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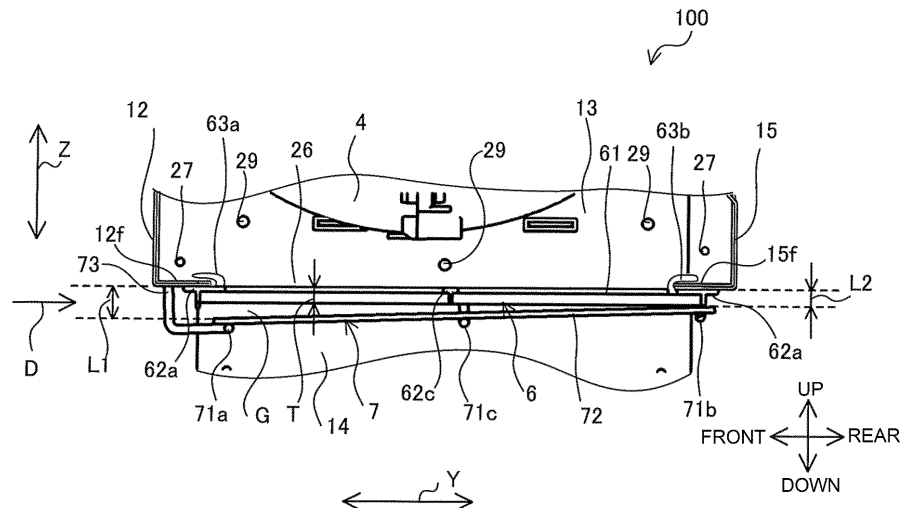
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(54) **AIR CONDITIONER**

(57) An air-conditioning apparatus includes a housing having an opening port and an air passage formed in the housing and connected to the opening port; an air-sending device installed in the housing and configured to generate an air flow in the air passage; a heat exchanger disposed in the air passage and configured to cause air and a heat medium to exchange heat; a fan guard installed on the housing with a gap defined be-

tween the fan guard and a face of the housing in which the opening port is provided, the fan guard preventing a contact with the air-sending device; and a filter attached to the housing such that the filter is inserted into the gap, the filter covering the opening port. The fan guard is installed on the housing such that the gap is narrowed toward an inward portion in an insertion direction into which the filter is inserted.

FIG. 8



Description

Technical Field

[0001] The present disclosure relates to an air-conditioning apparatus provided with a filter and a fan guard.

Background Art

[0002] Some air-conditioning apparatus installed in a living space or other spaces includes a housing having an air inlet and an air outlet, a heat exchanger, and an air-sending device. Further, a filter that catches dust in air is provided to the air inlet. When dust adheres to the filter, thus causing clogging, a volume of air from the air outlet reduces and hence, the performance of the air-conditioning apparatus reduces. For this reason, the filter is cleaned or replaced regularly. Therefore, engaging pawls or other engaging parts are provided to the filter and portions to be engaged that are engaged with the engaging pawls are provided to the housing so that the filter can be mounted on and removed from the housing.

[0003] There is an air-conditioning apparatus where a filter is installed on an air inlet provided at the upper face of a housing, and a fan guard (finger guard) is installed on an air outlet provided at the front portion of the lower face of the housing (see Patent Literature 1, for example). In the air-conditioning apparatus disclosed in Patent Literature 1, the finger guard is held by one surface of an air blowing circuit and one surface of a vertical wind direction changing blade that faces the one surface of the air blowing circuit to prevent the finger of a person from contacting the fan.

Citation List

Patent Literature

[0004] Patent Literature 1: Japanese Unexamined Patent Application Publication No. 2016-205722

Summary of Invention

Technical Problem

[0005] When an operator attaches a filter to a housing, there may be a case where the operator cannot easily perform the operation depending on the location where the air-conditioning apparatus is installed, the depth dimension of the air-conditioning apparatus, and the position where the filter is mounted. For example, as disclosed in Patent Literature 1, there is an air-conditioning apparatus having the air outlet provided at the front portion of the lower face of the housing, and such an air-conditioning apparatus is usually installed at a high position on a wall surface. In the case of such an air-conditioning apparatus, it is difficult for an operator to visually check the upper face of the housing to which the filter is

attached, particularly, the portion of the upper face close to the back face. Further, for example, in the case where the air-conditioning apparatus is installed on a floor close to a window, a limitation may be imposed on the height dimension of the air-conditioning apparatus. In this case, when the air inlet is provided at the lower face of the housing, a space necessary for the operator to check the position of a portion to be engaged cannot be ensured between the lower face and the floor, so that there may be case where the operator cannot easily perform the operation.

