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(71) Applicant: **Sanyo Electric Co., Ltd.**
Osaka 570-8677 (JP)

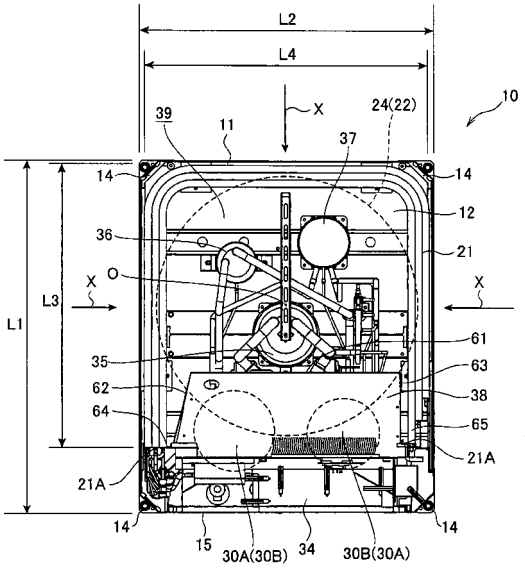
(72) Inventors:
- **Ibaraki, Yoshiaki**
Moriguchi-shi
Osaka 570-8677 (JP)
- **Nakamura, Takeshi**
Moriguchi-shi
Osaka 570-8677 (JP)
- **Koyama, Koji**
Moriguchi-shi
Osaka 570-8677 (JP)
- **Sukena, Ryoichi**
Moriguchi-shi
Osaka 570-8677 (JP)
- **Uchida, Yoichi**
Moriguchi-shi
Osaka 570-8677 (JP)

(74) Representative: **Glawe, Delfs, Moll**
Patent- und Rechtsanwälte
Postfach 26 01 62
80058 München (DE)

(54) Outdoor unit for air conditioner

(57) An outdoor unit (10) for an air conditioner having a compressor (30A, 30B) disposed on a bottom plate (12) of a housing (11), a heat exchanger (21) that has tube plates (21A) at both the ends thereof and is designed to be substantially U-shaped in section and disposed on the bottom plate along three surfaces of a back surface side and both side surface sides of the housing, and air blower (22) disposed above the heat exchanger, wherein is designed so that the length in a depth direction located at both the side surface sides of the housing is set to be longer than the length in a width direction located at the back surface side of the housing, and the compressor is disposed at the front surface side of the housing (11).

FIG.4



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Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to an outdoor unit for a top air-blow-out type air conditioner having an air blower at the upper portion of a housing.

2. Description of the Related Art

[0002] There is known an outdoor unit for an air conditioner having a compressor disposed on a bottom plate of a housing whose horizontal cross-section is designed to be substantially rectangular, a U-shaped heat exchanger which is disposed on the bottom plate and designed to be U-shaped along three side surfaces of the housing, an air blower (axial flow fan) disposed at the upper portion of the heat exchanger, and an electrical component box in which electrical component parts for controlling the compressor and the air blower are mounted (for example, see JP-A-2006-189196) . In this type outdoor unit, in order to prevent rain drops from directly impinging against the compressor having electrically-operated elements, a machine chamber having water-proof property is provided in the housing, and the compressor is mounted in this machine chamber.

[0003] Furthermore, this type of outdoor unit has been frequently disposed at the outside of a building, between buildings or the like. Therefore, the mount space for the outdoor unit has been limited, and thus the outdoor unit has been required to be miniaturized. Furthermore, an outdoor unit having the following construction to enhance the heat-exchange efficiency of a heat exchanger has been disclosed. That is, in a housing having a limited volume, an opening face for maintenance is provided to one side surface in the longitudinal direction of the housing, the shaft center of an air blower is shifted to a predetermined one of right and left sides of an opening face, an electrical component box is disposed at the opening face side at which the shaft center of the air blower is disposed, and a compressor is disposed behind the electrical component box, thereby providing a space for reducing air flow resistance in the housing (for example, see JP-A-2008-128496).

[0004] In the above outdoor unit, the heat transfer area of the heat exchanger of the outdoor unit and the air blowing space are limited because the machine chamber is provided, and thus this outdoor unit has a problem that the energy efficiency of the outdoor unit is influenced or the outdoor unit must be designed in a large scale to secure sufficient heat transfer area and air blowing space.

[0005] Furthermore, the compressor has electrically operated elements such as a motor, a coil, etc., and thus the maintenance frequency of the compressor is high. However, the compressor is disposed at the rear side of the opening face of the outdoor unit, and thus the maintenance performance is low. In addition,the compressor obstructs the air flow in the housing, and thus greatly affects the heat-exchange efficiency of the heat exchanger.

SUMMARY OF THE INVENTION

[0006] The present invention has been implemented in view of the foregoing problems of the related arts, and has an object to provide a compact outdoor unit in which maintenance performance is enhanced and the heat-exchange efficiency of a heat exchanger is increased.

[0007] In order to attain the above object, an outdoor unit (10) for an air conditioner having a compressor (30A, 30B) disposed on a bottom plate (12) of a housing (11), a heat exchanger (21) that has tube plates (21A) at both the ends thereof and is designed to be substantially U-shaped in section and disposed on the bottomplate along three surfaces of a back surface side and both side surface sides of the housing and air blower (22) disposed above the heat exchanger, is **characterized in that** the heat exchanger is designed so that the length in a depth direction located at both the side surface sides of the housing is set to be longer than the length in a width direction located at the back surface side of the housing, and the compressor is disposed at the front surface side of the housing (11).

[0008] The outdoor unit for the air conditioner described above may further comprise a partition plate (38) for sectioning the inside of the housing into a heat-exchange chamber (39) containing the heat exchanger and a machine chamber containing the compressor in a front-and-rear direction, wherein both the ends of the partition plate are fixed to the tube plates.

[0009] In the above outdoor unit for the air conditioner, the air blower may be disposed at a substantially equal distance from each of a back surface side and both side surface sides of the housing.

[0010] In the above outdoor unit for the air conditioner, the partition plate may have right and left side plates that are fixed to the tube plates and extend to the inside of the heat exchanger, and at least one of the side plates may be formed obliquely so as to be farther away from the inner surface of the heat exchanger as the side plate concerned shifts from the tube plates to the inside of the heat exchanger.

[0011] In the above outdoor unit for the air conditioner, the partition plate may be divided into an upper partition plate (38A) and a lower partition plate (38B) in an up-and-down direction, and freely detachably fixed to the tube plates.

[0012] In the above outdoor unit for the air conditioner, the upper partition plate may be bent so that the upper portion thereof serves as an oblique surface.

[0013] In the above outdoor unit for the air conditioner, the lower partition plate may have an opening portion through which pipes for connecting parts disposed in the

heat-exchange chamber and the machine chamber are passed.

[0014] In the above outdoor unit for the air conditioner, the compressor may be disposed so that at least a part of the compressor is located in front of the tube plates of the heat exchanger.

[0015] In the above outdoor unit for the air conditioner, refrigerant circuit constituent parts (32) connected to the compressor may be disposed to be shifted to the front surface side of the housing together with the compressor.

[0016] The outdoor unit for the air conditioner may further comprise an electrical component box (34) which is provided in the housing and in which electrical component parts for controlling the compressor or the air blower are mounted, wherein the electrical component box is provided at the upper side of the compressor and at the front surface side of the housing so as to be overlapped with the air blower in height direction.

[0017] In the above outdoor unit for the air conditioner, the housing may have a maintenance panel (15) covering the front surface side of the housing, and the maintenance panel may be divided into two parts in the up-and-down direction and threadably mounted on the housing so as to be freely detachable.

[0018] In the above outdoor unit for the air conditioner, an accumulator (35), an oil separator (36) or a receiver tank (37) that is connected to the compressor may be disposed behind the compressor on a bottom plate (12) of the housing.

[0019] In the above outdoor unit for the air conditioner, the accumulator may have a reinforcing bar that is threadably mounted to the center of an upper portion of the accumulator, and the reinforcing bar is threadably mounted on the housing.

[0020] An outdoor unit (10) for an air conditioner having a compressor (30A, 30B) and a heat exchanger (21) that are disposed on a bottom plate (12) of a housing (11), is characterized by comprising a front panel (18, 19) disposed at the front side of the housing and a substantially L-shaped panel member (18, 19) disposed between the lower end portion of the front panel and the front end portion of the bottomplate, is characterized wherein the panel member is provided with knockout holes (50A, 50B, 51A, 51B)at a front plate portion continuing with the lower end portion of the front panel and a bottom plate portion continuing with the front end portion of the bottom plate.

[0021] In the above outdoor unit for the air conditioner, the front panel may be disposed to form a space between the front panel and the bottom plate in a depth direction and a height direction, and the panel member may be disposed to cover the space.

[0022] In the above outdoor unit for the air conditioner, the panel member may have a bent portion (18D and 19D) obtained by step-bending the tip of the bottom plate portion so that the bent portion extends onto the front end portion of the bottom plate.

[0023] The outdoor unit for the air conditioner may further comprise four support poles (14) arranged at four corners of the housing, wherein the panel member is fixed to the support poles disposed at the front side.

[0024] In the above outdoor unit for the air conditioner, the panel member is divided into two parts in a width direction of the housing, knockout holes for leading out electrical wires are formed in one of the two parts, and knockout holes for leading out refrigerant pipes are formed in the other part.

[0025] In the above outdoor unit for the air conditioner, a pipe connection portion (45) fixed to the support poles may be provided on the other panel member on which the knockout holes for leading out the refrigerant pipes are formed.

[0026] According to the present invention, the heat exchanger is designed so that the length in the depth direction located at both the side surface sides of the housing is set to be longer than the length in the width direction located at the back surface side of the housing, the partition plate through which the inside of the housing is divided into the heat-exchange chamber containing the heat exchanger and the machine chamber containing the compressor in the front-and-rear direction is provided, and the compressor is located at the front side of the housing. Therefore, even when the housing is miniaturized, a sufficient heat transfer area of the heat exchanger can be secured, so that the heat exchange efficiency of the heat exchanger can be enhanced, and the energy efficiency of the outdoor unit canbe enhanced. Furthermore, the maintenance space of the compressor can be secured at the front side of the housing, and thus the outdoor unit having excellent maintenance performance can be provided.

BRIEF DESCRIPTION OF THE DRAWINGS

[0027]

Fig. 1 is a perspective view showing the outlook of an outdoor unit of an air conditioner according to a first embodiment of the present invention;

Fig. 2 is a front view of the outdoor unit under the state that a front panel is detached;

Fig. 3 is a side cross-sectional view of the outdoor unit;

Fig. 4 is a top view showing the internal construction of the outdoor unit;

Fig. 5 is a partial perspective view showing the outdoor unit which shows a mount state of a partition plate;

Fig. 6 is an enlarged perspective view of a valve table;

Fig. 7 is a perspective view showing the outlook of the outdoor unit of the air conditioner according to a second embodiment;

Fig. 8 is a front view of the outdoor unit under the state that the front panel is detached;

Fig. 9 is an exploded perspective view showing the construction of a bottom plate;

Fig. 10 is a bottom view showing the construction of the bottom plate;

Fig. 11 is a perspective view showing the lower portion of the front side of a housing; and

Fig. 12 is a side cross-sectional view showing the lower portion of the front side of the housing.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0028] Preferred embodiments according to the present invention will be described hereunder with reference to the accompanying drawings.

[0029] An air conditioner according to a first embodiment of the present invention comprises an outdoor unit 10 and an indoor unit (not shown), and makes refrigerant flow through a refrigerant circuit connected through a refrigerant pipe to perform cooling operation and heating operation. The outdoor unit 10 is disposed outdoors, and heat-exchanges with outdoor air. The outdoor unit 10 condenses the refrigerant to radiate heat to the outdoor air under cooling operation, and evaporates the refrigerant to take heat from the outdoor air under heating operation. In the following description, the up-and-down (vertical) and right-and-left (horizontal) directions represent the directions when the outdoor unit 10 is installed and viewed from the front side thereof.

[0030] Fig. 1 is a perspective view of the outlook of the outdoor unit 10, and Fig. 2 is a front view of the outdoor unit 10 under the state that a front panel is detached. The outdoor unit 10 has a substantially parallelepiped box-shaped unit case (housing) 11 , and the unit case 11 has apair of legmembers 13 extending in the front-and-rear direction, a bottom plate 12 which is bridged and fixed over the leg members 13, support poles 14 extending in the vertical direction from four corners of the bottom plate 12, and a front panel 15.

[0031] A heat exchanger 21 described later is mounted on the bottom plate 12, and the back surface and both the right and left side surfaces of the unit case 11 are formed by the heat exchanger 21. An air blower 22 and a bell mouth 25 around the air blower 22 are disposed above the heat exchanger 21, and a fan guard 26 for preventing contact to the air blower 22 is disposed at an air blow-out opening 25A of the bell mouth 25. A face panel 27 having a heat insulating member such as foamed polystyrene or the like is provided around the bell mouth 25.

