the center of gravity Q1 of the layout of the second elastic members (12) is the intersection of the line connecting the second elastic members (12) at the upper left corner and the lower right corner in FIG. 4 and the line connecting the second elastic members (12) at the lower left corner and the upper right corner in FIG. 4.

[0093] In the example illustrated in FIG. 4, the three first elastic members (11) are placed at vertexes of an equilateral triangle. The three first elastic members (11) are identical with each other in terms of the material, area, and thickness. Thus, the center of gravity of the layout of the first elastic members (11) is the center of gravity of the equilateral triangle in plan view.

[0094] The first compressor (10) has a cylindrical shape. The center of gravity C1 of the first compressor (10) is an approximate point to the center of the circle in FIG. 4. In the illustration of FIG. 4, the center of gravity C1 of the first compressor (10) coincides with the center of gravity of the layout of the three first elastic members (11) supporting the first supporting leg (16) in plan view.

[0095] The second compressor (20) has a cylindrical shape. The center of gravity C2 of the second compressor (20) is an approximate point to the center of the circle in FIG. 4. In the illustration of FIG. 4, the center of gravity C2 of the second compressor (20) coincides with the center of gravity of the layout of the three first elastic members (11) supporting the second supporting leg (26) in plan view.

[0096] The center of gravity of the combination of the intermediate plate (5) and the first and second compressors (10) and (20) in plan view will be referred to as the center of gravity P1. The center of gravity P1 is located in the vicinity of the center of gravity Q1 of the layout of the second elastic members (12) in plan view.

[0097] Specifically, since the first compressor (10) is heavier in weight than the second compressor (20), the center of gravity P1 is closer to the first compressor (10) than the center of gravity Q1 of the layout. Thus, the first compressor (10) is the nearest compressor from the center of gravity P1. The distance from the center of gravity P1 to the first compressor (10) in plan view will be referred to as a distance r1. The center of gravity Q1 of the layout is located in an area having the center of gravity P1 as the center and the distance r1 as a radius. The center of gravity P1 may substantially coincide with the center of gravity Q1 of the layout of the second elastic members (12) in plan view.

[0098] This makes it possible to obtain a double anti-vibration structure having a high vibration control effect in consideration of the position of the center of gravity, while ensuring the degree of freedom of the layout for arranging the first compressor (10) and second compressor (20).

[0099] The control unit (100) may be configured to control the operation of the first compressor (10) and the second compressor (20) to reduce the transmission of the vibration generated in the first compressor (10) and the second compressor (20) to the housing (2).

[0100] For example, the control unit (100) may be configured to control the first compressor (10) and the second compressor (20) so that they rotate in the same rotational direction and with phases shifted by 180°. In this configuration, centrifugal forces generated in the first compressor (10) and the second compressor (20) cancel out each other.

[0101] Accordingly, vibrations generated in the first compressor (10) and the second compressor (20) cancel out each other, which makes it possible to further enhance the vibration isolation effect.

-Advantages of Embodiment-

[0102] In a feature (1) of the embodiment, the intermediate plate (5) is supported by the bottom member (3) through the second elastic members (12). The first compressor (10) and the second compressor (20) are supported by the same intermediate plate (5) through the plurality of first elastic members (11).

[0103] According to the first feature of the embodiment, a more compact implementation area for the first compressor (10) and the second compressor (20) can be attained, compared with the case where the first compressor (10) and the second compressor (20) are placed separately from each other. In addition, since the overall weight of the structure supported by the second elastic members (12) is increased, the vibration isolation effect improves.

[0104] In a feature (2) of the embodiment, the second compressor (20) is lighter in weight than the first compressor (10).

[0105] According to the feature (2) of the embodiment, the vibration of the second compressor (20) can be reduced by the weight of the first compressor (10).

[0106] In a feature (3) of the embodiment, the center of gravity Q1 of the layout is located in an area whose radius is the distance r1 from the center of gravity P1 to the center of gravity of the nearest compressor to the center of gravity P1 in plan view.

[0107] According to the feature (3) of the embodiment, it is possible to obtain a double anti-vibration structure having a high vibration control effect in consideration of the position of the center of gravity, while ensuring the degree of freedom of the layout for arranging a plurality of compressors.

[0108] In a feature (4) of the embodiment, the center of gravity P1 substantially coincides with the center of gravity Q1 of the layout in plan view.

[0109] According to the feature (4) of the embodiment, it is possible to obtain a double anti-vibration structure having a high vibration control effect in consideration of the position of the center of gravity, while ensuring the degree of freedom of the layout for arranging a plurality of compressors.

[0110] In a feature (5) of the embodiment, the rotations of the first compressor (10) and the second compressor (20) are controlled, so that the centrifugal forces generated in the first compressor (10) and the second compressor (20) cancel out each other.

[0111] According to the feature (5) of the embodiment, the vibrations generated in the plurality of compressors cancel out each other, which makes it possible to further enhance the vibration isolation effect.

-Variations of First Embodiment-

[0112] As illustrated in FIG. 5, a first compressor (10), a second compressor (20), and a plurality of refrigerant circuit component parts (31) are placed on the intermediate plate (5). In the example illustrated in FIG. 5, the refrigerant circuit component parts (31) are a utilization-side heat exchanger (37) and an accumulator (38).

[0113] In the example illustrated in FIG. 5, the center of gravity Q1 of the layout of the second elastic members (12) is the intersection of the line connecting the second elastic members (12) at the upper left corner and the lower right corner in FIG. 5 and the line connecting the second elastic members (12) at the lower left corner and the upper right corner in FIG. 4.

[0114] The center of gravity of the combination of the intermediate plate (5), the first compressor (10), the second compressor (20), the utilization-side heat exchanger (37), and the accumulator (38) in plan view will be referred to as the center of gravity P2. The center of gravity P2 is located in the vicinity of the center of gravity Q1 of the layout of the second elastic members (12) in plan view.

[0115] Specifically, the first compressor (10) and the second compressor (20) are located at lower portions of FIG. 5, and therefore the center of gravity P2 is closer to the lower side than the center of gravity Q1 of the layout. Moreover, since the first compressor (10) is heavier in weight than the second compressor (20), the center of gravity P2 is closer to the first compressor (10) than the center of gravity Q1 of the layout. Thus, the center of gravity P2 is closer to the lower right side in FIG. 5 than the center of gravity Q1 of the layout.

[0116] In this configuration, the first compressor (10) is the nearest compressor from the center of gravity P2. The distance from the center of gravity P2 to the first compressor (10) in plan view will be referred to as a distance r2. The center of gravity Q1 of the layout is located in an area having the center of gravity P2 as the center and the distance r2 as a radius. The center of gravity P2 may substantially coincide with the center of gravity Q1 of the layout of the second elastic members (12) in plan view.

[0117] This makes it possible to obtain a double anti-vibration structure having a high vibration control effect in consideration of the position of the center of gravity, while ensuring the degree of freedom of the layout for arranging the first compressor (10) and second compressor (20).

[0118] Although not illustrated in the drawings, refrigerant circuit component parts (31) other than the first compressor (10), the second compressor (20), the accumulator (38), and the utilization-side heat exchanger (37) may be arranged on the intermediate plate (5). Examples of the refrigerant circuit component parts (31) include the intermediate heat exchanger (45), the four-way switching valve (33), the check valve bridge (35), the expansion valve (36), the bypass check valve (61), etc.

«Second Embodiment»

[0119] In the following description, the same reference characters designate the same components as those of the first embodiment, and the description is focused only on the difference.

[0120] As illustrated in FIG. 6, an intermediate plate (5) includes a first intermediate plate (15) and a second intermediate plate (25). The first compressor (10) is supported by the first intermediate plate (15) through a plurality of first elastic members (11). The second compressor (20) is supported by the second intermediate plate (25) through a plurality of first elastic members (11).

[0121] The intermediate plate (5) includes the first intermediate plate (15) and the second intermediate plate (25) which are coupled integrally. The first intermediate plate (15) and the second intermediate plate (25) are coupled integrally to each other with coupling members (27).