[0006] The present disclosure has been made to solve the above-mentioned problem, and it is an object of the present disclosure to provide an air-conditioning apparatus where the filter can be easily installed on the housing.

Solution to Problem

[0007] An air-conditioning apparatus according to an embodiment of the present disclosure includes a housing having an opening port and an air passage formed in the housing and connected to the opening port; an air-sending device installed in the housing and configured to generate an air flow in the air passage; a heat exchanger disposed in the air passage and configured to cause air and a heat medium to exchange heat; a fan guard installed on the housing with a gap defined between the fan guard and a face of the housing in which the opening port is provided, the fan guard preventing a contact with the air-sending device; and a filter attached to the housing such that the filter is inserted into the gap, the filter covering the opening port. The fan guard is installed on the housing such that the gap is narrowed toward an inward portion in an insertion direction into which the filter is inserted.

Advantageous Effects of Invention

[0008] In the air-conditioning apparatus according to an embodiment of the present disclosure, the gap between the fan guard and the face in which the opening port is provided is narrowed toward the inward portion in the insertion direction into which the filter is inserted. Therefore, the filter can be easily inserted from a frontward portion in the insertion direction, and the filter can be brought close to the housing at the inward portion in the insertion direction. Accordingly, when the operator inserts the filter along the fan guard, the fan guard is also used as a guide for the filter and hence, the operator can easily install the filter into the housing even in the case where the inward portion in the insertion direction cannot be visually checked easily.

Brief Description of Drawings

[0009]

[Fig. 1] Fig. 1 is a perspective view showing the external appearance of an air-conditioning apparatus according to Embodiment 1 of the present disclosure.

[Fig. 2] Fig. 2 is a side view showing the external appearance of the air-conditioning apparatus according to Embodiment 1 of the present disclosure.

[Fig. 3] Fig. 3 is a bottom view of the air-conditioning apparatus according to Embodiment 1 of the present disclosure.

[Fig. 4] Fig. 4 is a longitudinal cross-sectional view of the air-conditioning apparatus according to Embodiment 1 of the present disclosure.

[Fig. 5] Fig. 5 is an explanatory view showing the configuration of a filter according to Embodiment 1 of the present disclosure.

[Fig. 6] Fig. 6 is a perspective view showing the configuration of a fan guard according to Embodiment 1 of the present disclosure.

[Fig. 7] Fig. 7 is a partial side view showing a housing according to Embodiment 1 of the present disclosure in a state where the fan guard and the filter are attached to the housing.

[Fig. 8] Fig. 8 is a partially enlarged view of a region R shown in Fig. 4.

[Fig. 9] Fig. 9 is an explanatory view showing another example of a portion to be engaged according to Embodiment 1 of the present disclosure.

Description of Embodiments

Embodiment 1

[0010] Fig. 1 is a perspective view showing the external appearance of an air-conditioning apparatus according to Embodiment 1 of the present disclosure. Fig. 2 is a side view showing the external appearance of the air-conditioning apparatus according to Embodiment 1 of the present disclosure. Fig. 3 is a bottom view of the air-conditioning apparatus according to Embodiment 1 of the present disclosure. Herein, the case where an air-conditioning apparatus 100 is installed on a floor 200 of an air-conditioned space will be described as an example. In the drawings, an X direction shown by an arrow indicates the width direction of the air-conditioning apparatus 100, a Y direction shown by an arrow indicates the depth direction of the air-conditioning apparatus 100, and a Z direction shown by an arrow indicates a height direction of the air-conditioning apparatus 100.

[0011] The air-conditioning apparatus 100 is connected to an outdoor unit not shown in the drawing via two connection pipes, thus forming a heat medium circuit. Any medium, such as refrigerant, water, and brine, for example, may be used as a heat medium. Herein, the case where water is used as the heat medium will be described as an example.