[0032] The front panel 15 is divided in two parts in the vertical direction so as to comprise an upper panel 15A and a lower panel 15B. The upper panel 15A and the lower panel 15B are bridged and fixed between the support poles 14 at the front side. As shown in Fig. 2, refrigerant circuit constituent parts 32 such as compressors 30A, 30B, a four-way valve 31, valve members such as an expansion valve, etc. are connected to one another through pipes and mounted at the front side of the unit case 11 as shown in Fig. 2. An electrical component box 34 for controlling various kinds of equipment of the outdoor unit 10 is disposed above the compressors 30A, 30B, etc. Therefore, by detaching the front panel 15, a worker can easily perform a maintenance work for the compressors 30A, 30B, the electrical component parts in the electrical component box, etc. from the front side.

[0033] Next, the arrangement construction of the respective equipment in the unit case 11 will be described.

[0034] Fig. 3 is a side cross-sectional view of the outdoor unit 10, and Fig. 4 is a top view showing the internal construction of the outdoor unit 10.

[0035] As shown in Fig. 3, the air blower 22 has a fan motor 23 disposed above the heat exchanger 21, and a propeller fan (impeller) 24 secured to the shaft of the fan motor 23. A joint member (not shown) for joining the support poles 14 at the position corresponding to the upper end of the heat exchanger 21 is provided between the adjacent support poles 14, and the fan motor 23 is fixed to a support frame 16 bridged between the joint members.

[0036] When the propeller fan 24 is rotated by the fan motor 23 , outdoor air is sucked into the unit case 11 from the surrounding of the outdoor unit 10, more specifically from the left surface side, back surface side and right surface side of the unit case 11 excluding the front surface of the unit case as indicated by arrows X in Figs. 3 and 4, and the sucked outdoor air is blown out to the outside through an air blow-out opening 25A of the bell mouth 25 provided to the upper surface portion of the unit case 11. That is, the outdoor unit 10 is designed as an top air-blow-out type in which heat-exchanged air is blown out from the upper surface.

[0037] Not only the compressors 30A and 30B and the refrigerant circuit constituent parts 32, but also an accumulator 35, an oil separator and a receiver tank 37 constituting a part of the refrigerant circuit are mounted on the bottom plate 12. The unit case 11 is provided with a partition plate 38 extending upwardly from the upper side of the bottom plate 12 to the lower end portion of the electrical component box 34, and the inside of the unit case 11 is sectioned into a heat-exchange chamber 39 and a machine chamber 40 by the partition plate 38. The partition plate 38 is provided to prevent rain drops from directly impinging against each equipment mounted in the machine chamber 40. Furthermore, an opening portion through which pipes for connecting equipment disposed in each chamber are passed are formed in the partition plate 38.

[0038] As shown in Fig. 4, the unit case 11 is designed to have a substantially rectangular shape in which the length L1 in the depth direction is longer than the length L2 in the width direction. The air blower 22 is disposed so that the rotational shaft O of the propeller fan 24 is located at the same distance from each of the back surface side and both the side surface sides of the unit case 11. Therefore, according to this construction, the rotational shaft O of the propeller fan 24 is located to be shifted to the back surface side, and thus a space is formed at the front surface side of the air blower 22. The electrical

component box 34 is disposed in the space which is formed at the front side of the air blower 22, and the electrical component box 34 is disposed to be overlapped with the air blower 22 and the bell mouth 25 in the height direction, and threadably mounted on the support poles 14. Accordingly, the electrical component box 34 is prevented from disturbing flow of air which is passed through the heat exchanger 21 and blown out to the air blower 22 and thus the air flow resistance in the unit case 11 can be reduced. Therefore, air flow noise can be reduced without increasing the size of the unit case 11.

[0039] The heat exchanger 21 which is formed to be bent in a substantially U-shape in section is disposed on the bottom plate 12 of the unit case 11. The heat exchanger 21 is disposed to extend from the left side surface of the unit case 11 along the back surface and the right side surface of the unit case 11, and the length L3 of the unit case 11 in the depth direction is longer than the length L4 of the unit case 11 in the width direction. A pipe plate 21A is provided to both the end faces of the heat exchanger 21 having the substantially U-shape in section to fix a refrigerant pipe which is installed to be continuously meandered in the heat exchanger 21. In this embodiment, the heat exchanger 21 is integrally formed by bending the heat exchanger 21 in a substantially U-shape in section, however, two heat exchangers each of which is designed to be substantially L-shaped in section may be disposed so as to face each other in a substantially U-shape in section.

[0040] An accumulator 35, an oil separator 36 and a receiver tank 37 which constitute a part of the refrigerant circuit together with the compressors 30A and 30B and the refrigerant circuit constituent parts 32 are disposed on the bottom plate 12 at the inside surrounded by the heat exchanger 21. A frame 17 is fixed to the center of the upper portion of the accumulator 35, and the frame 17 extends from the upper end portion of the accumulator 35 and is fixed to the joint member for joining the support poles 14 to prevent the swinging motion of the accumulator 35.

[0041] The accumulator 35, the oil separator 36 and the receiver tank 37 are pressure containers for temporarily stocking refrigerant or refrigerant oil, and the maintenance frequency for them is low. Furthermore, the compressors 30A, 30B and the refrigerant circuit constituent parts 3 have electrically-operated elements such as a motor, a coil, etc., and thus the maintenance frequency for them is high. Therefore, in this construction, the partition plate 38 which upwardly extends from the upper side of the bottom plate 12 to the lower end portion of the electrical component box 34 is provide, and the inside of the unit case 11 is sectioned into the heat-exchange chamber 39 and the machine chamber 40 by the partition plate 39 as shown in Fig . 3. The compressors 30A and 30B and the refrigerant circuit constituent parts 32 for which the maintenance frequency is high are mounted in the machine chamber 40, and the heat exchanger 21, the accumulator 35, the oil separator 36 and the receiver tank 37 for which the maintenance frequency is low are mounted in the heat-exchange chamber 39. The partition plate 38 prevents rain drops from directly impinging against the respective equipment mounted in the machine chamber 40.

[0042] As shown in Fig. 5, the partition plate 38 is disposed at the inside of the heat exchanger 21 which is formed in the unit case 11 so as to have a substantially U-shaped section, and it is divided into an upper partition plate 38A and a lower partition plate 38B. Accordingly, when maintenance for each equipment mounted in the heat exchanger 39 is required, the maintenance work can be performed by detaching only the upper partition plate 38A, and thus the detaching workability of the partition plate 38 is enhanced.

[0043] Furthermore, the upper partition plate 38A has four plates of a main plate 51A, an upper plate 51B and side plates 51C and 51D, and the respective plates are fixed to one another by screwing or welding. Accordingly, the upper partition plate 38A having a complicated shape can be manufactured at low cost as compared with a case where it is manufactured by press molding or the like.

[0044] The main plate 51A of the upper partition plate 38A and the lower partition 38B are formed substantially in the same shape in section. Accordingly, the partition plate 38 has a back surface 61, both right and left side surfaces 62, 63 formed by substantially vertically bending the back surface 61 toward the front side of the unit case 11, and fixing portions 64, 65 formed by substantially vertically bending the side surfaces 62, 63 toward the outside of the unit case 11 so as to be substantially parallel to the back surface 61, and the fixing portions 64, 65 are fixed to the tube plates 21A of the heat exchanger 21.

[0045] The side surfaces 62, 63 are formed obliquely so as to be gradually farther away from the tube plates 21A as it is shifted from the inner surface of the heat exchanger 21 disposed along both the side surface sides as the depth direction of the unit case 11 to the inside of the heat exchanger 21. Accordingly, a gap is provided between the partition plate 38 and the heat exchanger 21 so that the heat exchanger 21 is prevented from being partially covered by the partition plate 38, and thus the heat transfer area of the heat exchanger 21 is effectively used. Furthermore, the side surfaces 62, 63 of the partition plate 38 are provided to be oblique to the side surfaces of the heat exchanger 21. Therefore, the flow direction of air stream sucked into the unit case 11 through the heat exchanger 21 is not rapidly varied by the partition plate 38, and the heat exchange efficiency of the heat exchanger 21 is not diminished.

[0046] Plural screw holes are formed in the fixing portions 64, 65, and the partition plate 38 is freely detachably and threadably secured to the tube plates 21A of the heat exchanger 21 having the substantially U-shaped section through the plural screw holes. Accordingly, the partition plate 38 constituting the machine chamber 40 is thread-

ably fixed to the heat exchanger 21, and thus the machine chamber 40 can be simply formed in the unit case 11. Furthermore, the heat exchanger 21 can be disposed along the overall three surfaces of the right and left side surfaces and the back surface of the unit case 11, and the heat transfer area of the heat exchanger 21 can be provided broadly.

[0047] The upper plate 51B of the upper partition plate 38A is provided to have a slope face extending from the back surface 61 of the upper partitionplate 38A to the lower endportion of the electrical component box 34 (see Fig. 3). Accordingly, the flow of air which is sucked from the heat exchanger 21 and blown out from the air blower 22 disposed at the upper side of the heat exchanger 21 is not obstructed by the partition plate 38, and thus air flow in the heat-exchange chamber 39 is smooth.

[0048] The front-side end portion of the upper plate 51B has an edge portion 52 which is formed by bending the upper plate 51B substantially in parallel to the bottom plate 12, the edge portion 52 is provided in contact with the bottom surface of the electrical component box 34, and when the electrical component box 34 is threadably fitted to the support poles 14, the edge portion 52 holds the electrical component box 34 in the height direction.

[0049] An opening 53 for check and a lead-wire drawing hole 54 are formed in the slope surface of the upper plate 51B. The check opening 53 is normally covered by a panel 53A, and the panel 53A is mounted on the upper plate 51B freely detachably. The check opening 53 is an opening for checking the inside of the heat-exchange chamber 39 from the machine chamber 40 side. Accordingly, when the inside of the heat-exchange chamber 39 closed by the partition plate 38 and the electrical component box 34 is checked from the front side of the unit case 11, by detaching the panel 53A covering the check opening 53, the inside of the heat-exchange chamber 39 can be easily checked.

[0050] A rubber cap 54A is fitted in the lead-wire drawing hole 54, the rubber cap 54A has a crack, and a lead wire which extends from the machine chamber 40 and is joined to the fan motor 23 is drawn out from this crack. Accordingly, rain drops can be prevented from invading from the lead-wire drawing hole 54 into the machine chamber 40, and also the lead wire can be prevented from coming into contact with the metal plate of the lead-wire drawing hole 54.

[0051] An opening portion 38C through which a pipe for connecting equipment disposed in each of the machine chamber 40 and the heat-exchange chamber 39 which are sectioned by the partition plate 38 is formed at the lower portion of the back surface of the lower partitionplate 38B, and various kinds of connectionpipes are connected to the respective equipment through the opening portion 38C between the machine chamber 40 and the heat-exchange chamber39. Accordingly, when the upper partition plate 38A is detached for maintenance work, these connection pipes are prevented from disturbing this maintenance work, and thus the maintenance workability is enhanced.

[0052] Recently, in consideration of restriction in mount area and maintenance space or feed-in of the outdoor unit into an elevator and passage of the outdoor unit through a door to install the outdoor unit on the proof of a building or the like, the outdoor unit has been strongly required to be miniaturized. Therefore, compactdesign, high heat-exchange efficiency and easy maintenance are required for outdoor units. Therefore, according to this construction, there is implemented an outdoor unit in which the unit case 11 is miniaturized, the heat-exchange efficiency is high and the maintenance can be easily performed.

[0053] Specifically, as shown in Fig. 4, the unit case 11 of this construction is designed in a substantially rectangular shape in which the length L1 in the depth direction is longer than the length L2 in the width direction, and the front panel 15 is disposed in the width direction corresponding to the short-side direction of the unit case 11. Furthermore, with respect to the heat exchanger 21 disposed in the unit case 11, the length L3 in the depth direction located at both the side surface sides of the unit case 11 is longer than the length L4 in the width direction located at the back surface side of the unit case 11.

[0054] In this construction, the two confronting sides of the heat exchanger 21 which is formed to be substantially U-shaped in section is set to be longer than the other one side. Therefore, when heat exchangers having the same heat-exchange area are compared with each other, the mount area of the heat exchanger 21 can be reduced as compared with the case where the other one side is set to be longer than the two confronting sides, and thus the mount area of the unit case 11 can be reduced.

[0055] The inside of the unit case 11 is sectioned into the heat-exchange chamber 39 and the machine chamber 40 by the partition plate 38, and as shown in Fig. 2 the machine chamber 40 is provided at the front side of the unit case 11. Refrigerant circuit constituent parts 32 such as compressors 30A, 30B having electrically-operated elements such as a motor, a coil, etc. which are high in maintenance frequency, valve bodies such as a four-way valve 31, an expansion valve, etc. are mounted in the machine chamber 40 so as to be connected to one another through pipes. The electrical component box 34 for controlling various kinds of equipment of the outdoor unit 10 is disposed above the compressors 30A, 30B, etc.