[0122] Specifically, the coupling members (27) are a pair of upper and lower members which vertically sandwich the intermediate plate (5). A left edge portion of the first intermediate plate (15) and a right edge portion of the second intermediate plate (25) are in contact with each other. The pair of upper and lower coupling members (27) cover the boundary between the first intermediate plate (15) and the second intermediate plate (25).

[0123] The coupling members (27), the first intermediate plate (15), and the second intermediate plate (25) are coupled integrally to each other by brazing or welding. The first intermediate plate (15) and the second intermediate plate (25) are therefore melted and joined to each other, thereby improving a joint strength of the intermediate plate (5).

[0124] The first intermediate plate (15) and the second intermediate plate (25) may be coupled integrally to each other by brazing or welding the boundary between the first intermediate plate (15) and the second intermediate plate (25), without the coupling members (27).

[0125] Alternatively, the coupling members (27), the first intermediate plate (15), and the second intermediate plate (25) may be coupled integrally with a rivet or bolt. This configuration can make it easy to perform the operation of coupling the first intermediate plate (15) and the second intermediate plate (25) integrally to each other.

«Third Embodiment»

[0126] As illustrated in FIG. 7, an intermediate plate (5) includes a first intermediate plate (15) and a second intermediate plate (25). The first compressor (10) is supported by the first intermediate plate (15) through a plurality of first elastic members (11). The second compressor (20) is supported by the second intermediate plate (25) through a plurality of first elastic members (11).

[0127] The intermediate plate (5) includes the first intermediate plate (15) and the second intermediate plate (25) which are coupled integrally. The first intermediate plate (15) and the second intermediate plate (25) are coupled integrally to each other, with the first intermediate plate (15) and the second intermediate plate (25) partially overlapped with each other in plan view.

[0128] Specifically, the second intermediate plate (25) has a coupling portion (28). The coupling portion (28) is formed by bending an edge portion of the second intermediate plate (25) closer to the first intermediate plate (15) into a step-like shape. The coupling portion (28) of the second intermediate plate (25) overlaps the first intermediate plate (15) in plan view.

[0129] The first intermediate plate (15) and the coupling portion (28) of the second intermediate plate (25) are coupled integrally to each other by brazing or welding, for example. Alternatively, the first intermediate plate (15) and the coupling portion (28) of the second intermediate plate (25) may be coupled integrally with a rivet or bolt.

[0130] This configuration allows the first intermediate plate (15) and the second intermediate plate (25) to overlap each other in a greater area, thereby making it possible to ensure the rigidity of the intermediate plate (5). The coupling portion (28) may be formed in the first intermediate plate (15).

«Fourth Embodiment»

[0131] As illustrated in FIG. 8, an intermediate plate (5) includes a first intermediate plate (15) and a second intermediate plate (25). The first compressor (10) is supported by the first intermediate plate (15) through a plurality of first elastic members (11). The second compressor (20) is supported by the second intermediate plate (25) through a plurality of first elastic members (11).

[0132] The intermediate plate (5) includes the first intermediate plate (15) and the second intermediate plate (25) which are coupled integrally. The first intermediate plate (15) and the second intermediate plate (25) are coupled integrally to each other via a third elastic member (13).

[0133] Specifically, the second intermediate plate (25) has a coupling portion (28). The coupling portion (28) is formed by bending an edge portion of the second intermediate plate (25) closer to the first intermediate plate (15) into a step-like shape. The coupling portion (28) of the second intermediate plate (25) overlaps the first intermediate plate (15) in plan view.

[0134] Between the coupling portion (28) of the second intermediate plate (25) and the first intermediate plate (15), the third elastic member (13) is provided. The first intermediate plate (15) and the second intermediate plate (25) are coupled integrally to each other via the third elastic member (13). The third elastic member (13) is made from rubber of urethan. The third elastic member (13) is bonded to the first intermediate plate (15) and the second intermediate plate (25).

[0135] In this configuration, the third elastic member (13) can ease the differences in the displacement of the first intermediate plate (15) and the second intermediate plate (25) caused by the vibrations in the first intermediate plate (15) and the second intermediate plate (25).

«Fifth Embodiment»

[0136] As illustrated in FIGS. 9 and 10, a first compressor (10) and a second compressor (20) are placed on an intermediate plate (5). The center of gravity of the combination of the intermediate plate (5), the first compressor (10), and the second compressor (20) in plan view will be referred to as the center of gravity P1. Between the intermediate plate (5) and a bottom member (3), a fourth elastic member (14) is provided in a position overlapping the center of gravity P1 in plan view. The fourth elastic member (14) is made from rubber or urethan.

[0137] The fourth elastic member (14) provided in a position where the center of gravity is located can reduce warping of the intermediate plate (5) due to vibrations of the first compressor (10) and the second compressor (20).

[0138] Similarly in the case in which the first compressor (10), the second compressor (20), the utilization-side heat exchanger (37), and the accumulator (38) are provided on the intermediate plate (5) as illustrated in FIG. 5, the fourth elastic member (14) is provided in a position overlapping the center of gravity P2 in plan view.

«Sixth Embodiment»

[0139] As illustrated in FIG. 11, a first compressor (10), a second compressor (20), and a third compressor (70) are placed on an intermediate plate (5). The intermediate plate (5) includes a first intermediate plate (15), a second intermediate plate (25), and a third intermediate plate (75) which are coupled integrally.

[0140] The second intermediate plate (25) is placed at a lower left corner of the first intermediate plate (15). The third intermediate plate (75) is placed at an upper left corner of the first intermediate plate (15). The second intermediate plate (25) and the third intermediate plate (75) are coupled integrally to the first intermediate plate (15), with the second intermediate plate (25) and the third intermediate plate (75) partially overlapped with the first intermediate plate (15) in plan view.

[0141] Specifically, the second intermediate plate (25) has a coupling portion (28). The coupling portion (28) is formed by bending an edge portion of the second intermediate plate (25) closer to the first intermediate plate (15) into a step-like shape. The coupling portion (28) of the second intermediate plate (25) overlaps the first intermediate plate (15) in plan view.

[0142] The third intermediate plate (75) has a coupling portion (78). The coupling portion (78) is formed by bending an edge portion of the third intermediate plate (75) closer to the first intermediate plate (15) into a step-like shape. The coupling portion (78) of the third intermediate plate (75) overlaps the first intermediate plate (15) in plan view.

[0143] The first intermediate plate (15) and each of the coupling portions (28) and (78) of the second and third intermediate plates (25) and (75) are coupled integrally to each other by brazing or welding, for example. Alternatively, the first intermediate plate (15) and each of the coupling portions (28) and (78) of the second and third intermediate plates (25) and (75) may be coupled integrally with a rivet or bolt.

[0144] The first compressor (10) is supported by the first intermediate plate (15) through a plurality of first elastic members (11). The first compressor (10) is provided with a first supporting leg (16). Between the first supporting leg (16) and the first intermediate plate (15), three first elastic members (11) are provided. A plurality of refrigerant circuit component parts (31) are placed on the first intermediate plate (15). In the example illustrated in FIG. 11, the refrigerant circuit component parts (31) are a utilization-side heat exchanger (37) and an accumulator (38).

[0145] The second compressor (20) is supported by the second intermediate plate (25) through a plurality of first elastic members (11). The second compressor (20) is provided with a second supporting leg (26). Between the second supporting leg (26) and the second intermediate plate (25), three first elastic members (11) are provided.

[0146] The third compressor (70) is supported by the third intermediate plate (75) through a plurality of first elastic members (11). The third compressor (70) is provided with a third supporting leg (76). Between the third supporting leg (76) and the third intermediate plate (75), three first elastic members (11) are provided.

[0147] Between the first intermediate plate (15) and the bottom member (3), a plurality of second elastic members (12) are provided. The second elastic members (12) are provided at four corners of the first intermediate plate (15).

[0148] Between the second intermediate plate (25) and the bottom member (3), a plurality of second elastic members (12) are provided. The second elastic members (12) are provided at the upper left corner and the lower left corner of the second intermediate plate (25).

[0149] Between the third intermediate plate (75) and the bottom member (3), a plurality of second elastic members (12) are provided. The second elastic members (12) are provided at the upper left corner and the lower left corner of the third intermediate plate (75).