[0012] The air-conditioning apparatus 100 includes a housing 1, and bases 14 that support the housing 1. The

housing 1 includes a top portion 11, a front surface portion 12, two side frames 13, and a back surface portion 15. The top portion 11 is disposed at the upper face of the housing 1. The front surface portion 12 is disposed at the front face of the housing 1. The respective two side frames 13 are disposed at both lateral faces of the housing 1 in the width direction (the X direction shown by the arrow). The back surface portion 15 is disposed at the back face of the housing 1. The housing 1 has an open bottom that is used as an air inlet 26. The top portion 11 has an air outlet 21. An air passage is formed in the housing 1, and the air passage makes the air inlet 26 and the air outlet 21 communicate with each other.

[0013] The front surface portion 12 includes a plurality of plate parts 12a, 12b, 12c. Each of the plate parts 12a, 12b, 12c is attached to the side frames 13, or to the side frames 13 and the top portion 11 by, for example, screws. When maintenance of the air-conditioning apparatus 100 is performed, a required plate part out of the plurality of plate parts 12a, 12b, 12c is removed to inspect a device installed in the housing 1 or to replace a component.

[0014] The lower end portion of the front surface portion 12 has a front flange 12f formed by bending the lower end portion of the front surface portion 12 toward the rear. The front flange 12f partially covers a front portion of the bottom of the housing 1, thus forming the leading edge portion of the air inlet 26. The lower end portion of the back surface portion 15 has a rear flange 15f formed by bending the lower end portion of the back surface portion 15 toward the front. The rear flange 15f partially covers a rear portion of the bottom of the housing 1, thus forming the trailing edge portion of the air inlet 26.

[0015] The side frames 13 are used as a platform for installing devices in the housing 1. Each side frame 13 has a plurality of screw holes 29 (see Fig. 7), and a fixing screw 91 is inserted into each screw hole 29 to fix the base 14. The right side frame 13 has a drain hole 23 that allows discharging of moisture generated in the housing 1 to the outside.

[0016] One of the bases 14 is installed at the right lower portion of the housing 1 and the other of the bases 14 is installed at the left lower portion of the housing 1 to support the housing 1. In the example shown in Fig. 1, each base 14 includes a first piece 14a extending in the height direction (the Z direction shown by the arrow), and a second piece 14b extending toward the outside in the width direction (the X direction shown by the arrow) from the lower end of the first piece 14a. The base 14 is thus formed into a substantially L shape as viewed in a front view.

[0017] The upper portion of the first piece 14a of the base 14 is fixed to the side frame 13 by the plurality of fixing screws 91, and the second piece 14b of the base 14 is in contact with the floor 200. The housing 1 is supported by the bases 14 such that the height of the bottom of the housing 1 from the floor 200 is set to a height h. Therefore, a space is defined between the floor 200 and the bottom in which the air inlet 26 is provided. Air is

suctioned into the housing 1 through the space defined as described above and the air inlet 26.

[0018] Fig. 4 is a longitudinal cross-sectional view of the air-conditioning apparatus according to Embodiment 1 of the present disclosure. A plate-shaped air-sending device base 16 is installed in the housing 1, and the air-sending device base 16 has a ventilation hole 16a. The air-sending device base 16 is provided to extend between the two side frames 13, and is fixed to the respective side frames 13 by, for example, screws.

[0019] The air-conditioning apparatus 100 also includes a heat exchanger 2, a drain pan 3, an air-sending device 4, a filter 6, and a fan guard 7. The heat exchanger 2 is installed on the air passage. The heat exchanger 2 is, for example, a plate fin heat exchanger and exchanges heat between surrounding air and water flowing through a heat transfer tube. The heat exchanger 2 is disposed in the housing 1 and inclined to the front surface portion 12. The upper end portion of the heat exchanger 2 is positioned close to the back surface portion 15, and the lower end portion of the heat exchanger 2 is positioned close to the front surface portion 12. The heat exchanger 2 extends in the width direction (the X direction shown by the arrow) of the air-conditioning apparatus 100, and both lateral ends of the heat exchanger 2 are installed at the respective side frames 13.

[0020] Specifically, the right end portion of the heat exchanger 2 is attached to the right side frame 13 such that a water outlet 24 and a water inlet 22 of the heat transfer tubes shown in Fig. 1 and Fig. 2 are exposed from the side frame 13, and each heat transfer tube has a valve. Each valve is configured such that the valve can be externally manipulated by an operator. Of the two connection pipes that connect the air-conditioning apparatus 100 and the outdoor unit with each other, one connection pipe is connected to the water outlet 24 of the heat transfer tube, and the other connection pipe is connected to the water inlet 22 of the heat transfer tube. Further, a pipe cover 13a is attached, on the outside, to the right side frame 13 at a position where the right end portion of the heat exchanger 2 is attached.