[0056] As shown in Fig. 4, the compressors 30A, 30B are disposed at the front side of the unit case 11 so that parts thereof are located in front of the tube plates 21A provided to both the end faces of the heat exchanger 21 which is formed to be substantially U-shaped in section. According to this construction, disturbance of the flow of air sucked from the heat exchanger 21 by the compressors 30A, 30B can be suppressed to the minimum level. Therefore, the air flow in the unit case 11 is smooth and thus the energy efficiency of the outdoor unit 10 can be enhanced.

[0057] A valve table 45 is threadably mounted on the support pole 14 at the left side of the front surface of the unit case 11, and service valves 46, 47 and 48 are concentrically disposed on the valve table 45. The service valves 46, 47 and 48 are a service valve 46 for a gas pipe, a service valve 47 for a liquid pipe and a service valve 48 for an oil balance pipe. The valve table 45 is threadably mounted on the support pole 14 at one end thereof, and the service valve 46 for the gas pipe in which the pipe pressure is highest is disposed at the nearest position to the threadably mounted portion of the valve table 45 to the support pole 14. A support member 49 is threadably mounted on the valve table 45 in the neighborhood of the center of the valve table 45, and the support member 49 is threadably mounted on the bottom plate 12, whereby the strength of the valve table 45 is enhanced. The support member 49 maybe designed to have a reinforcing clasp such as an L-shaped clasp or the like.

[0058] Accordingly, the service valve 46 for the gas pipe, the service valve 47 for the liquid pipe and the service pipe 48 for the oil balance pipe are concentrically disposed on the valve table 45, so that the valve operation of the service valves 47, 48 and 48 can be intensively performed.

[0059] Furthermore, as shown in Fig. 6, the valve table 45 is formed by bending one piece of metal plate, and the service valves 46, 47 and 48 are mounted in the machine chamber 40 and disposed so that when each of the service valves 46, 47 and 48 is operated, a service tool such as a trench or the like does not interfere with the other service valves. Furthermore, the upper end or the lower end of the valve table 45 is subjected to L-bending processing, and they are bent substantially vertically to the mount face of the service valves 46, 47 and 48, so that the strength of the valve table 45 is reinforced.

[0060] According to the above construction, by detaching the upper panel 15A or the lower panel 15B of the front panel 15, a worker can easily perform, from the front side, the maintenance work of the compressors 30A, 30B, the refrigerant circuit constituent parts 32, the electrical components in the electrical component box 34, etc. which are high in maintenance frequency, and can intensively perform the valve operation of the service valve 46 for the gas pipe, the service valve 47 for the liquid pipe and the service valve 48 for the oil balance pipe. Furthermore, the machine chamber 40 covered by the partition plate 38 is disposed to be shifted to the front side of the unit case 11, the area of the partition plate 38 which is overlapped with the suction port of the heat exchanger 21 can be minimized, and also the compressors 30A, 30B and the refrigerant circuit constituent parts 32 are collectively mounted in the machine chamber 40, so that the air flow in the unit case 11 can be made smooth and the heat exchange efficiency can be enhanced.

[0061] The accumulator 35, the oil separator 36 and the receiver tank 37 which are pressure containers for temporarily stocking refrigerant or refrigerant oil and low in maintenance frequency are mounted in the heat-exchanger chamber 39 together with the heat exchanger 21 (see Fig. 4) . The accumulator 35, the oil separator 3 6 and the receiver tank 37 are arranged behind the partition plate 38, and sufficient space can be provided between the respective closed vessels thereof.

[0062] Furthermore, the frame 17 is fixed to the center of the upper portion of the accumulator 35. The frame 17 extends from the upper end portion of the accumulator 35 and is joined to a joint member for joining the support poles 14 so as to prevent swinging motion of the accumulator 35.

[0063] According to this construction, the respective kinds of closed vessels of the accumulator 35, the oil separator 36 and the receiver tank 37 which are low in maintenance frequency are arranged behind the machine chamber 40 in which the compressors 30A, 30B whose maintenance frequency is high are mounted. Therefore, the accumulator 35, the oil separator 36 and the receiver tank 37 which are low in maintenance frequency do not disturb the maintenance work of the compressors 30A, 30B, etc. in the machine chamber 40, and thus the maintenance work efficiency of the outdoor unit 10 can be enhanced. Furthermore, the accumulator 35, the oil separator 36 and the receiver tank 37 are provided in the heat-exchange chamber 39 so that sufficient space can be formed between the respective closed vessels thereof. Therefore, the air flow in the heat-exchange chamber 39 is not disturbed, and the air flow in the heat-exchange chamber 39 is made smooth, so that the heat exchange efficiency is enhanced. Furthermore, the accumulator 3 is fixed to the unit case 11 by using the frame 17, and thus even when the accumulator 35 is designed to be tall to increase the amount of the refrigerant and the pipe between an indoor unit (not shown) and the outdoor unit 10 is lengthened, the accumulator 35 is not swung.

[0064] As described above, according to this embodiment, the heat exchanger 21 having a substantially U-shape in which the length L3 in the depth direction is longer than the length L4 in the width direction is provided along the three surfaces of the back surface side and both the side surface sides of the unit case 11 having a substantially rectangular shape in which the length L1 in the depth direction is longer than the length L2 in the width direction, and thus a sufficient heat transfer area of the heat exchanger 21 can be secured even when the unit case 11 is miniaturized. Furthermore, the compressors 30A, 30B are arranged at the front surface side of the housing 11, and thus the space for maintenance of the compressors 30A, 30B which are high in maintenance frequency can be easily secured at the front surface side of the outdoor unit 10, so that the maintenance performance of the outdoor unit 10 can be enhanced.

[0065] Furthermore, according to this embodiment, the partition plate 38 is provided to section the inside of the unit case 11 into the heat-exchange chamber 39 containing the heat exchanger 21 and the machine chamber 40

containing the compressors 30A, 30B at the front and rear sides respectively, and the fixing portions 64, 65 as both the ends of the partition plate 38 are fixed to the tube plates 21A of the heat exchanger 21. Therefore, the machine chamber 40 can be easily formed at the front side of the inside of the unit case 11, and thus rain drops can be prevented from directly impinging against the compressors 30A, 30B having the electrically-operated elements such as the motor, the coil, etc.

[0066] The air blower 22 comprising the fan motor 23 and the propeller fan 24 secured to the shaft of the fan motor 23 is located substantially at the equal distance from each of the back surface side and both the side surface sides of the unit case 11 having the substantially rectangular shape in which the length L1 in the depth direction is longer than the length L2 in the width direction. Therefore, the effect of the partition plate 38 on the air flow (swirl flow) occurring in the unit case 11 along the shaft of the air blower 22 can be reduced.

[0067] Furthermore, the partition plate 38 has both the right and left side plates 62, 63 which are fixed to the tube plates 21A and extend to the inside of the heat exchanger 21 having the substantially U-shaped section, and at least one of the side plates 62 and 63 is formed obliquely so as to be farther away from the inner surface of the heat exchanger 21 as it is shifted from the tube plate 21A to the inside of the heat exchanger. Therefore, even when the partition plate 38 is disposed inside the heat exchanger 21 having the substantiallyU-shaped section, the gap is provided between the partition plate 38 and the heat exchanger 21, and thus the heat exchanger 21 is prevented from being partially covered by the partition plate 38. Furthermore, the flow direction of air flow sucked through the heat exchanger 21 into the unit case 11 is not rapidly varied by the partition plate 38. Therefore, the heat transfer area of the heat exchanger 21 can be effectively used, and also the heat exchange efficiency of the heat exchanger 21 is not reduced.

[0068] The partition plate 38 is divided into the two parts of the upper partition plate 38A and the lower partition plate 38B, and it is threadably mounted on the tube plates 21A of the heat exchanger 21 so as to be freely detachable from the tube plates 21A of the heat exchanger 21. Therefore, when maintenance of each equipment mounted in the heat-exchange chamber 39 is required, only the upper partition plate 38A may be detached to perform the maintenance work. Accordingly, the workability of detaching the partition plate 38 can be enhanced, and the labor for the maintenance work can be reduced.

[0069] The upper portion of the upper partition plate 38A is bent to forma slope face extending from the back surface of the upper partition plate 38A to the lower end portion of the electrical component box 34. Therefore, the cross-sectional area in the air flow (swirl flow) of air in the unit case 11 which is sucked from the heat exchanger 21 and blown out from the air blower 22 disposed at the upper side of the heat exchanger 21 is not rapidly varied, and thus the heat-exchange efficiency of the heat exchanger 21 is not reduced.

[0070] Furthermore, the opening portion 38C through which pipes for connecting the parts disposed in each of the machine chamber 40 and the heat-exchange chamber 39 sectioned by the partition plate 38 are passed is formed at the lower portion of the back surface of the lower partition plate 38B, and the respective connection pipes are connected to the respective parts through the opening portion 38C. Therefore, when the upper partition plate 38A is detached for the maintenance work, these connection pipes are prevented from obstructing the maintenancework, and thus the maintenance workability can be enhanced.

[0071] The compressors 30A, 30B are disposed at the front side of the unit case so that at least a part thereof is located in front of the tube plates 21A provided to both the end faces of the heat exchanger 21 having the substantially U-shaped section. Therefore, the disturbance of the flow of air sucked from the heat exchanger 21 by the compressors 30A, 30B can be suppressed to the minimum level. Furthermore, the air flow in the unit case 11 is made smooth, and the energy efficiency of the outdoor unit 10 can be enhanced.

[0072] Furthermore, the refrigerant circuit constituent parts 32 connected to the compressors 30A, 30B are disposed to be shifted to the front side of the unit case 11 together with the compressors 30A, 30B. Therefore, the maintenance of the valve bodies such as the four-way valve 31 and the expansion valve, etc. contained in the refrigerant circuit constituent parts 32 can be efficiently performed. In addition, the compressors 30A, 30B or the refrigerant circuit constituent parts 32 can be prevented from disturbing the suction of outside air into the unit case 11 through the heat exchanger 21, and the air flow in the unit case 11 is smooth, so that the heat-exchange efficiency of the heat exchanger 21 can be enhanced.

[0073] The electrical component box 34 which is frequently disposed at the front side of the unit case 11 to perform maintenance easily is located to be overlapped with the air blower 22 in the height direction. Therefore, the electrical component box 345 does not obstruct the flow of air which is passed through the heat exchanger 21 and blown out from the air blower 22, and thus the air flow resistance in the unit case 11 can be reduced. Furthermore, the compressors 30A, 30B and the refrigerant circuit constituent parts 32 can be disposed at the lower side of the electrical component box 34, and the maintenance efficiency of the compressors 30A, 30B or the refrigerant circuit constituent parts 32 which are high in maintenance frequency can be increased.

[0074] Furthermore, the front surface of the unit case 11 is covered by the front panel 15 which is threadably mounted on the support poles 14 so as to be freely detachable, and the front panel 15 is divided into the upper panel 15A and the lower panel 15B. Therefore, when the maintenance of the electrical component box 34 is performed, the upper panel 15A is detached, and when the maintenance of the compressors 30A, 30B or the refrig-

erant circuit constituent parts 32 is performed and also when the service valve operation is carried out, the lower panel 15B is detached, so that the maintenance work can be easily performed.

[0075] Furthermore, the various kinds of closed containers such as the accumulator 35, the oil separator 36 and the receiver tank 37 which are lower in maintenance frequency than the compressors 30A, 30B or the refrigerant circuit constituent parts 32 are arranged behind the compressors 30A, 30B. Therefore, the accumulator 35, the oil separator 36, the receiver tank 37, etc. which are low in maintenance frequency are prevented from disturbing the maintenance work of the compressors 30A, 30B which are high in maintenance frequency, so that the working efficiency of the maintenance of the outdoor unit 10 can be enhanced.

[0076] Furthermore, the frame 17 is fixed to the center of the upper portion of the accumulator 35, and the frame 17 is fixed to the joint member for joining the support poles 14 of the unit case 11. Therefore, even when the accumulator 35 is designed to be tall to increase the amount of refrigerant and the pipe between the indoor unit and the outdoor is lengthened, the accumulator 35 is not swung.

[0077] Next, a second embodiment will be described.

[0078] An outdoor unit of an air conditioner having a compressor and a heat exchanger arranged on the bottom plate of a housing is well known. This type outdoor unit is connected to an indoor heat exchanger of an indoor unit through a refrigerant pipe to circulate refrigerant. Therefore, lead-out holes (knockout holes) for leading out refrigerant pipes are formed in a front plate or bottom plate of the housing of the outdoor unit, and when the outdoor unit is installed on site, a knockout hole suitable for an installation place is punched out to be opened.

[0079] However, in this construction, the knockout hole is formed in the bottom plate, and thus a metal mold for press-molding this knockout hole is required, so that the number of manufacturing steps and the manufacturing cost are increased. Furthermore, when a knockout hole formed in the bottom plate is punched out, the punch-out work must be executed at a narrow place, so that the workability is degraded.