[0150] Thus, the third compressor (70) can be added by making a minimum design change in which the third intermediate plate (75) is added and coupled integrally to the first intermediate plate (15).

«Seventh Embodiment»

[0151] As illustrated in FIG. 12, a first compressor (10), a second compressor (20), and a third compressor (70) are placed on an intermediate plate (5). The intermediate plate (5) includes the first intermediate plate (15) and the second intermediate plate (25).

[0152] The second intermediate plate (25) has a coupling portion (28). The coupling portion (28) is formed by bending an edge portion of the second intermediate plate (25) closer to the first intermediate plate (15) into a step-like shape. The coupling portion (28) of the second intermediate plate (25) overlaps the first intermediate plate (15) in plan view. The intermediate plate (5) is configured by coupling integrally the first intermediate plate (15) and the coupling portion (28) of the second intermediate plate (25).

[0153] The first compressor (10) is supported by the first intermediate plate (15) through a plurality of first elastic members (11). A plurality of refrigerant circuit component parts (31) are placed on the first intermediate plate (15). In the example illustrated in FIG. 12, the refrigerant circuit component parts (31) are a utilization-side heat exchanger (37) and an accumulator (38).

[0154] The second compressor (20) is supported by the second intermediate plate (25) through a plurality of first elastic members (11). The third compressor (70) is supported by the second intermediate plate (25) through a plurality of first elastic members (11).

[0155] Between the first intermediate plate (15) and the bottom member (3), a plurality of second elastic members (12) are provided. The second elastic members (12) are provided at four corners of the first intermediate plate (15).

[0156] Between the second intermediate plate (25) and the bottom member (3), a plurality of second elastic members (12) are provided. The second elastic members (12) are provided at the upper left corner and the lower left corner of the second intermediate plate (25).

[0157] Thus, the third compressor (70) can be added by making a minimum design change in which the second compressor (20) and the third compressor (70) are supported by the second intermediate plate (25).

«Eighth Embodiment»

[0158] As illustrated in FIG. 13, a first compressor (10), a second compressor (20), and a third compressor (70) are placed on an intermediate plate (5). The intermediate plate (5) includes a first intermediate plate (15), a second intermediate plate (25), and a third intermediate plate (75).

[0159] The second intermediate plate (25) has a coupling portion (28). The coupling portion (28) is formed by bending an edge portion of the second intermediate plate (25) closer to the first intermediate plate (15) into a step-like shape. The coupling portion (28) of the second intermediate plate (25) overlaps the first intermediate plate (15) in plan view.

[0160] The third intermediate plate (75) has a coupling portion (78). The coupling portion (78) is formed by bending an edge portion of the third intermediate plate (75) closer to the second intermediate plate (25) into a step-like shape. The coupling portion (78) of the third intermediate plate (75) overlaps the second intermediate plate (25) in plan view.

[0161] The coupling portion (28) of the second intermediate plate (25) is coupled integrally to the first intermediate plate (15). The coupling portion (78) of the third intermediate plate (75) is coupled integrally to the second intermediate plate (25). Thus, the intermediate plate (5) includes the first intermediate plate (15), the second intermediate plate (25), and the third intermediate plate (75) which are coupled integrally.

[0162] The first compressor (10) is supported by the first intermediate plate (15) through a plurality of first elastic members (11). A plurality of refrigerant circuit component parts (31) are placed on the first intermediate plate (15). In the example illustrated in FIG. 13, the refrigerant circuit component parts (31) are a utilization-side heat exchanger (37) and an accumulator (38).

[0163] The second compressor (20) is supported by the second intermediate plate (25) through a plurality of first elastic members (11). The third compressor (70) is supported by the second intermediate plate (25) through a plurality of first elastic members (11).

[0164] Between the first intermediate plate (15) and the bottom member (3), a plurality of second elastic members (12) are provided. The second elastic members (12) are provided at four corners of the first intermediate plate (15).

[0165] Between the second intermediate plate (25) and the bottom member (3), a plurality of second elastic members (12) are provided. The second elastic members (12) are provided at the upper left corner and the lower left corner of the second intermediate plate (25).

[0166] Between the third intermediate plate (75) and the bottom member (3), a plurality of second elastic members (12) are provided. The second elastic members (12) are provided at the upper left corner and the lower left corner of the third intermediate plate (75).

[0167] Thus, the third compressor (70) can be added by making a minimum design change in which the third intermediate plate (75) is added and coupled integrally to the other intermediate plates.

«Other Embodiments»

[0168] The above-described embodiments may be modified as follows.

[0169] Even though this embodiment describes a configuration with two or three compressors, the embodiment may be configured with four or more compressors.

[0170] While the embodiments and variations have been described above, it will be understood that various changes in form and details can be made without departing from the spirit and scope of the claims. The above embodiments and variations may be appropriately combined or modified by replacing the elements thereof as long as the functions of the subject matters of the present disclosure are not impaired. In addition, the expressions of "first," "second," and "third" in the specification and claims are used to distinguish the terms to which these expressions are given, and do not limit the number and order of the terms.

INDUSTRIAL APPLICABILITY

[0171] As described above, the present disclosure is useful for a refrigeration cycle apparatus.

DESCRIPTION OF REFERENCE CHARACTERS

[0172]

1	Refrigeration Cycle Apparatus
2	Housing
3	Bottom Member
5	Intermediate Plate
10	First Compressor
11	First Elastic Member
12	Second Elastic Member
13	Third Elastic Member
14	Fourth Elastic Member
15	First Intermediate Plate
20	Second Compressor
25	Second Intermediate Plate
31	Refrigerant Circuit Component Part
70	Third Compressor
75	Third Intermediate Plate
100	Control Unit
P1	Center of Gravity
P2	Center of Gravity
Q1	Center of Gravity of Layout

Claims

1. A refrigeration cycle apparatus comprising: a housing (2) having a bottom member (3); and a plurality

of compressors accommodated in the housing (2),

the plurality of compressors at least including a first compressor (10) and a second compressor (20),
the first compressor (10) and the second compressor (20) being supported by a same intermediate plate (5) through a plurality of first elastic members (11), and
the intermediate plate (5) being supported by the bottom member (3) through second elastic members (12).

2. The refrigeration cycle apparatus of claim 1, wherein the intermediate plate (5) includes a first intermediate plate (15) supporting the first compressor (10) and a second intermediate plate (25) supporting the second compressor (20), the first intermediate plate (15) and the second intermediate plate (25) being coupled integrally.

3. The refrigeration cycle apparatus of claim 2, wherein

the plurality of compressors further include a third compressor (70),
the third compressor (70) is supported by a third intermediate plate (75) through a first elastic member (11), and
the intermediate plate (5) includes the first intermediate plate (15), the second intermediate plate (25), and the third intermediate plate (75) which are coupled integrally.

4. The refrigeration cycle apparatus of claim 2, wherein

the plurality of compressors further include a third compressor (70), and
the third compressor (70) is supported by the second intermediate plate (25) through a first elastic member (11).

5. The refrigeration cycle apparatus of any one of claims 2 to 4, wherein
the first intermediate plate (15) and the second intermediate plate (25) are coupled integrally, with the first intermediate plate (15) and the second intermediate plate (25) partially overlapped with each other in plan view.

6. The refrigeration cycle apparatus of any one of claims 2 to 5, wherein
the first intermediate plate (15) and the second intermediate plate (25) are coupled integrally by brazing or welding.

7. The refrigeration cycle apparatus of any one of claims 2 to 5, wherein
the first intermediate plate (15) and the second intermediate plate (25) are coupled integrally with a rivet or bolt.

8. The refrigeration cycle apparatus of any one of claims 2 to 5, wherein
the first intermediate plate (15) and the second intermediate plate (25) are coupled integrally via a third elastic member (13).

9. The refrigeration cycle apparatus of any one of claims 1 to 8, wherein
the second compressor (20) is lighter in weight than the first compressor (10).