[0021] The drain pan 3 is disposed below the heat exchanger 2, and receives water (drain water) generated when air is cooled by the heat exchanger 2 (see Fig. 4). The drain pan 3 is installed onto the air-sending device base 16 in an inclined state where the right end portion of the drain pan 3 is disposed at a lower position than is the left end portion of the drain pan 3. The drain pan 3 is also inclined in the depth direction (the Y direction shown by the arrow), and has a groove 3a at the lowermost portion of the drain pan 3. The groove 3a of the drain pan 3 is connected to the drain hole 23 provided in the right side frame 13. Drain water falling into the drain pan 3 from the heat exchanger 2 flows through the groove 3a toward the right, and is discharged to the outside of the housing 1 through the drain hole 23.

[0022] The air-sending device 4 is, for example, a sirocco fan. The blades of the air-sending device 4 are

rotated by a motor to generate an air flow. As shown in Fig. 4, the air-sending device 4 is installed below the air-sending device base 16 such that a discharge port 4a for air communicates with the ventilation hole 16a of the air-sending device base 16.

[0023] The fan guard 7 is provided to the bottom of the housing 1 in which the air inlet 26 is provided such that the fan guard 7 extends between the two side frames 13. The fan guard 7 prevents the finger of a person from coming into contact with the air-sending device 4 through the air inlet 26. A gap G is defined between the fan guard 7 and the bottom of the housing 1.

[0024] The filter 6 is provided such that the filter 6 covers the air inlet 26 to prevent the intrusion of dust and other particles into the housing 1. The filter 6 is disposed in the gap G between the bottom of the housing 1 and the fan guard 7, and is attached to the edge portion of the air inlet 26 such that the filter 6 can be mounted on or removed from the housing 1.

[0025] The air-conditioning apparatus 100 also includes a controller not shown in the drawing. The air-sending device 4, a remote control and other device are connected to the controller via a signal line. The controller controls the rotation frequency of the air-sending device 4 in accordance with signals input from the remote control to control a volume of air that is blown out from the air outlet 21.

[0026] Next, the manner of operation of the air-conditioning apparatus 100 will be described with reference to Fig. 1 to Fig. 4. During the operation of the air-conditioning apparatus 100, an air flow is generated because of the operation of the air-sending device 4, so that air in an air-conditioned space is suctioned into the housing 1 through the air inlet 26. At this point of operation, in the process where air is suctioned into the housing 1, dust in the air-conditioned space is removed by the filter 6. The air suctioned into the housing 1 is, by the air-sending device 4, supplied to the heat exchanger 2 disposed in the air passage, and exchanges heat at the heat exchanger 2 with water flowing through the heat exchanger 2.

[0027] In the case where cold water flows through the heat exchanger 2, the air supplied to the heat exchanger 2 is cooled by the cold water, and the cooled air is blown out to the outside of the housing 1 through the air outlet 21 by the air-sending device 4. The cooling operation of the air-conditioned space is performed in this manner. In contrast, in the case where hot water flows through the heat exchanger 2, air supplied to the heat exchanger 2 is heated by the hot water, and the heated air is blown out to the outside of the housing 1 through the air outlet 21 by the air-sending device 4. The heating operation of the air-conditioned space is performed in this manner.

[0028] Fig. 5 is an explanatory view showing the configuration of the filter according to Embodiment 1 of the present disclosure. The filter 6 includes net portions 61 and a frame portion 62. The net portions 61 catch dust in air while allowing air to pass through the net portions

61. The frame portion 62 is provided on the peripheries of the net portions 61 to hold the net portions 61. The frame portion 62 includes an outer frame portion 62a, first partition portions 62b, and a second partition portion 62c. The outer frame portion 62a is formed into a quadrangular shape, for example. The first partition portions 62b partition a region surrounded by the outer frame portion 62a in the width direction (the X direction shown by the arrow). The second partition portion 62c partitions the region surrounded by the outer frame portion 62a in the depth direction (the Y direction shown by the arrow). In one example shown in Fig. 5, the region surrounded by the outer frame portion 62a is partitioned into six sections by two first partition portions 62b and one second partition portion 62c, and the net portion 61 is installed in each section.