[0080] Therefore, this embodiment provides an outdoor unit of an air conditioner which can easily lead out a refrigerant pipe from the front plate or bottom plate of the housing with a simple construction.

[0081] Fig. 7 is a perspective view showing the outlook of an outdoor unit 10A according to this embodiment, and Fig. 8 is a front view of the outdoor unit 10A under the state that the front panel is detached. In these figures, the same elements as the first embodiment are represented by the same reference numerals, and the description thereof is omitted.

[0082] In this embodiment, lead-out panels (panel members) 18 and 19 fixed to the support poles 14 at the front side are arranged side by side at the lower portion of the front panel 15, that is, at the lower end portion of the lower panel 15B. Knockout holes which are punched out and opened when refrigerant pipes or electrical wires are lead out from the unit case 11 are formed in the panel members 18 and 19.

[0083] As shown in Fig. 9, the bottom 12 is designed to be corrugated so that projections and recesses are provided in the width direction thereof, and it is divided into a front bottom plate 12A and a rear bottom plate 12B in the front-and-rear direction. The front bottom plate 12A and the rear bottom plate 12B are fixedly bridged over a pair of leg members 13. The front bottom plate 12A and the rear bottom plate 12B are formed of the same sheet-metal material, and may have the same plate thickness. However, in this embodiment, the sheet metal of the front bottom plate 12a on which the compressors 30a, 30B are arranged are set to be larger in thickness than the rear bottom plate 12B to increase the mechanical strength of the front bottom plate 12a.

[0084] A streak of recess portion 12C extending in the width direction is formed on each of the front bottom plate 12A and the rear bottom plate 12B by trapezoid bending to reinforce the front and rear bottom plates 12A and 12B, whereby the front bottom plate 12A and the rear bottom plate 12B are formed like a substantially corrugated panel. The recess portions 12C are formed on the front bottom plate 12A and the rear bottomplate 12B by using the same press die. In this embodiment, the bottom plate 12 is divided into two parts in the front-and-rear direction, and one streak of recess portion 12C which extends in the width direction and has the same shape is formed on each of the font bottom plate 12A and the rear bottom plate 12B. Accordingly, the respective recess portions 12C can be formed by a partial die type press die , and the labor for manufacturing the bottom plate and the material cost can be more greatly reduced as compared with a case where plural reinforcing grooves are formed on a single bottom plate by using a whole die.

[0085] A front end portion 12G of the front bottom plate 12A is formed to be substantially U-shaped in section by bending the tip 12G1 of a plate material downwardly and then folding back the bent tip 12G1 backwardly. Likewise, the rear end portion 12H of the rear bottom plate 12B is formed to be substantially U-shaped in section by bending the tip 12H1 of a plate material downwardly and then folding back the bent tip 12H1 forwardly. Accordingly, the mechanical strength of the front bottom plate 12A and the rear bottom plate 12B are further increased.

[0086] Furthermore, the rear end portion of the front bottom plate 12A and the front end portion of the rear bottom plate 12B which correspond to the divided faces of the bottom plate 12 are subjected to Z-bending (step bending) processing to form stepped portions 12D and 12E. The stepped portions 12d and 12E are formed substantially in parallel to the recess portions 12C, and located to be lower than the recess portions 12C in height. The stepped portions 12D and 12E are bent substantially in the same depth as the front end portion 12G of the front bottom plate 12A and the rear end portion 12H of

the rear bottom plate 12B. With the stepped portions 12D and 12E, the bending depth of the front end portion 12G of the front bottom plate 12A and the rear end portion 12H of the rear bottom plate 12B is larger than the depth of the recess portions 12C, whereby the mechanical strength of the front bottom plate 12A and the rear bottom plate 12B are further increased. In this construction, as shown in Fig. 4, the accumulator 35 is disposed so as to stride over the stepped portions 12D, 12E. Accordingly, the accumulator which is disposed at the substantially center portion of the bottom plate 12 and heavy in weight because refrigerant is stocked is disposed so as to stride over the steppedportions 12D and 12E which has high mechanical strength because they are subjected to the step bending processing, and thus the center portion of the bottom plate 12 can be prevented from sagging due to the weight of the accumulator.

[0087] Each of the front bottom plate 12A and the rear bottom plate 12B is provided with fixing portions 12F having screw holes at the front and rear ends of both the side edge portions. These fixing portions 12F are provided substantially at the same height as the recess portions 12C from the mount face of the bottom plate 12, and they are on the upper surfaces 13A of the leg members 13 together with the recess portions 12C and fixed by screws.

[0088] The leg members 13 are formed of channel steel or the like. In order to make the right and left leg members 13 as common parts, the upper surfaces 13A of the leg members 13 are provided with plural screw holes at the positions corresponding to the screw holes provided at both the right and left end sides of the bottomplate 12. Furthermore, plural clamps 13B which are formed integrally with the leg members 13 are provided on the inner surfaces of the leg members 13 by cutting and raising parts of the leg members 13, and the stepped portions 12D, 12E, the tip 12G1 of the front end portion 12G of the front bottom plate 12A and the tip 12H1 of the rear end portion 12H of the rear bottom plate 12B are fixed to the respective clamps 13B by screws.

[0089] Furthermore, as shown in Fig. 10, reinforcing members B1, B2 which are formed in a substantially Z shape are provided to the lower portions of the front bottom plate 12A and the rear bottom plate 12B, and fixed to the bottom plate 12 by screws. The sagging of the bottom plate 12 in the depth direction is prevented by the reinforcing members B1, B2, thereby increasing the mechanical strength of the bottom plate 12.

[0090] The outdoor unit 10A is provided with the panel members 18 and 19 at the lower portion of the unit case 11. As shown in Fig. 11, the panel member 18, 19 has a front plate portion 18A, 19A continuing with the lower end portion 15B1 (Fig. 7) of the lower panel 15B, and a bottom plate portion 18B, 19B continuing with the front end portion 12G of the front bottom plate 12A so as to be substantially L-shaped in section. With respect to one panel member 18, two pairs of large and small knockout holes 50A, 50B, 51A, 51B for leading out electrical wires are formed in the front plate portion 18A and the bottom plate portion 18B respectively. Furthermore, with respect to the other panel member 19, large knockout holes 52 and 53 for leading out refrigerant pipes are formed in the front plate portion 19A and the bottom plate portion 19B respectively.

[0091] In this embodiment, the left edge of the front plate portion 18A is fixed to the support pole 14 by screws, and the upper edge of the front plate portion 18A is fixed to the lower end portion 15B1 (Fig. 7) of the lower panel 15B, thereby fixing one panel member 18. Furthermore, likewise, the right edge of the front plate portion 19A is fixed to the support pole 14 by screws and the upper edge of the front plate portion 19A is fixed to the lower end portion 15B1 of the lower panel 15B (Fig. 7), thereby fixing the other panel member 19.

[0092] The valve table (pipe connection portion) 45 fixed to the support pole 14 at the left side of the front surface of the unit case 11 is provided on the other panel member 19. The service valves 46, 47 and 48 are concentrically disposed on the valve table 45. The service valves 46, 47 and 48 are the service valve 46 for the gas pipe, the service valve 47 for the liquid pipe and the service valve 48 for the oil balance pipe. One end of the valve table 45 is threadably mounted on the support pole 14, and the service valve 46 for the gas pipe which is highest in pipe pressure is disposed at a position nearest to the threadably mounted portion of the valve table 45 on the support pole 14. One end of the support member 49 is threadably mounted in the neighborhood of the center of the valve table 45. The other end of the support member 49 is fixed to the front bottom plate 12A to enhance the mechanical strength of the valve table 45. A reinforcing clasp such as an 1-shaped clasp or the like may be used as the support member 49.

[0093] As described above, the service valve 46 for the gas pipe, the service valve 47 for the liquid pipe and the service valve 48 for the oil balance pipe are concentrically mounted on the valve table 45, and thus the refrigerant pipes connected to the respective service valves can be easily drawn out when they are led out through the knockout holes 52,53.

[0094] In this construction, as shown in Fig. 12, the lower panel 15B of the front panel 15 is disposed so that space A is formed between the lower panel 15B and the bottom plate 12A in the depth direction and the height direction, and the panel members 18, 19 are arranged so as to cover the space A. In this construction, the bottom plate 12 can be formed to be smaller with respect to the mount area of the unit case 11. As described above, various kinds of heavy loads such as the compressors 30A, 30B, etc. are mounted on the bottom plate 12, and thus the manufacturing cost is increased because the thickness of the plate is increased, etc. However, according to this construction, the L-shaped panel members 18, 19 are arranged between the lower panel 15B of the front panel 15 and the front bottom plate 12A, whereby the bottom plate 12 can be reduced in sized, and thus the

manufacturing cost can be reduced.

[0095] As shown in Fig. 12, in the panel members 18 and 19, the tips of the respective bottom plate portions 18B and 19b are upwardly step-bent. Specifically, the panel members 18 and 19 has raised portions 18C and 19C which are formed by substantially vertically folding the tip portions of the bottom plate portions 18B and 19B, and bent portions 18D and 19D formed by substantially horizontally folding the tip portions of these raised portions 18C and 19C in the depth direction of the unit case 11. In this construction, when the panel members 18 and 19 are fixed to the unit case 11, the raising portions 18C and 19C abuts against the end face 12G2 of the front endportion 12G of the front bottomplate 12A, and also the bent portions 18D and 19D extend onto the front end portion 12G of the front bottom plate 12A to be stacked on the upper surface 12G3 of the front end portion 12G. According to this construction, the bent portions 18D and 19D are stacked on the upper surface 12G3 of the front end portion 12G. Therefore, the front plate portions 18A and 19A can be fixed by screws under the state that the tips of the bottom plate portions 18B and 19B (the bent portions 18D and 18D) are hooked to the upper surface 12G3 of the front end portion 12G, and thus the attaching/detaching work can be easily performed. Furthermore, the raising portions 19C, 19C abut against the end face 12G2 of the front end portion 12G of the front bottom plate 12A. Therefore, even when a load is imposed on each of the panel members 18 and 19 in the depth direction of the unit case 11, the raising portions 18C and 19C are made to abut against the end face 12G2 of the front end portion 12G, thereby preventing deformation or distortion of the panel members 18 and 19.

[0096] As described above, according to this embodiment, there are provided the front panel 15 disposed at the front side of the unit case 11, and the substantially L-shapedpanel members 18 and 19 disposed between the lower end portion 15B1 of the lower panel 15B of the front panel 15 and the front end portion 12G of the front bottom plate 12A, and also in these panel members 18 and 19, the knockout holes 50A, 50B, 51A, 52, 53 are provided to the bottom plate portions 18B, 19B continuing with the lower end portion 15B1 of the lower panel 15B. Therefore, it is unnecessary to provide knockout holes on the front panel 15 of the bottom plate 12, and thus the construction of the front panel 15 of the bottom plate 12 can be simplified. Furthermore, the panel members 18 and 19 provided with the knockout holes 50A, 50B, 51A, 51B, 52, 53 are arranged between the lower end portion 15B1 of the lower panel 15B and the front end portion 12G of the front bottom plate 12A. Therefore, by detaching the panel members 18, 19 to perform a work, the knockout holes can be simply punched out on site.

[0097] Furthermore, according to this embodiment, the front panel 15 is disposed so as to form space A between the front panel 15 and the front bottom plate 12A in the depth direction and the height direction, and the panel members 18, 19 are arranged so as to cover this space A. Therefore, the bottom plate 12 (the front bottom plate 12A and the rear bottom plate 12B) can be formed to be smaller than the mount area of the unit case 11. Accordingly, the manufacturing cost of the bottom plate can be also reduced.

[0098] Still furthermore, the panel members 18, 19 are provided with the bent portions 18D and 19D obtained by upwardly step-bending the tips of the bottom plate portions 18B and 19B, and the bent portions 18D and 19D are made to extend onto the upper surface 12G3 of the front end portion 12G of the front bottom plate 12A. Therefore, the front plate portions 18A and 19A can be fixed by screws under the state that the tips of the bottom plate portions 18B, 19B (the bent portions 18D, 19D) are hooked to the upper surface 12G3 of the front end portion 12G, and thus the attaching/detaching work can be easily performed.

[0099] Still furthermore, the support poles 14 are provided at the four corners of the unit case 11, and the panel members 18 and 19 are fixed to the pair of support poles 14 disposed at the front side. Therefore, the construction of attaching/detaching each of the panel members 18, 19 can be simplified.

[0100] Still furthermore, the panel member 18, 19 is arranged to be divided into two parts in the unit case 11, the knockout holes 50A, 50B, 51A, 51B for leading out the electrical wires are formed in one panel member 18, and the knockout holes 52, 53 for leading out the refrigerant pipes are formed in the other panel member 19. Therefore, the connection and lead-out work of the electrical wires and the refrigerant pipes can be easily performed from the front surface side of the unit case 11.