10. The refrigeration cycle apparatus of any one of claims 1 to 9, wherein

assuming that P1 is a center of gravity of a combination of the intermediate plate (5) and the plurality of compressors in plan view, that Q1 is a center of gravity of layout of the second elastic members (12) in plan view, and that r1 is a distance from the center of gravity P1 to a center of gravity of a nearest one of the plurality of compressors to the center of gravity P1,
the center of gravity Q1 of the layout is located in an area having the center of gravity P1 as a center and the distance r1 as a radius.

11. The refrigeration cycle apparatus of claim 10, wherein
the center of gravity P1 substantially coincides with the center of gravity Q1 of the layout in plan view.

12. The refrigeration cycle apparatus of any one of claims 1 to 9, wherein

assuming that P2 is a center of gravity of a combination of the intermediate plate (5), the plurality of compressors, and a refrigerant circuit component part (31) placed on the intermediate plate (5) in plan view, that Q1 is a center of gravity of layout of the second elastic members (12) in plan view, and that r2 is a distance from the center of gravity P2 to a center of gravity of a nearest one of the plurality of compressors to the center of gravity P2,
the center of gravity Q1 of the layout is located in an area having the center of gravity P2 as a center and the distance r2 as a radius.

13. The refrigeration cycle apparatus of claim 12, wherein
the center of gravity P2 substantially coincides with the center of gravity Q1 of the layout in plan view.

14. The refrigeration cycle apparatus of claim 10 or 11, wherein

a fourth elastic member (14) is provided between the intermediate plate (5) and the bottom member (3), the fourth elastic member (14) being provided in a position overlapping the center of gravity P1 in plan view.

15. The refrigeration cycle apparatus of claim 12 or 13, wherein
a fourth elastic member (14) is provided between the intermediate plate (5) and the bottom member (3), the fourth elastic member (14) being provided in a position overlapping the center of gravity P2 in plan view.

16. The refrigeration cycle apparatus of any one of claims 1 to 15, further comprising:

a control unit (100) configured to control operations of the plurality of compressors, wherein
the control unit (100) is configured to control rotations of the plurality of compressors so that centrifugal forces generated in the plurality of compressors cancel out each other.

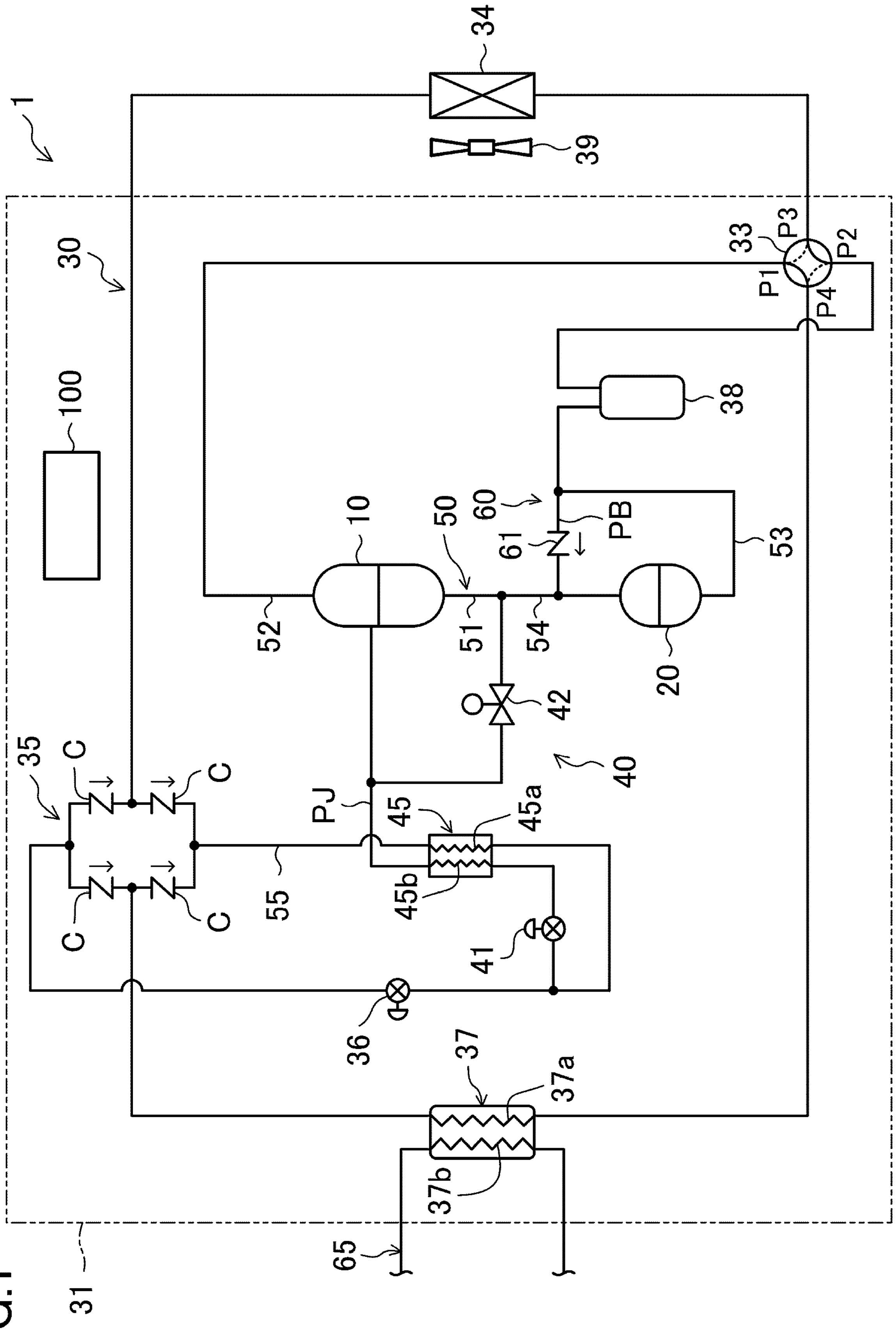
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FIG.1

FIG.2

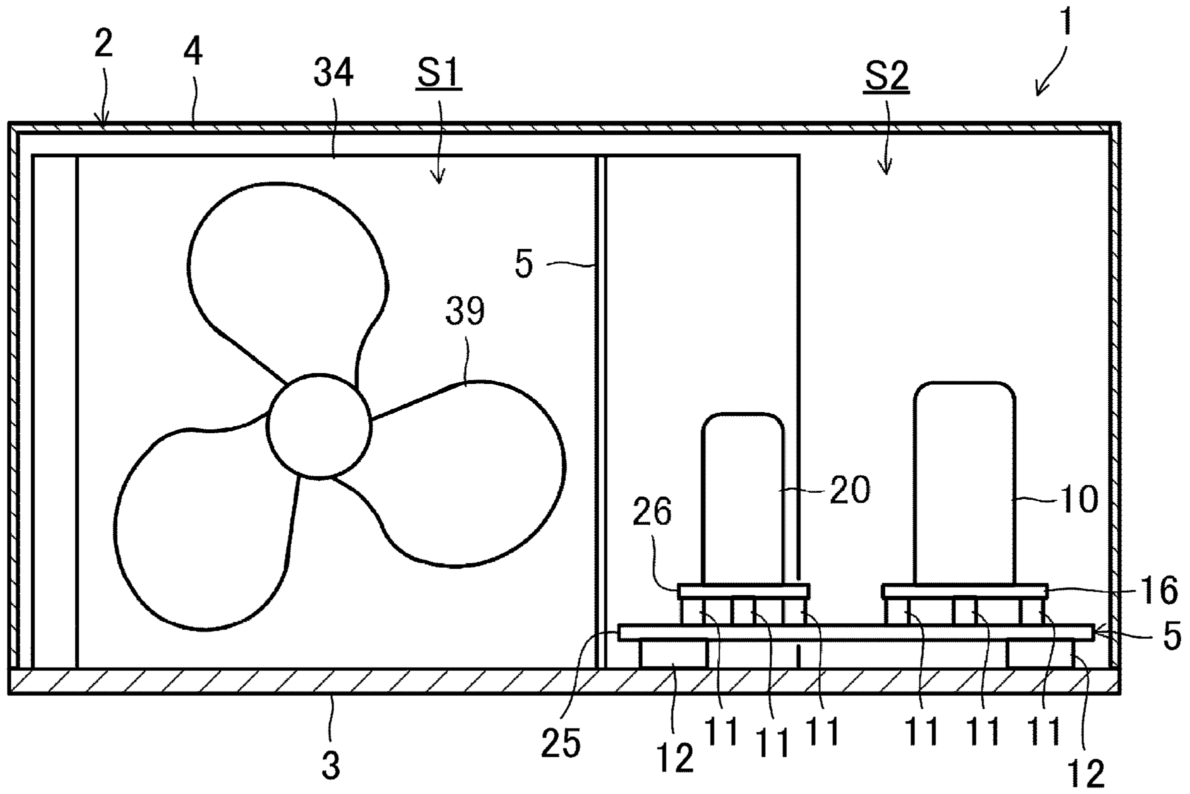
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FIG.3