[0029] Further, an engagement portion 63 that is engaged with the housing 1 is provided to the outer frame portion 62a. Fig. 5 shows the case where the engagement portion 63 includes a plurality of pawl portions 63a, 63b. Four pawl portions 63a, 63b are provided to protrude from the outer frame portion 62a toward the air inlet 26, that is, to protrude toward the bottom of the housing 1, in a state where the filter 6 is attached to the housing 1. Of the four pawl portions 63a, 63b, two pawl portions 63a are provided to the front side of the outer frame portion 62a, and the remaining two pawl portions 63b are provided to the rear side of the outer frame portion 62a. Each pawl portion 63a provided to the front is raised upward from the front side of the outer frame portion 62a at a position adjacent to the net portion 61 disposed on the front, and the distal end portion of the pawl portion 63a is bent toward the outside, that is, toward the front. Whereas each pawl portion 63b provided to the rear is raised upward from the rear side of the outer frame portion 62a at a position adjacent to the net portion 61 disposed on the rear, and the distal end portion of the pawl portion 63b is bent toward the outside, that is, toward the rear.

[0030] Fig. 6 is a perspective view showing the configuration of the fan guard according to Embodiment 1 of the present disclosure. The fan guard 7 is formed into a lattice shape by causing a plurality of steel wires to be welded with each other, for example. Specifically, the fan guard 7 is formed into a substantially planar shape by a plurality of horizontal bars 71 extending in the width direction (the X direction shown by the arrow), and a plurality of vertical bars 72 extending in the depth direction (the Y direction shown by the arrow) and having a rail shape. The vertical bars 72 are arranged parallel to each other such that a separation between the adjacent vertical bars 72 is set to a separation that prevents the insertion of the finger of a person, for example. In one example shown in Fig. 6, the plurality of vertical bars 72 are caused to extend between two front and rear horizontal bars 71a, 71b, and a center horizontal bar 71c is provided between the front horizontal bar 71a and the rear horizontal bar 71b to support the plurality of vertical bars 72.

[0031] Further, both end portions of the front horizontal bar 71a and both end portions of the rear horizontal bar 71b are provided with mounting portions 73 by which the fan guard 7 is mounted on the housing 1. Four mounting portions 73 are provided on the face of the fan guard 7 that faces the air inlet 26. Specifically, each mounting portion 73 is formed such that the end portion of each of the horizontal bars 71a, 71b projecting from the corresponding one of the plurality of vertical bars 72 in the width direction (the X direction shown by the arrow) is bent upward, and the distal end portion is curled toward the rear into an arc shape.

[0032] Fig. 7 is a partial side view showing the housing 1 according to Embodiment 1 of the present disclosure in a state where the fan guard and the filter are attached to the housing 1. Fig. 8 is a partially enlarged view of a region R shown in Fig. 4. Fig. 8 shows the case where the edge portion of the air inlet 26 forms a portion to be engaged of the housing 1 with which the engagement portion 63 of the filter 6 is engaged. The structure of the air inlet 26 of the air-conditioning apparatus 100 and an area around the air inlet 26 will be described in detail with reference to Fig. 7 and Fig. 8.

[0033] Each side frame 13 has respective mounting holes 27 at a position close to the front face and at a position close to the back face, and the mounting holes 27 are holes used for mounting the fan guard 7. When the mounting portions 73 are fixed to the side frames 13 by mounting screws 92, the fan guard 7 is assembled to the housing 1. Specifically, in a state where the shaft (not shown in the drawing) of each mounting screw 92 is inserted into each mounting hole 27 of the side frame 13, the distal end portion of each mounting portion 73 is caught by the shaft of the mounting screw 92, and the mounting screws 92 are fastened. With such operations, the mounting portions 73 are fixed to the side frames 13.