[0101] The valve table 45 fixed to the support poles 14 is provided above the other panel member in which the knockout holes 52, 53 for leading out the refrigerant pipes are formed. Therefore, the respective service valves are concentrically arranged on the valve table, whereby the refrigerant pipes can be easily drawn out when the refrigerant pipes connected to the service valves are led out through the knockout holes 52, 53.

Claims

1. An outdoor unit (10) for an air conditioner having a compressor (30A, 30B) disposed on a bottom plate (12) of a housing (11), a heat exchanger (21) that has tube plates (21A) at both the ends thereof and is designed to be substantially U-shaped in section and disposed on the bottom plate along three surfaces of a back surface side and both side surface sides of the housing, and air blower (22) disposed above the heat exchanger, **characterized in that** the heat exchanger is designed so that the length in a depth direction located at both the side surface sides of the housing is set to be longer than the length in a width direction located at the back surface side of the housing, and the compressor is disposed at

the front surface side of the housing (11).

2. The outdoor unit for the air conditioner according to claim 1, further comprising a partition plate (38) for sectioning the inside of the housing into a heat-exchange chamber (39) containing the heat exchanger and a machine chamber containing the compressor in a front-and-rear direction, wherein both the ends of the partition plate are fixed to the tube plates.

3. The outdoor unit for the air conditioner according to claim 1 or 2, wherein the air blower is disposed at a substantially equal distance from each of a back surface side and both side surface sides of the housing.

4. The outdoor unit for the air conditioner according to any one of claims 1 to 3, wherein the partition plate has right and left side plates that are fixed to the tube plates and extend to the inside of the heat exchanger, and at least one of the side plates is configured obliquely so as to be farther away from the inner surface of the heat exchanger as the side plate concerned shifts from the tube plates to the inside of the heat exchanger.

5. The outdoor unit for the air conditioner according to any one of claims 1 to 4, wherein the partition plate is divided into an upper partitionplate (38A) andalowerpartitionplate (38B) inanup-and-down direction, and freely detachably fixed to the tube plates.

6. The outdoor unit for the air conditioner according to claim 5, wherein the upper partition plate is bent so that the upper portion thereof serves as an oblique surface.

7. The outdoor unit for the air conditioner according to claim 5, wherein the lower partition plate has an opening portion through which pipes for connecting parts disposed in the heat-exchange chamber and the machine chamber are passed.

8. The outdoor unit for the air conditioner according to claim 5, wherein the compressor is disposed so that at least a part of the compressor is located in front of the tube plates of the heat exchanger.

9. The outdoor unit for the air conditioner according to claim 1 or 8, wherein refrigerant circuit constituent parts (32) connected to the compressor are disposed to be shifted to the front surface side of the housing together with the compressor.

10. The outdoor unit for the air conditioner according to any one of claims 1, 8 and 9, further comprising an electrical component box (34) which is provided in the housing and in which electrical component parts for controlling the compressor or the air blower are mounted, wherein the electrical component box is provided at the upper side of the compressor and at the front surface side of the housing so as to be overlapped with the air blower in height direction.

11. The outdoor unit for the air conditioner according to any one of claims 1, 8 to 10, wherein the housing has a maintenance panel (15) covering the front surface side of the housing, and the maintenance panel is divided into two parts in the up-and-down direction and threadably mounted on the housing so as to be freely detachable.

12. The outdoor unit for the air conditioner according to any one of claims 1, 8 to 11, wherein an accumulator (35), an oil separator (36) or a receiver tank (37) that is connected to the compressor are disposed behind the compressor on a bottom plate (12) of the housing.

13. The outdoor unit for the air conditioner according to claim 12, wherein the accumulator has a reinforcing bar that is threadablymounted to the center of an upper portion of the accumulator, and the reinforcing bar is threadably mounted on the housing.

14. An outdoor unit (10) for an air conditioner having a compressor (30A, 30B) and a heat exchanger (21) that are disposed on a bottom plate (12) of a housing (11), comprising a front panel (18, 19) disposed at the front side of the housing and a substantially L-shaped panel member (18, 19) disposed between the lower end portion of the front panel and the front end portion of the bottom plate, wherein the panel member is provided with knockout holes (50A, 50B, 51A, 51B)at a front plate portion continuing with the lower end portion of the front panel and a bottom plate portion continuing with the front end portion of the bottom plate.

15. The outdoor unit for the air conditioner according to claim 14, wherein the front panel is disposed to form a space between the front panel and the bottom plate in a depth direction and a height direction, and the panel member is disposed to cover the space.

16. The outdoor unit for the air conditioner according to any one of claims 14 and 15, wherein the panel member has a bent portion (18D and 19D) obtained by step-bending the tip of the bottom plate portion so that the bent portion extends onto the front end portion of the bottom plate.

17. The outdoor unit for the air conditioner according to any one of claims 14 to 16, further comprising four support poles (14) arranged at four corners of the housing, wherein the panel member is fixed to the support poles disposed at the front side.

18. The outdoor unit for the air conditioner according to any one of claims 14 to 17, wherein the panel member is divided into two parts in a width direction of the housing, knockout holes for leading out electrical wires are formed in one of the two parts, and knockout holes for leading out refrigerant pipes are formed in the other part.

19. The outdoor unit for the air conditioner according to claim 18, wherein a pipe connection portion (45) fixed to the support poles are provided on the other panel member on which the knockout holes for leading out the refrigerant pipes are formed.