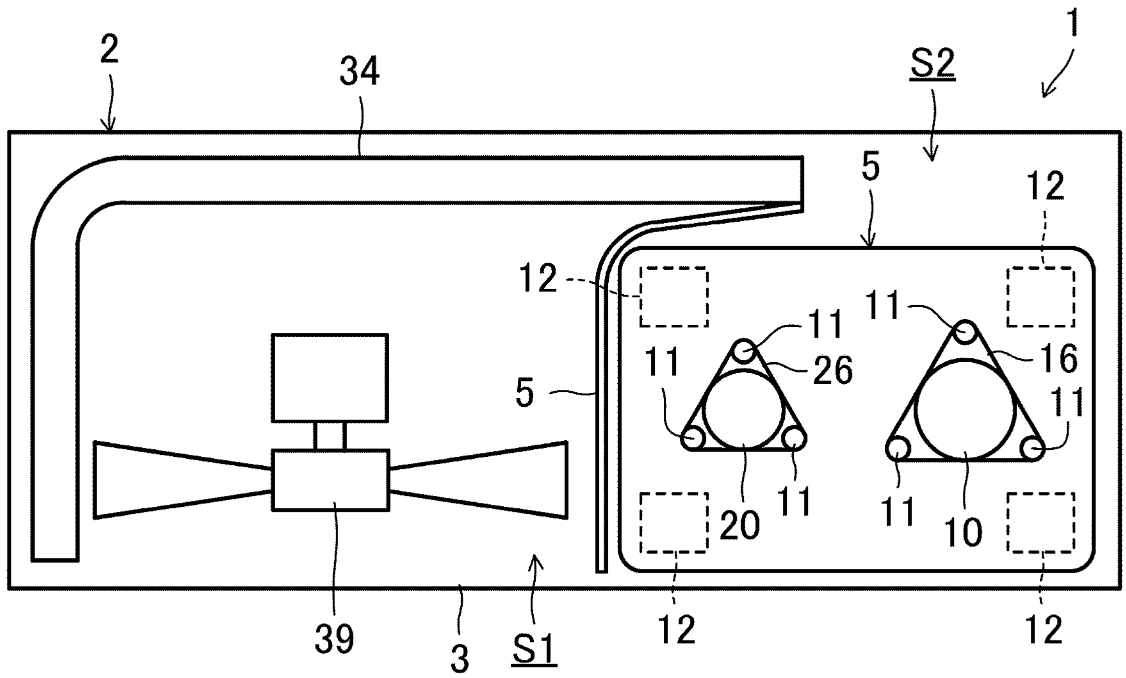
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FIG.4

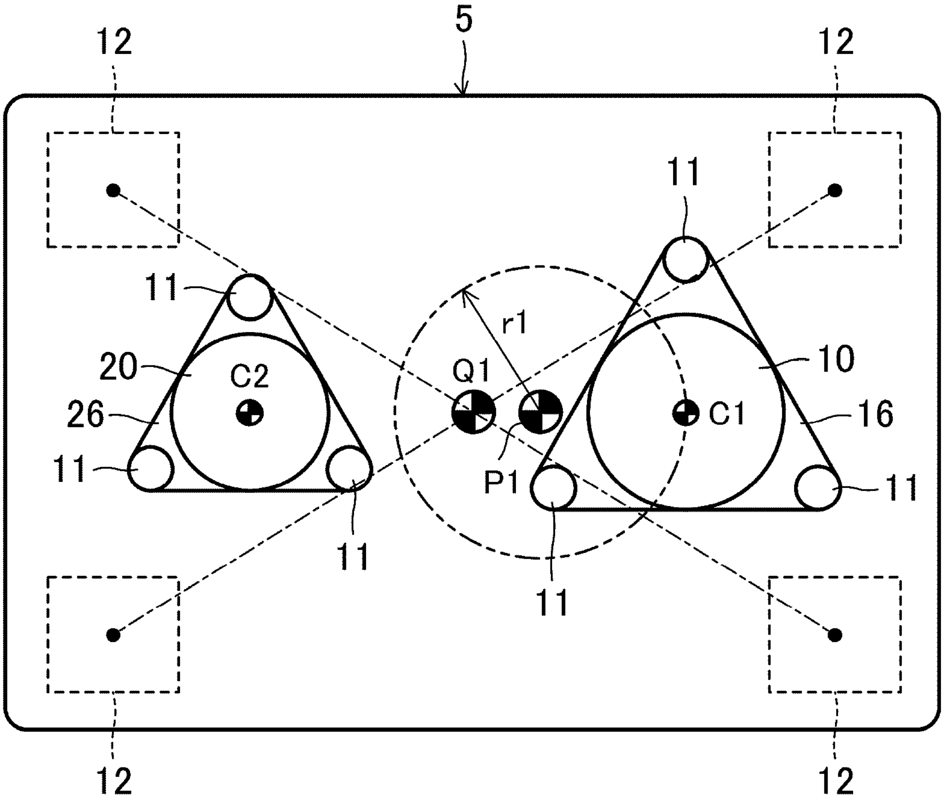
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FIG.5

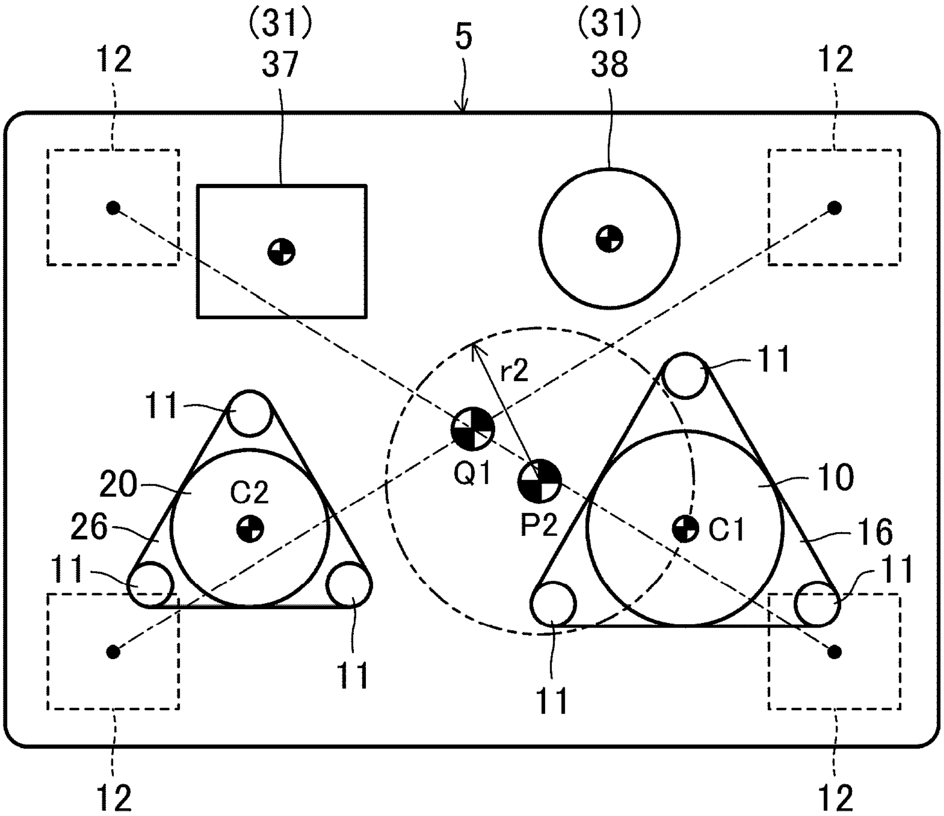
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FIG.6