[0034] As shown in Fig. 8, the fan guard 7 is inclined to the bottom of the housing 1. A separation L2 between the fan guard 7 and the bottom of the housing 1 at a position close to the back face is smaller than a separation L1 between the fan guard 7 and the bottom of the housing 1 at a position close to the front face. That is, at the position closer to the back surface portion 15 in the depth direction (the Y direction shown by the arrow), the fan guard 7 is positioned closer to the bottom of the housing 1 in the height direction (the Z direction shown by the arrow), that is, the gap G is gradually narrowed from the front face toward the back face. Herein, a portion of the bottom of the housing 1 close to the front face is composed of the front flange 12f of the front surface portion 12, and a portion of the bottom of the housing 1 close to the back face is composed of the rear flange 15f of the back surface portion 15. It is preferable that the separation L2 between the fan guard 7 and the bottom of the housing 1 at the position close to the back face be substantially equal to a thickness T of the filter 6.

[0035] Further, as described above, the plurality of vertical bars 72 are disposed on the upper faces of the three

horizontal bars 71a, 71b, 71c, so that the gap G between the fan guard 7 and the bottom of the housing 1 is a gap between the plurality of vertical bars 72 and the bottom of the housing 1. The fan guard 7 is installed such that the vertical bars 72 extend along the depth direction (the Y direction shown by the arrow).

[0036] The filter 6 is inserted into the gap G from the front face of the air-conditioning apparatus 100 by an operator such that the face of the filter 6 from which the plurality of pawl portions 63a, 63b protrude faces the air inlet 26. Hereinafter, there may be a case where the front face of the air-conditioning apparatus 100 is referred to as "frontward portion", and the back face of the air-conditioning apparatus 100 is referred to as "inward portion". When the filter 6 is pushed in a direction indicated by an arrow D (hereinafter referred to as "insertion direction") from the frontward portion toward the inward portion, the filter 6 smoothly moves along the plurality of vertical bars 72 of the fan guard 7. At this point of operation, the distal end portion of the filter 6 in the insertion direction is lifted to a position higher than the height position of the distal end portion of the filter 6 at the frontward portion, thus being brought close to the bottom of the housing 1, and the two pawl portions 63b provided to the filter 6 are guided to the position of the trailing edge portion of the air inlet 26. Then, the two pawl portions 63b of the filter 6 protruding upward are caught by the trailing edge portion of the air inlet 26 and, when the filter 6 is further pushed, the two pawl portions 63b are engaged with the trailing edge portion of the air inlet 26, that is, the rear flange 15f. In a state where the two pawl portions 63b on the rear of the filter 6 are engaged with the trailing edge portion of the air inlet 26, the two pawl portions 63a on the front of the filter 6 are caught by the leading edge portion of the air inlet 26, that is, the front flange 12f. The filter 6 is attached to the housing 1 in this manner.

[0037] As described above, the fan guard 7 is provided for preventing a contact with the air-sending device 4, and the fan guard 7 is also used as a guide for the filter 6. Therefore, by inserting the filter 6 into the gap G, an operator can easily attach the filter 6 to the housing 1. Further, in the case where the engagement portion 63 includes the pawl portions 63a, 63b, and the portion to be engaged is the edge portion of the air inlet 26, the operator can remove the filter 6 from the housing 1 by pulling the filter 6 toward the frontward portion. Accordingly, maintenance of the filter 6 can be easily performed.

[0038] Further, the horizontal bar 71c disposed at the center of the fan guard 7 and the second partition portion 62c of the filter 6 are disposed such that the horizontal bar 71c and the second partition portion 62c at least partially overlap with each other as viewed in a bottom view (see Fig. 3). As described above, by collectively disposing parts that inhibit air flowing into the housing, it is possible to reduce the resistance to air flowing into the housing through the fan guard 7 and the filter 6.

[0039] The shape of the engagement portion 63 of the filter 6 and the shape of the portion to be engaged of the

housing 1 are not limited to the above-mentioned shapes. Fig. 9 is an explanatory view showing another example of the portion to be engaged according to Embodiment 1 of the present disclosure. In one example shown in Fig. 9, the portion to be engaged includes insertion holes 12d, 15d. The front flange 12f has an insertion hole 12d at each of the left portion and the right portion of the front flange 12f, and the rear flange 15f has an insertion hole 15d at each of the left portion and the right portion of the rear flange 15f. When the filter 6 is inserted into the gap G by an operator, the fan guard 7 is used as a guide, so that the distal end portion of the filter 6 is lifted, and the pawl portions 63b on the rear of the filter 6 are inserted into the insertion holes 15d of the rear flange 15f. Further, in a state where the two pawl portions 63b are engaged with the rear flange 15f, the pawl portions 63a on the front of the filter 6 are inserted into the respective insertion holes 12d of the front flange 12f.