FIG.1

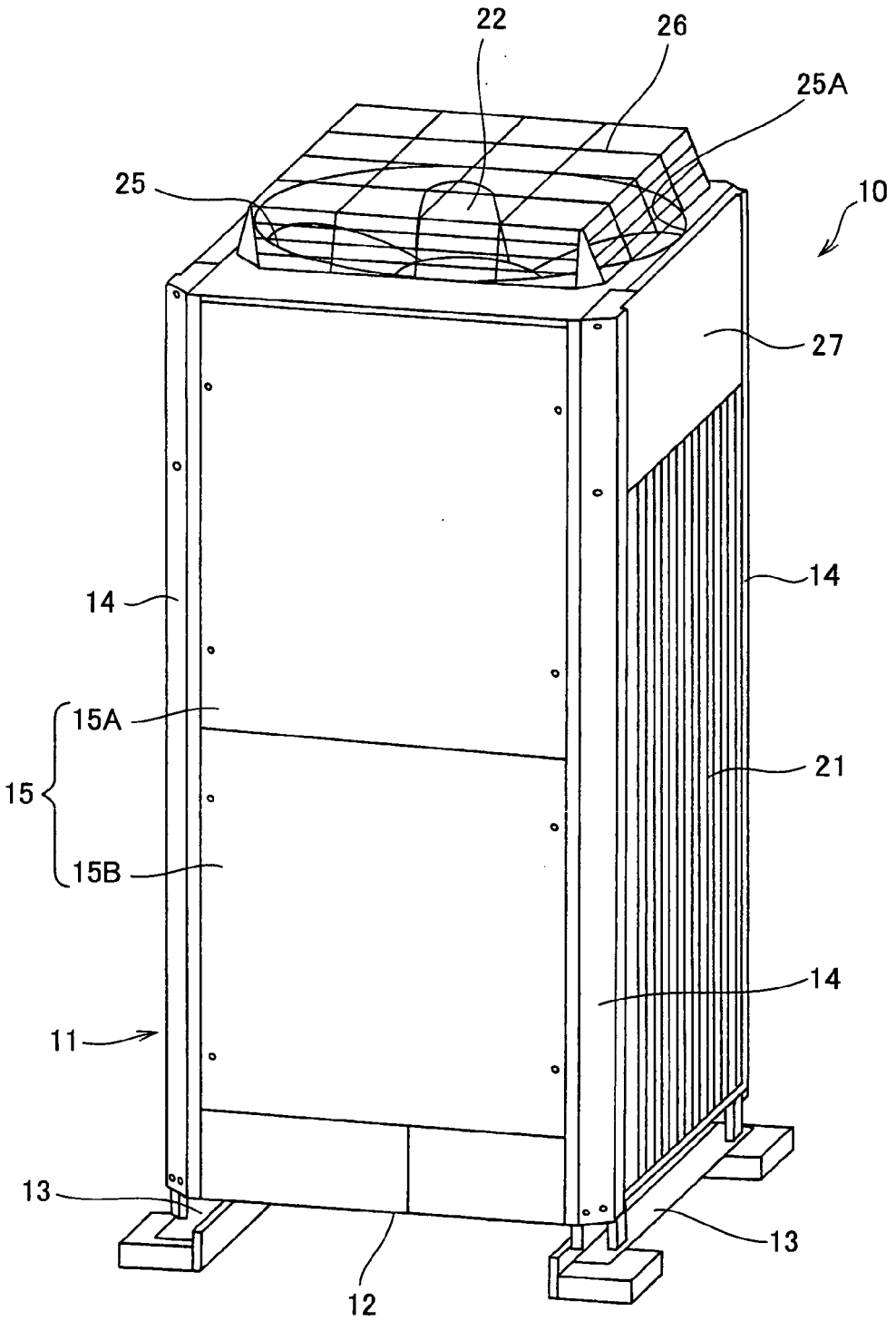


FIG.2

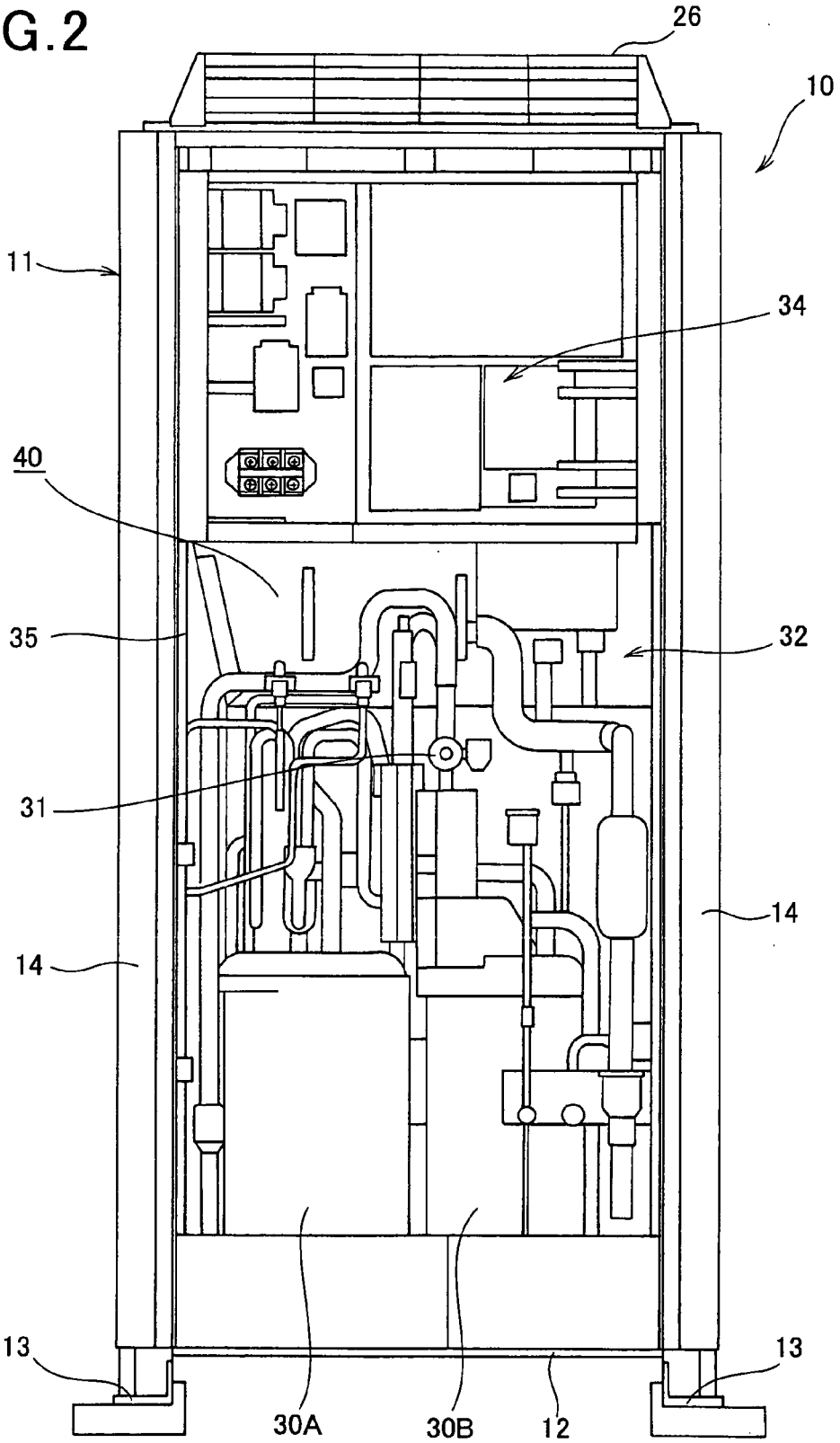
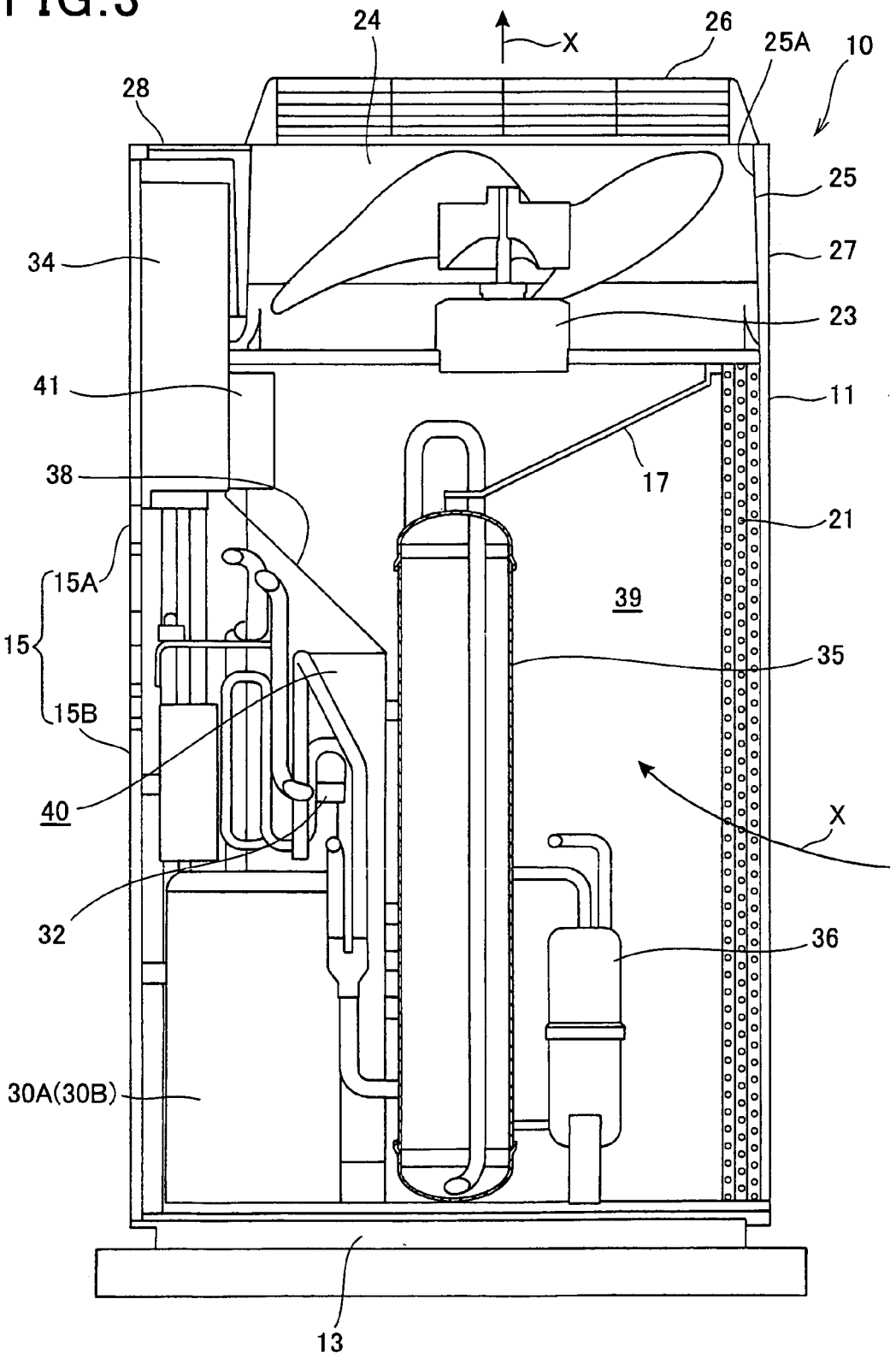


FIG.3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25A
10
28
25
34
27
23
41
11
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21
15A
39
15
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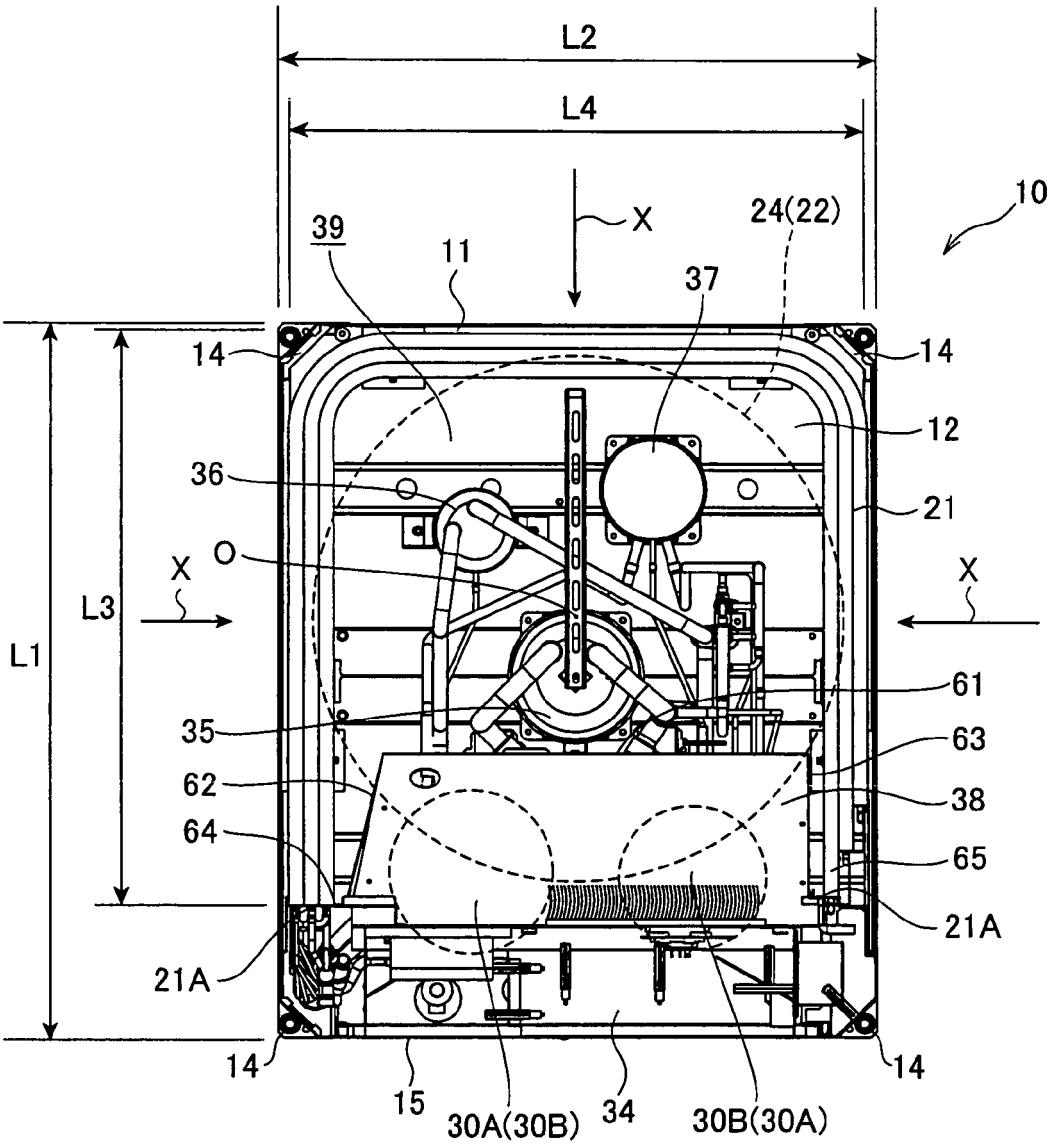
15B
40
X
32
36
30A(30B)
13

FIG.4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L4
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39
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37
14
14
12
36
21
O
X
X
L3
L1
61
35
63
62
38
64
65
21A
21A
14
14
15
30A(30B)
34
30B(30A)