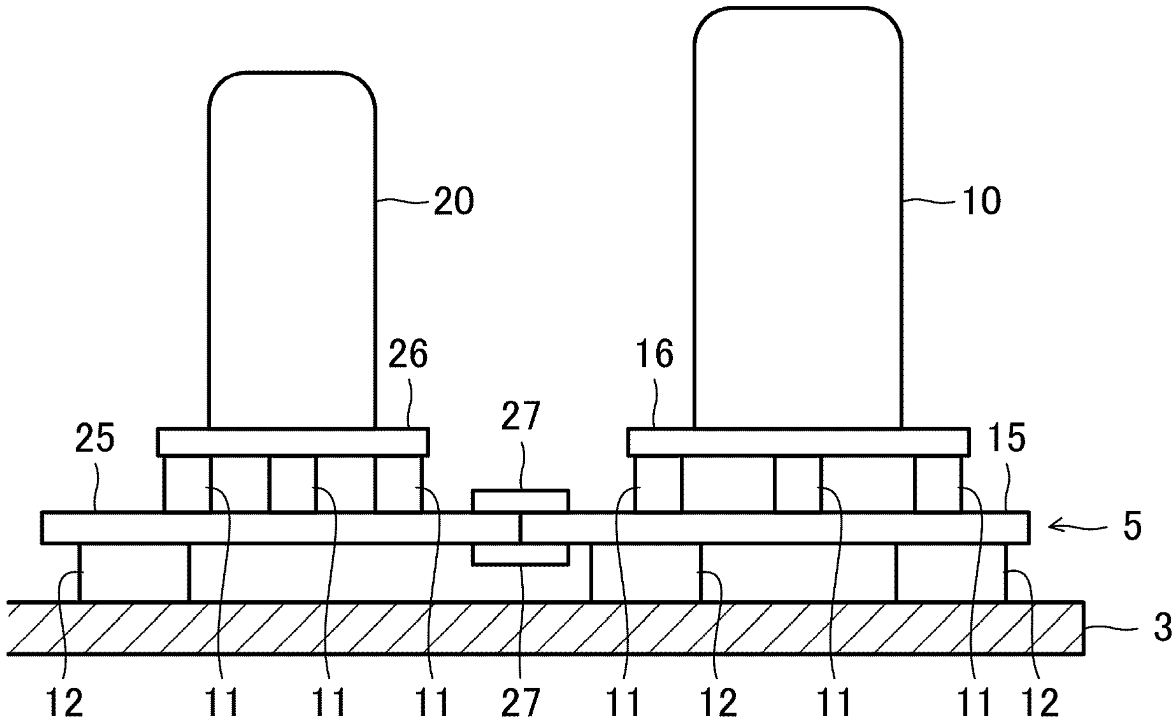
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FIG.7

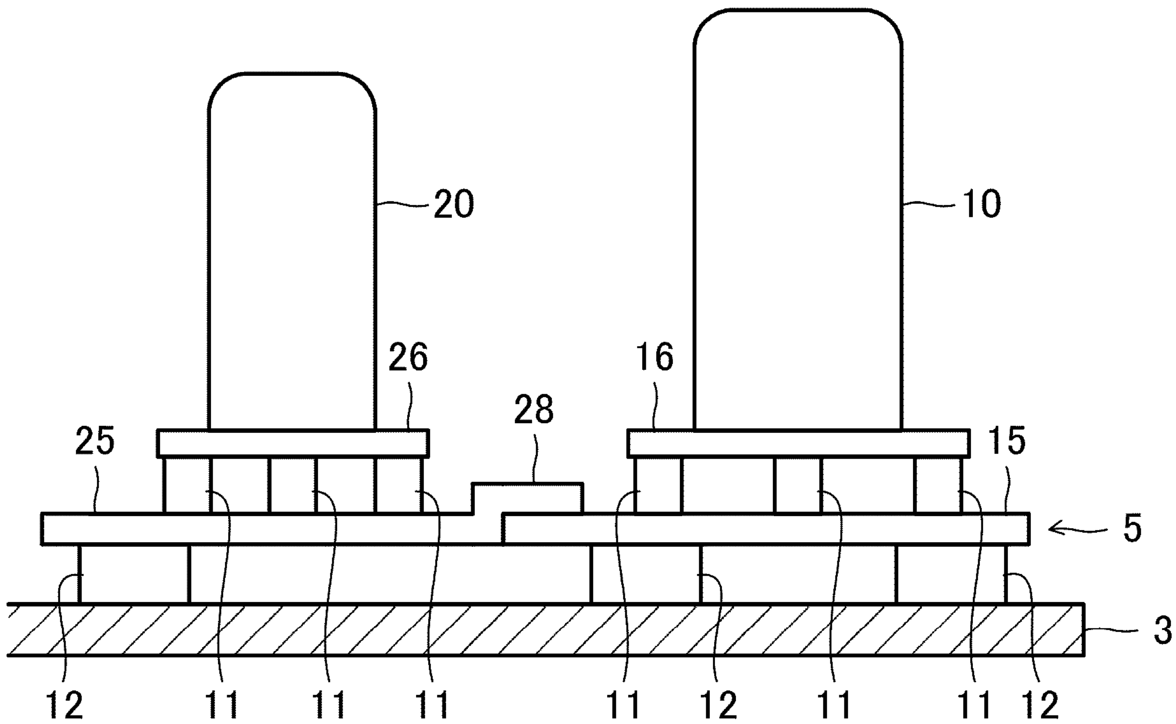
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FIG.8

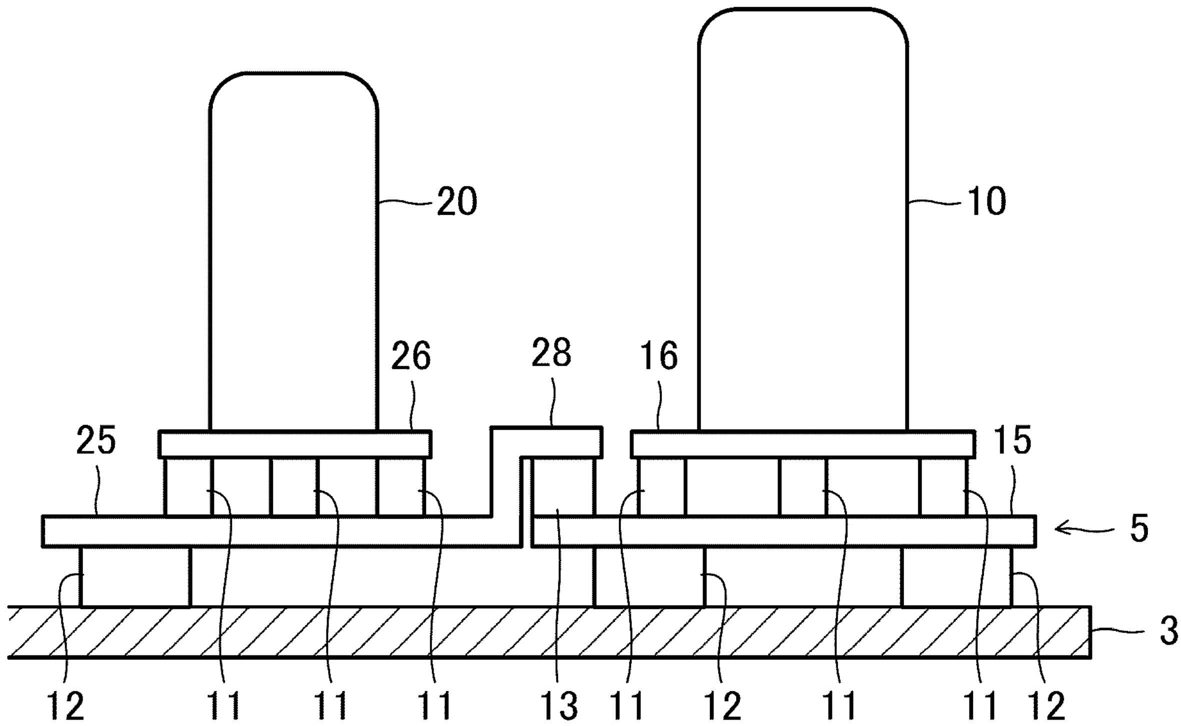
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FIG.9