[0040] As described above, in the air-conditioning apparatus 100 of Embodiment 1, the fan guard 7 is installed on the housing 1 such that the gap G between the fan guard 7 and the face of the housing 1 in which the air inlet 26 is provided is narrowed toward the inward portion in the insertion direction into which the filter 6 is inserted. With such a configuration, the gap G is greater on the frontward portion than at the inward portion in the insertion direction, so that the filter 6 can be easily inserted. Further, the gap G is narrowed toward the inward portion in the insertion direction and hence, the filter 6 can be, at the inward portion, brought close to the face of the housing 1 in which the air inlet 26 is provided. Therefore, when an operator inserts the filter 6 along the fan guard 7, the fan guard 7 is also used as the guide for the filter 6. Accordingly, even in the case where the inward portion in the insertion direction into which the filter 6 is inserted cannot be visually checked easily, the operator can easily install the filter 6 into the housing 1.

[0041] Further, when the filter 6 is inserted into the gap G, the fan guard 7 installed on the housing 1 guides the engagement portion 63 of the filter 6 to a position of the portion to be engaged that is provided to the housing 1. When the filter 6 is pushed in the insertion direction, the engagement portion 63 and the portion to be engaged are engaged with each other. Accordingly, the operator is not required to visually check the position of the engagement portion 63 and the position of the portion to be engaged, and the operator can mount the filter 6 onto the housing 1 by pushing the filter 6 in the insertion direction (direction indicated by the arrow D). Further, the above-mentioned filter 6 and fan guard 7 are easily applicable to some air-conditioning apparatus by replacing a filter and a fan guard of the air-conditioning apparatus with the above-mentioned filter 6 and fan guard 7, so that ease of mounting the filter 6 can be improved.

[0042] Further, the engagement portion 63 includes the pawl portions 63b provided on the filter 6 and protruding toward the opening port (the air inlet 26), and the portion to be engaged includes the insertion holes 15d

or the edge portion (for example, the rear flange 15f) of the opening port. With such a configuration, when the filter 6 is pushed, the pawl portions 63b protruding toward the air inlet 26 are inserted into the insertion holes 15d, or are caught by the edge portion of the air inlet 26, so that the engagement portion 63 and the portion to be engaged are engaged with each other. Further, when the filter 6 is pulled toward the frontward portion in an opposite direction of the insertion direction, the pawl portions 63b are removed from the insertion holes 15d or from the edge portion of the air inlet 26, so that the engagement is released. As described above, the filter 6 can be mounted on or removed from the housing 1 with a simple structure and hence, maintenance, such as replacement of the filter 6, can be easily performed.

[0043] Further, the fan guard 7 is formed into a planar shape, and is inclined to the face of the housing 1 in which the opening port (the air inlet 26) is provided. Therefore, by setting the length of the mounting portions 73 in the height direction (the Z direction shown by the arrow) at the frontward portion to be different from that at the inward portion in the insertion direction, or by setting the height position of the mounting holes 27 at which the mounting portions 73 are attached at the frontward portion to be different from that at the inward portion in the insertion direction, the configuration where the gap G is gradually narrowed can be achieved with a simple structure.

[0044] Further, the opening port is the air inlet 26 provided at the bottom of the housing 1. In this case, when an operator inserts the filter 6 into the gap G, the distal end portion of the filter 6 in the insertion direction is brought, against gravity, close to the bottom at which the air inlet 26 is provided while being supported by the fan guard 7. Therefore, also in the case where the air inlet 26 is provided at the bottom of the housing 1, the filter 6 can be easily mounted. As described above, in the case where the air-conditioning apparatus having the air inlet at the bottom of housing is installed on the floor 200 at a place having a limitation on an installation height, a sufficient space cannot be provided between the bottom of the housing and the floor 200, so that the operator cannot easily check the position of the portion to be engaged at the bottom. However, in the air-conditioning apparatus 100 of Embodiment 1, when the filter 6 is inserted into the gap G, the filter 6 is brought close to the bottom at a position close to the back face of the housing 1 and hence, the filter 6 can be easily installed on the housing 1.