FIG.5

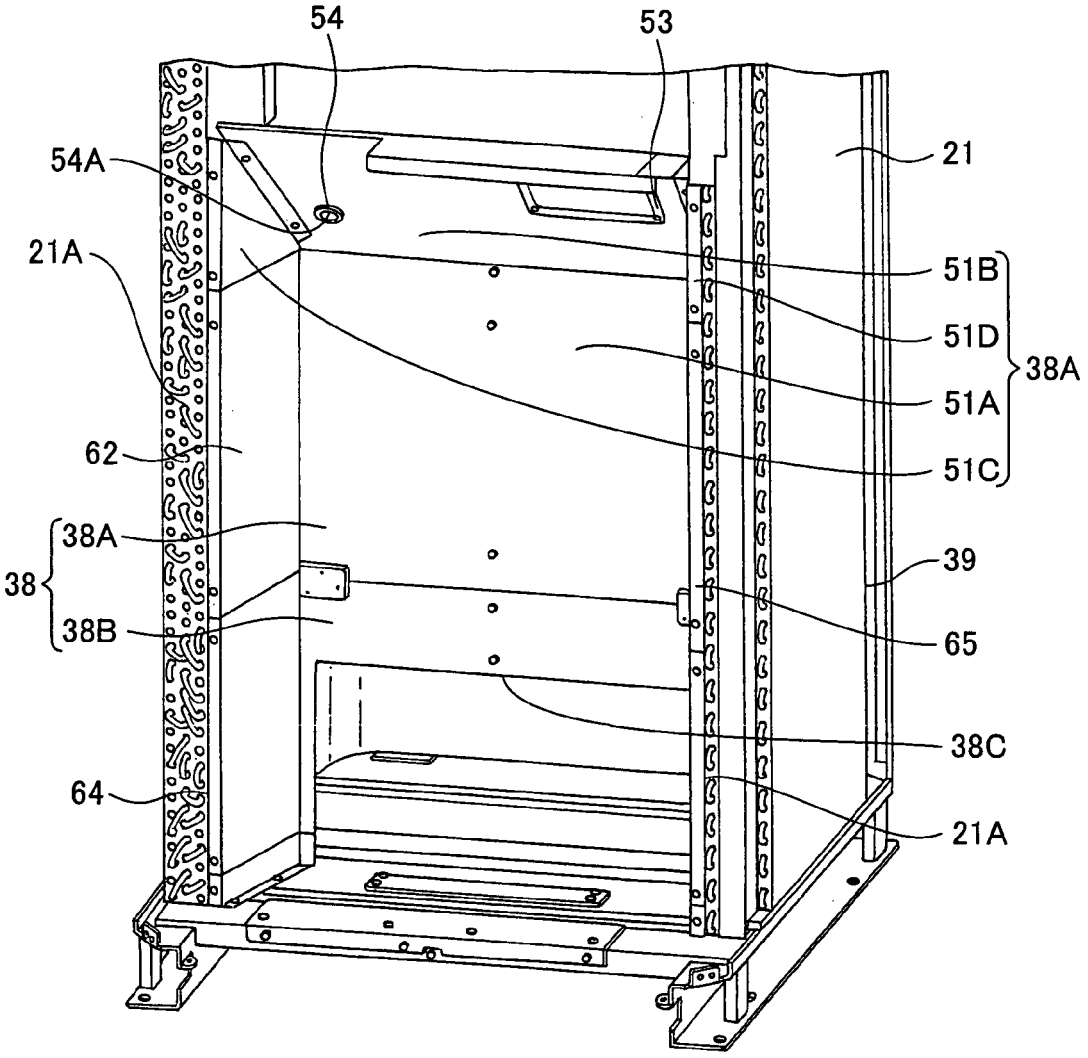


FIG.6

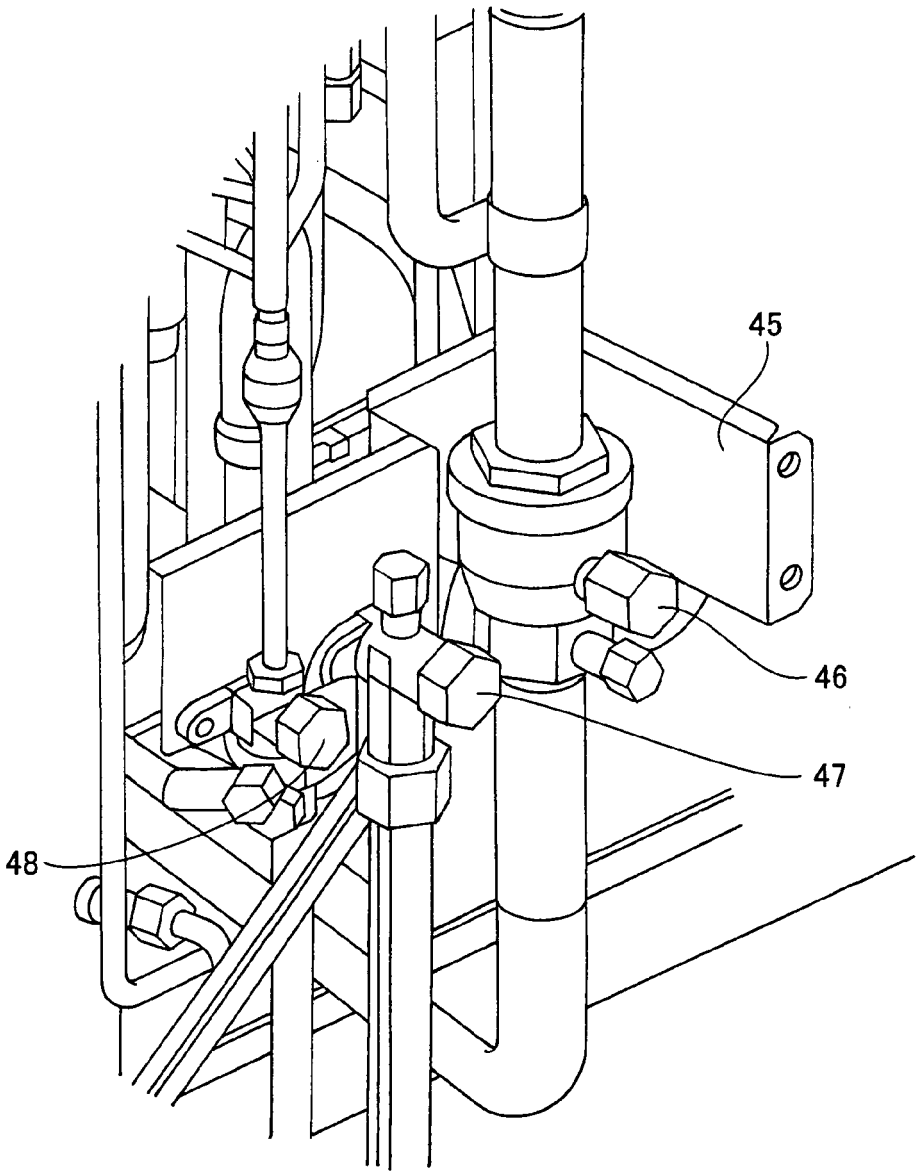


FIG.7

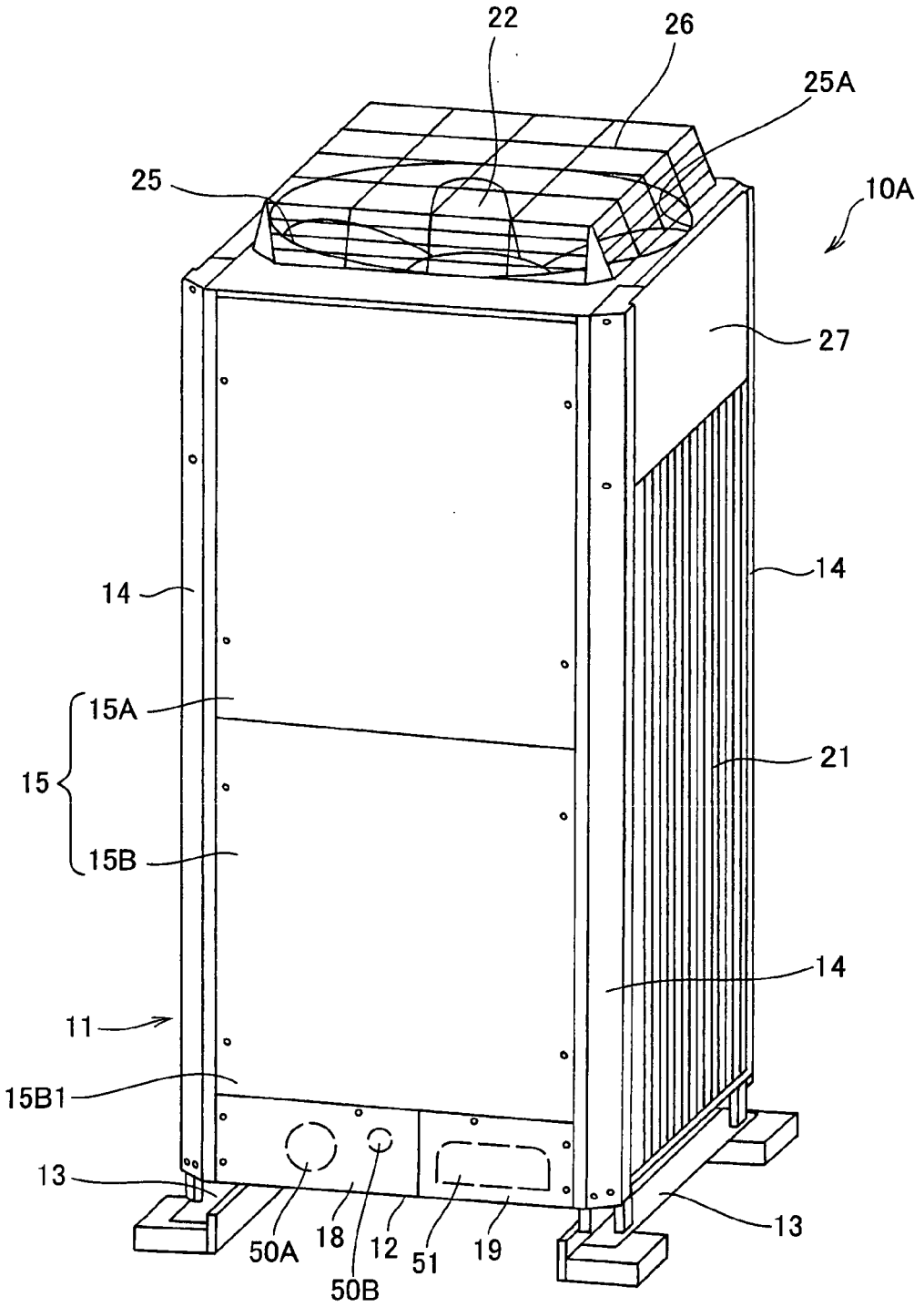

22
26
25A
25
10A
27
14
14
15A
15
15B
21
14
11
15B1
13
13
50A
18
12
51
19
50B

FIG.8

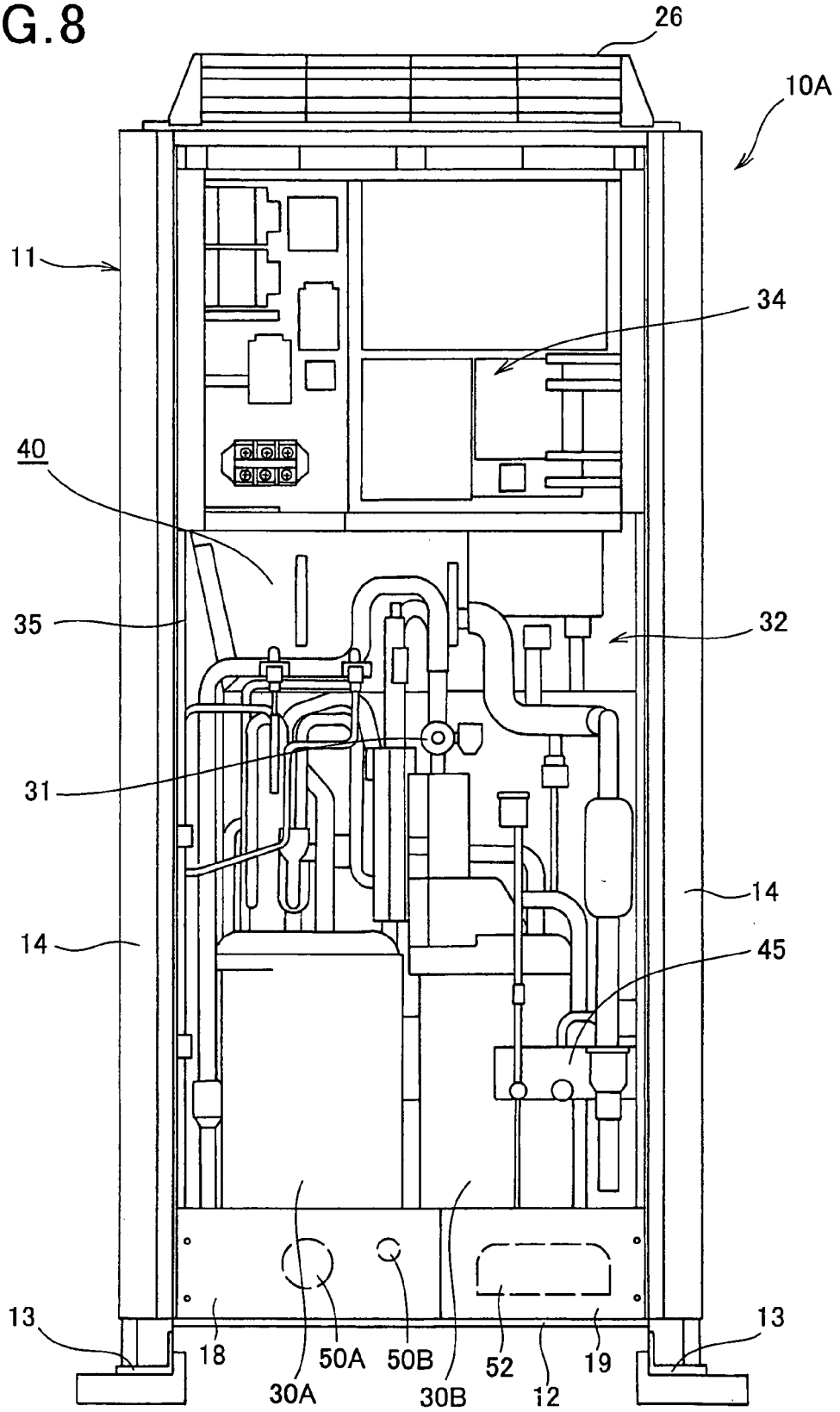
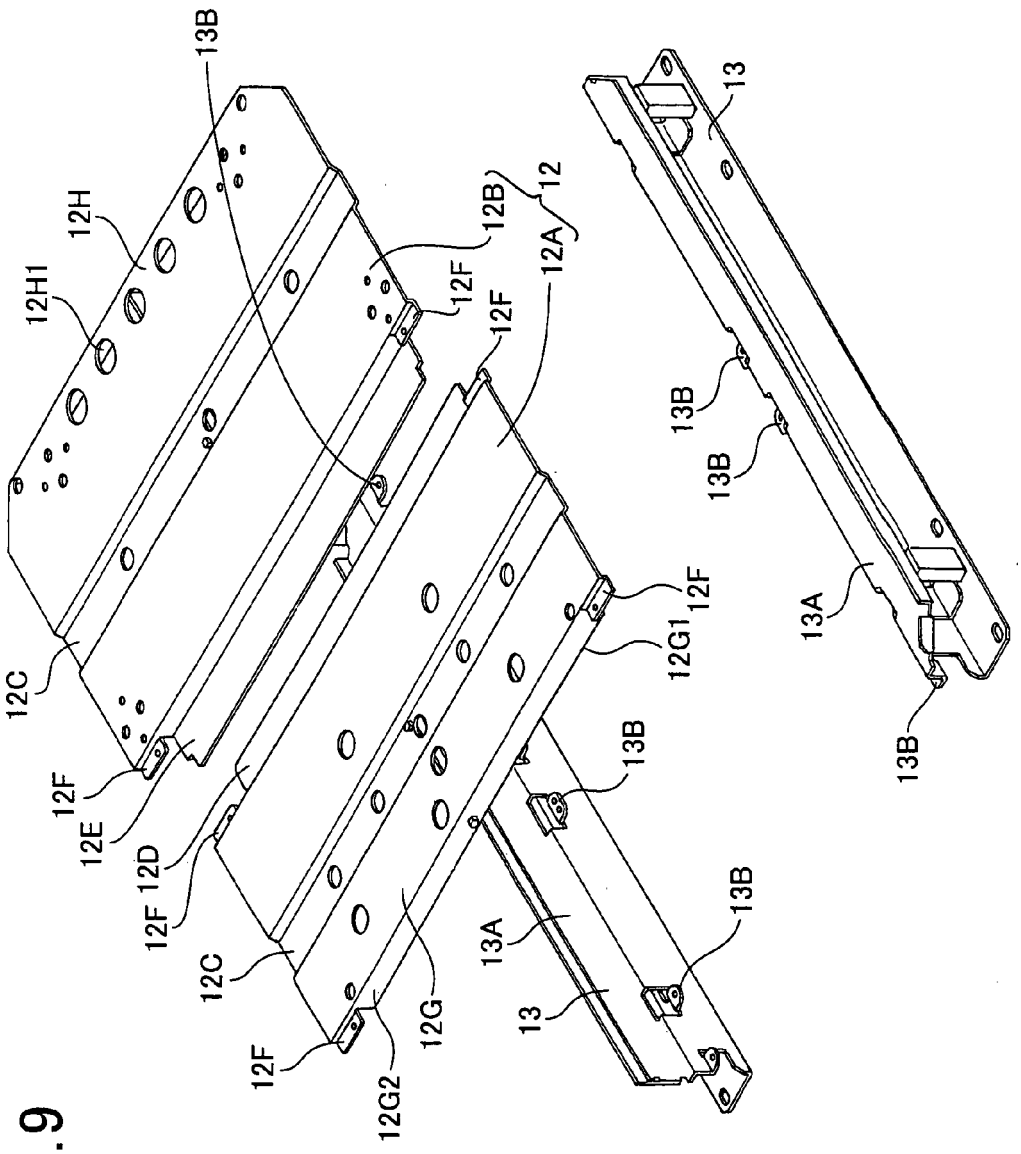