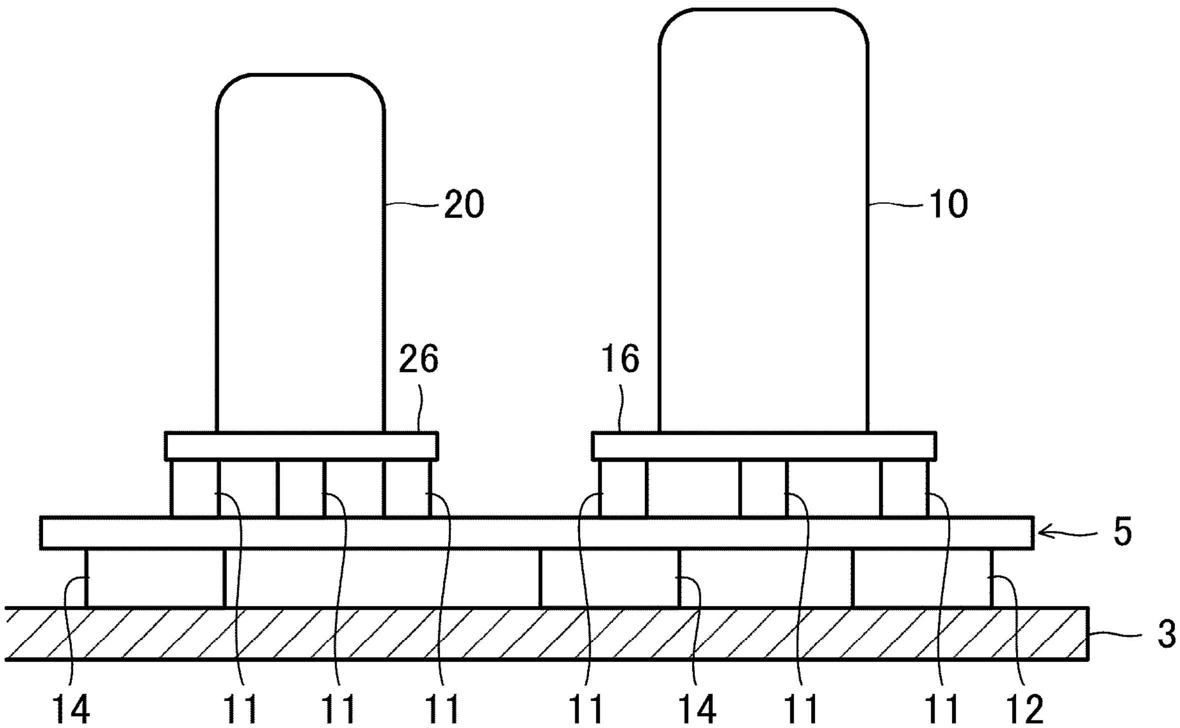
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FIG.10

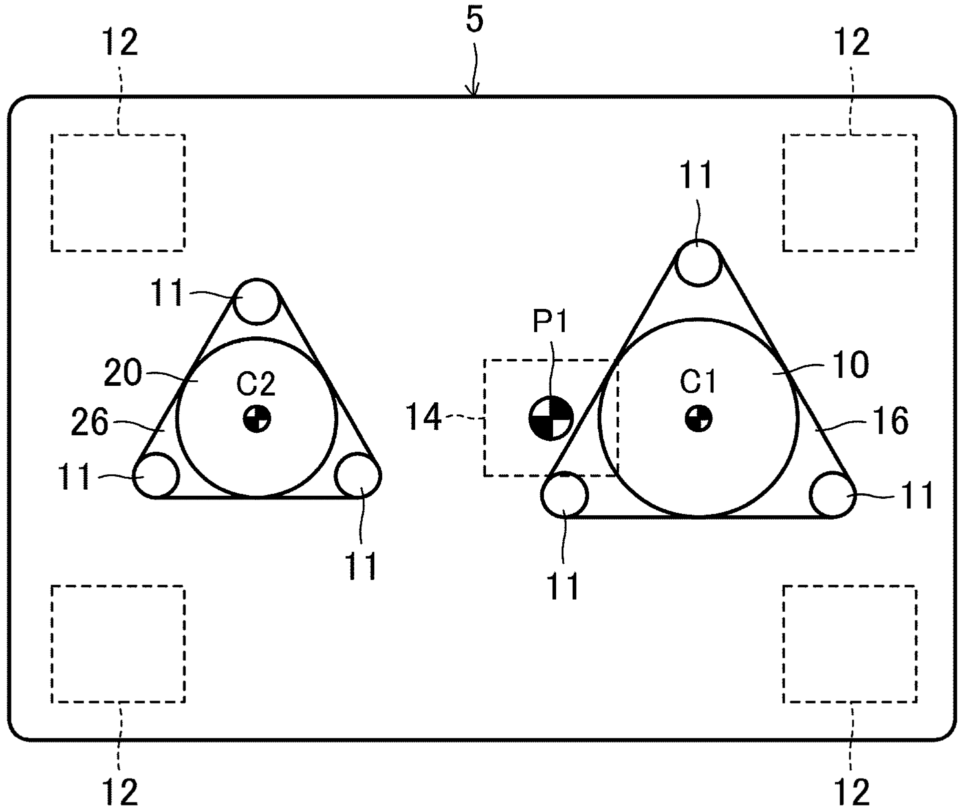
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FIG.11

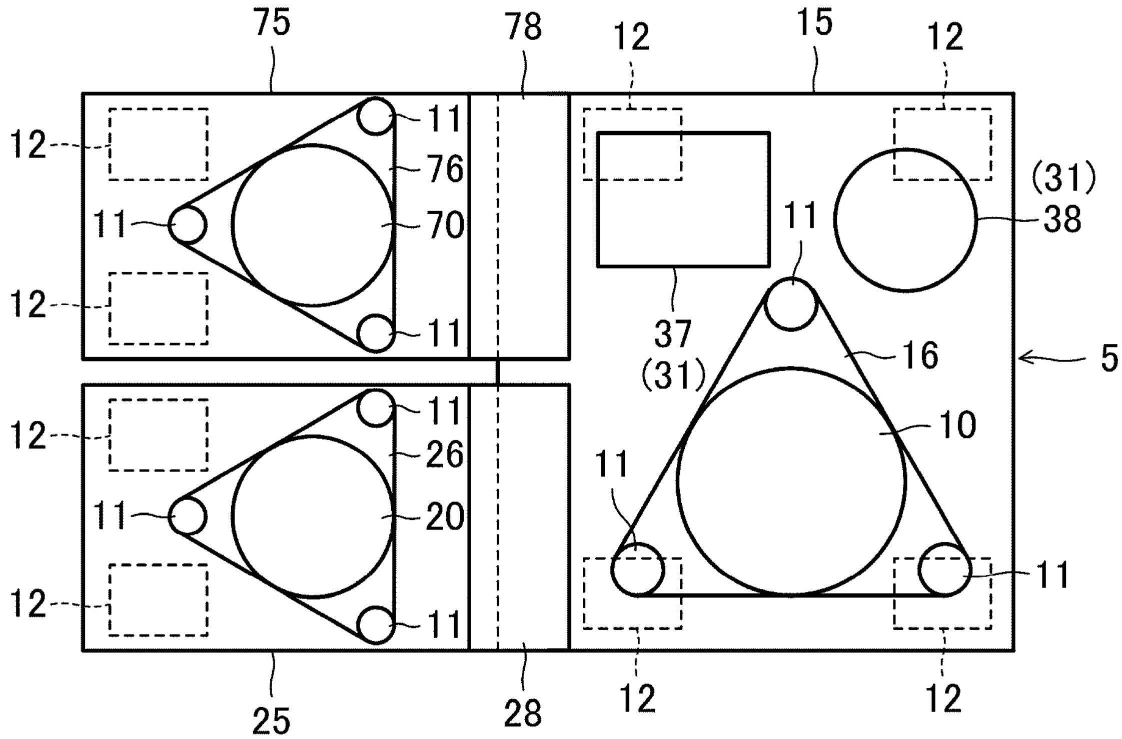
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FIG.12