FIG.9


13B
12H
12H1
12B
12
12A
12F
12F
13
13B
13B
13A
13B
12C
12F
12E
12D
12F
12F
12G1
13B
13A
13B
12C
13
12G
12F
12G2

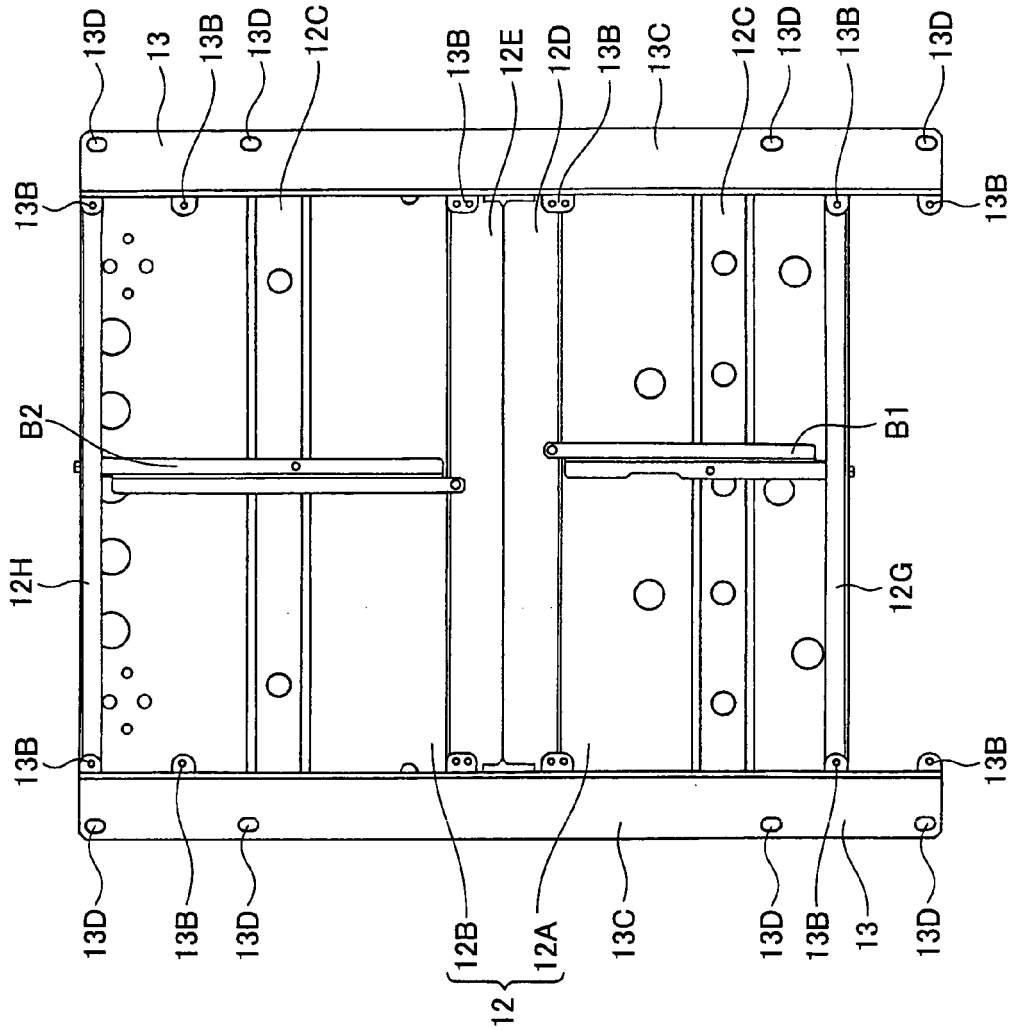

13D
13
13B
13D
12C
13B
12E
12D
13B
13C
12C
13D
13B
13D
13B
B2
B1
12H
12G
13B
13B
13D
13B
13D
12B
12A
13C
13D
13B
13
13D
12

FIG.10

FIG.11

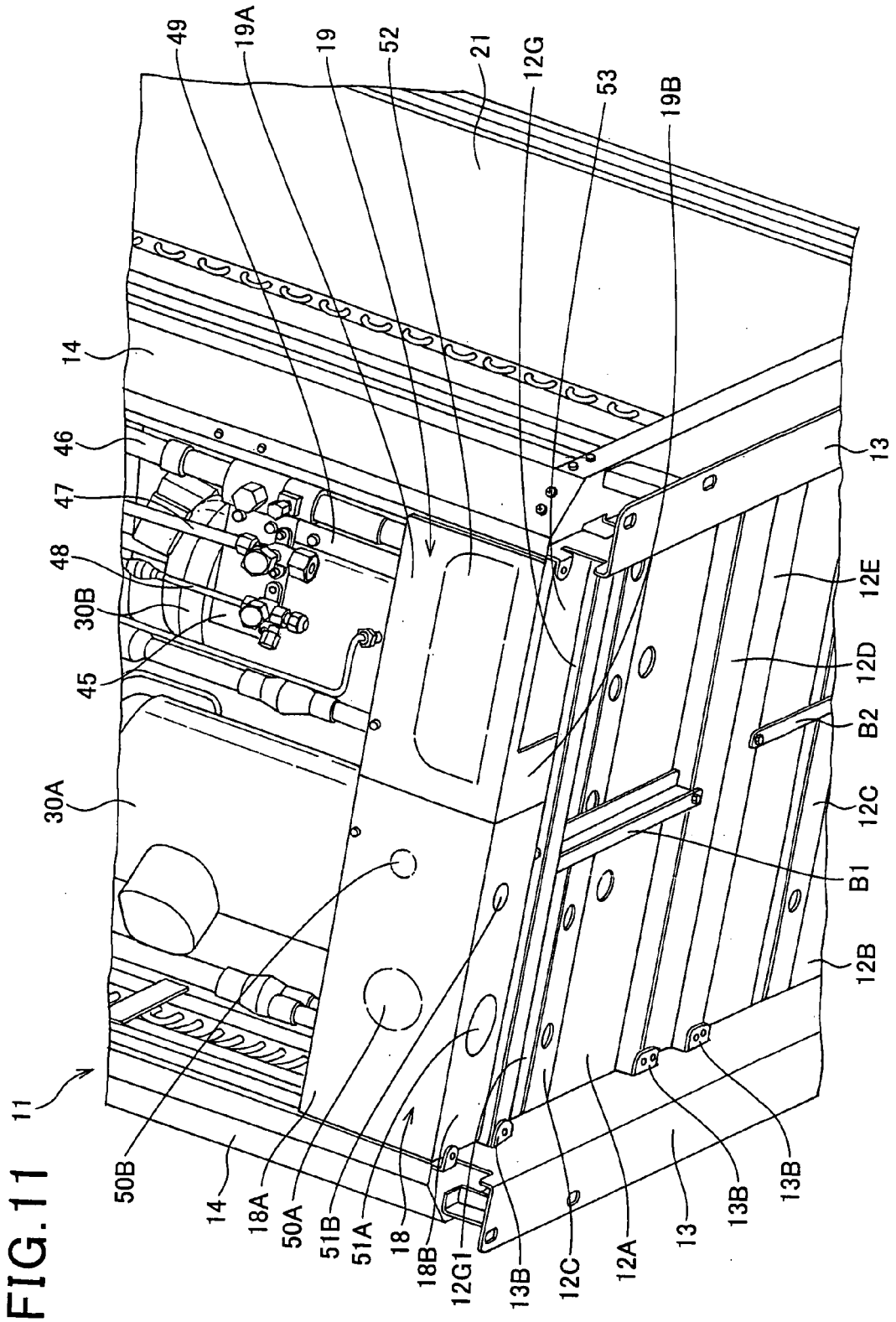
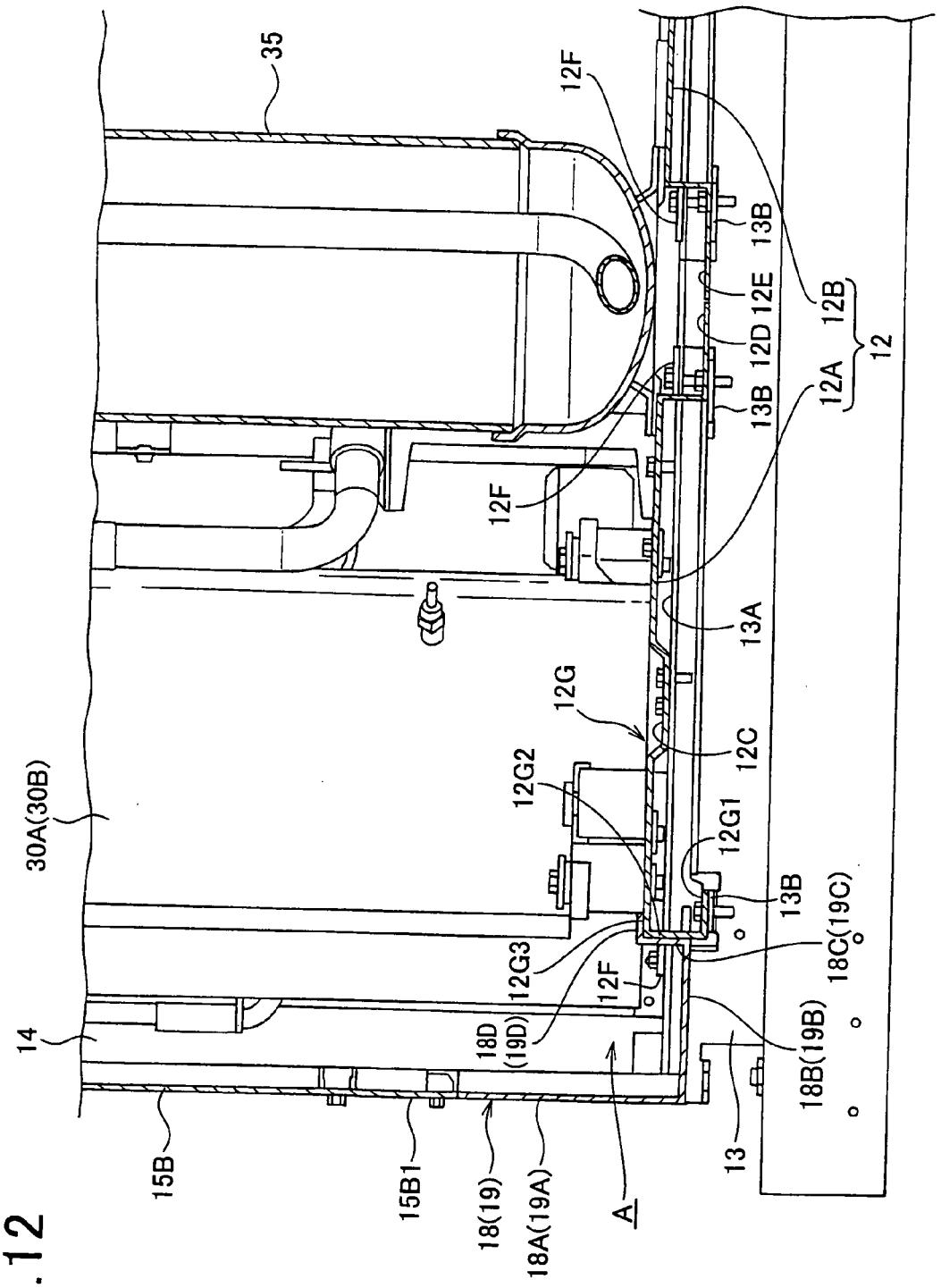

49
19A
19
52
21
12G
53
19B
14
46
47
48
30B
45
30A
11
50B
14
18A
50A
51B
51A
18
18B
12G1
13B
12C
12A
13
13B
13B
B1
12B
12C
B2
12D
12E
13

FIG.12


35
12F
13B
12E
12D
12B
12
12A
13B
12F
13A
12G
12C
12G2
12G1
13B
30A(30B)
18C(19C)
12G3
12F
14
18D
(19D)
18B(19B)
15B
15B1
18(19)
18A(19A)
A
13

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2006189196 A **[0002]**
- JP 2008128496 A **[0003]**