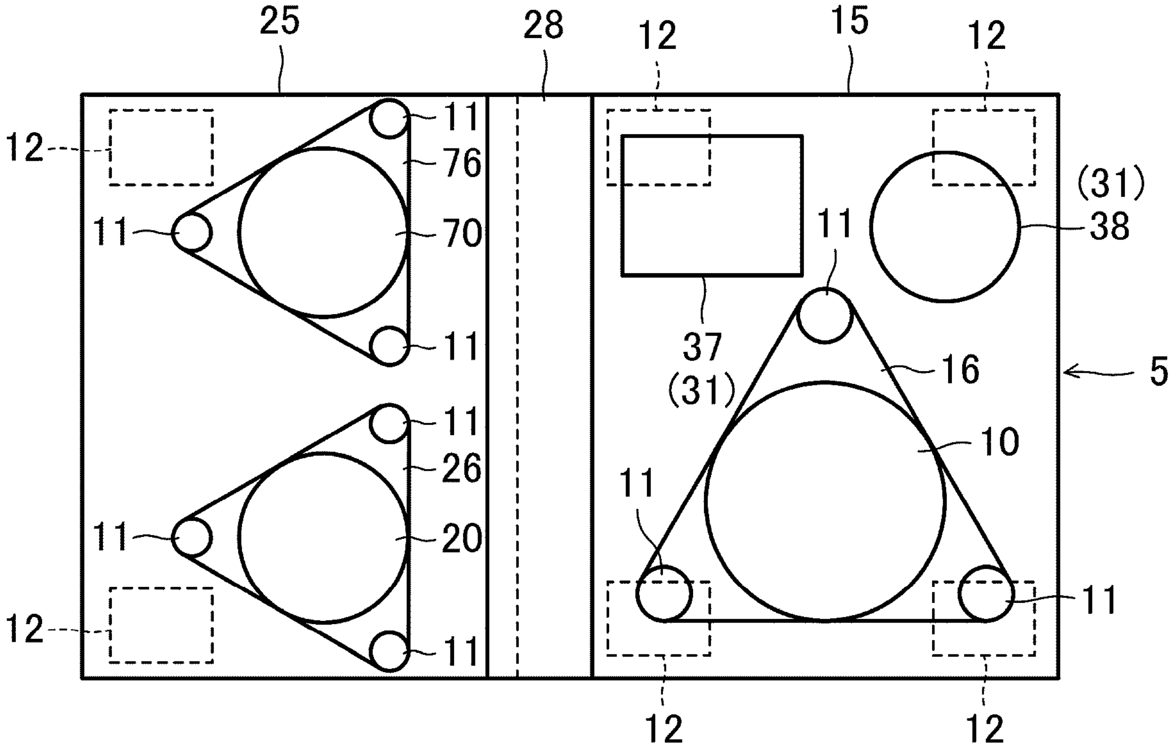
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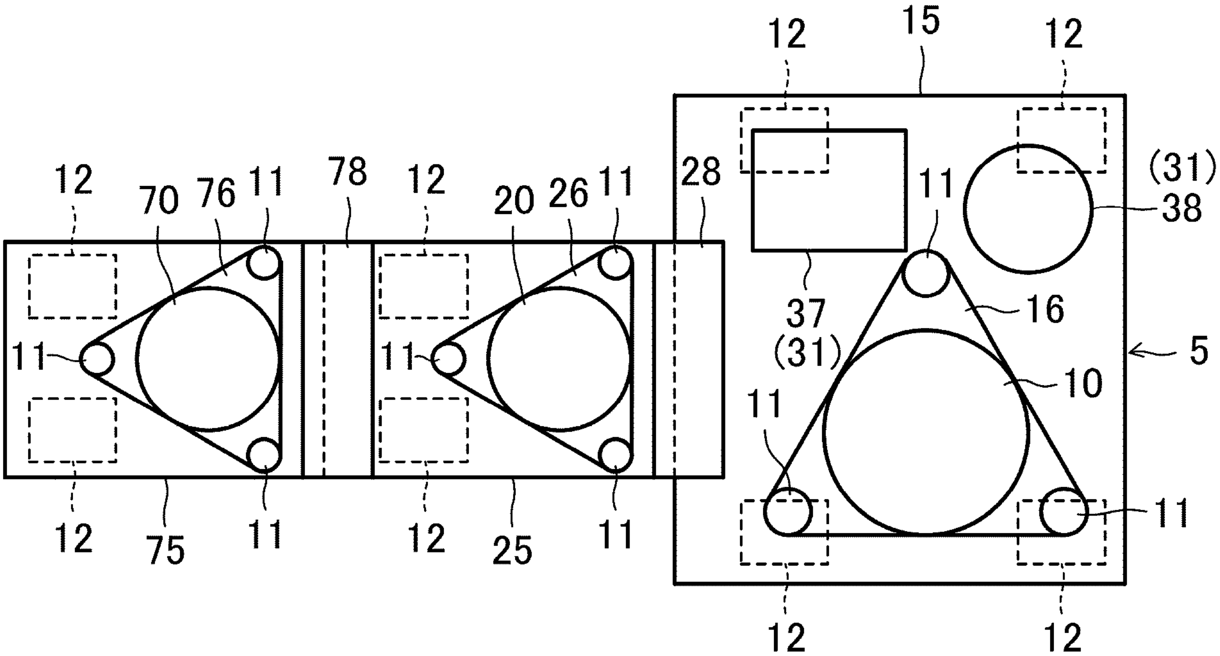
FIG.13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INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2021/010684

A. CLASSIFICATION OF SUBJECT MATTER
Int. Cl. F24F1/12(2011.01)i, F24F11/42(2018.01)i, F25B31/00(2006.01)i
FI: F24F1/12, F24F11/42, F25B31/00 A

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
Int. Cl. F24F1/12, F24F11/42, F25B31/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Published examined utility model applications of Japan 1922-1996
Published unexamined utility model applications of Japan 1971-2021
Registered utility model specifications of Japan 1996-2021
Published registered utility model applications of Japan 1994-2021

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 067655/1981 (Laid-open No. 179692/1982) (TOKYO SHIBAURA ELECTRIC CO., LTD.) 13 November 1982 (1982-11-13), description, p. 2, line 18 to p. 6, line 8, fig. 3-6	1 2-16
X Y A	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 062237/1989 (Laid-open No. 003636/1991) (MITSUBISHI ELECTRIC CORP.) 16 January 1991 (1991-01-16), description, p. 2, line 1 to p. 3, line 20, fig. 3, 4	1 2-9, 16 10-15

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Date of the actual completion of the international search	Date of mailing of the international search report
11.05.2021	18.05.2021

Name and mailing address of the ISA/	Authorized officer
Japan Patent Office 3-4-3, Kasumigaseki, Chiyoda-ku, Tokyo 100-8915, Japan	Telephone No.

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2021/010684

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 2000-283600 A (TOSHIBA CORP.) 13 October 2000, paragraph [0039], fig. 5	2-16
Y	JP 2017-198228 A (OBAYASHI CORP.) 02 November 2017, paragraph [0041], fig. 2	14-16
Y	JP 2008-039260 A (SHARP CORP.) 21 February 2008, paragraphs [0012], [0013], fig. 1, 2	16

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/JP2021/010684

Patent Documents referred to in the Report	Publication Date	Patent Family	Publication Date
JP 57-179692 U1	13.11.1982	(Family: none)	
JP 03-003636 U1	16.01.1991	(Family: none)	
JP 2000-283600 A	13.10.2000	(Family: none)	
JP 2017-198228 A	02.11.2017	(Family: none)	
JP 2008-039260 A	21.02.2008	(Family: none)	

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Patent documents cited in the description

- JP 2010243033 A **[0003]**