[0045] Embodiment of the present disclosure is not limited to the above-mentioned Embodiment, and various modifications are conceivable. For example, the description has been made such that the bottom of the housing 1 is open except for portions covered by the front flange 12f and the rear flange 15f. However, it may be configured such that a bottom plate is provided to the bottom of the housing 1, and the air inlet 26 is provided in the bottom plate. Further, the case where the fan guard 7 is installed on the opening port (the air inlet 26 in Embodiment 1) at the bottom has been described as an example. However,

in the case where the air-sending device 4 is installed at a position close to the top portion 11, the fan guard 7 may be installed on the opening port (the air outlet 21 in Embodiment 1) at the upper face. In this case, the fan guard 7 is installed on the housing 1 such that the gap G is defined between the fan guard 7 and the top portion 11.

[0046] Fig. 6 shows the case where the horizontal bars 71 and the vertical bars 72 of the fan guard 7 are orthogonal to each other. However, the shape of the fan guard 7 is not particularly limited to such a case. It is sufficient that the fan guard 7 is formed to prevent the insertion of the finger through the fan guard 7, and the vertical bars 72, which are parts extending in a direction aligning with the insertion direction into which the filter 6 is inserted, are disposed on the upper faces of the horizontal bars 71, that is, on the faces of the horizontal bars 71 that are close to the filter 6. Of the plurality of horizontal bars 71a, 71b, 71c, the horizontal bar 71c provided at the center may not be provided. As long as the fan guard 7 can be fixed to the housing 1, any shape may be adopted for the shape of the mounting portions 73.

[0047] Further, the number of pawl portions 63a, 63b is not limited to four. It is sufficient that the filter 6 can be stably installed on the housing 1. As long as the filter 6 can be easily mounted on and removed from the housing 1, any combination of shapes may be adopted for the shape of the engagement portion 63 and the shape of the portion to be engaged.

Reference Signs List

[0048] 1 housing 2 heat exchanger 3 drain pan 3a groove 4 air-sending device 4a discharge port 6 filter 7 fan guard 11 top portion 12 front surface portion 12a, 12b, 12c plate part 12d insertion hole 12f front flange 13 side frame 13a pipe cover 14 base 14a first piece 14b second piece 15 back surface portion 15d insertion hole 15f rear flange 16 air-sending device base 16a ventilation hole 21 air outlet 22 water inlet 23 drain hole 24 water outlet 26 air inlet 27 mounting hole 29 screw hole 61 net portion 62 frame portion 62a outer frame portion 62b first partition portion 62c second partition portion 63 engagement portion 63a, 63b pawl portion 71, 71a, 71b, 71c horizontal bar 72 vertical bar 73 mounting portion 91 fixing screw 92 mounting screw 100 air-conditioning apparatus 200 floor G gap L1, L2 separation T thickness h height

Claims

1. An air-conditioning apparatus, comprising:

a housing having an opening port and an air passage formed in the housing and connected to the opening port;

an air-sending device installed in the housing and configured to generate an air flow in the air

passage;

a heat exchanger disposed in the air passage and configured to cause air and a heat medium to exchange heat;

a fan guard installed on the housing with a gap defined between the fan guard and a face of the housing in which the opening port is provided, the fan guard preventing a contact with the air-sending device; and

a filter attached to the housing such that the filter is inserted into the gap, the filter covering the opening port,

the fan guard being installed on the housing such that the gap is narrowed toward an inward portion in an insertion direction into which the filter is inserted.

2. The air-conditioning apparatus of claim 1, wherein the filter includes an engagement portion that engages with the housing, the housing is provided with a portion to be engaged that is engaged with the engagement portion, when the filter is inserted, the fan guard installed on the housing guides the filter such that the engagement portion reaches a position of the portion to be engaged, and the engagement portion and the portion to be engaged are engaged with each other when the filter is pushed in the insertion direction.
3. The air-conditioning apparatus of claim 2, wherein the engagement portion is a pawl portion provided on the filter and protruding toward the opening port, and the portion to be engaged is an insertion hole or an edge portion of the opening port.
4. The air-conditioning apparatus of any one of claims 1 to 3, wherein the fan guard is formed into a planar shape, and is inclined to the opening-port-provided face of the housing.
5. The air-conditioning apparatus of any one of claims 1 to 4, wherein the opening port is an air inlet provided at a bottom of the housing.

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FIG. 1

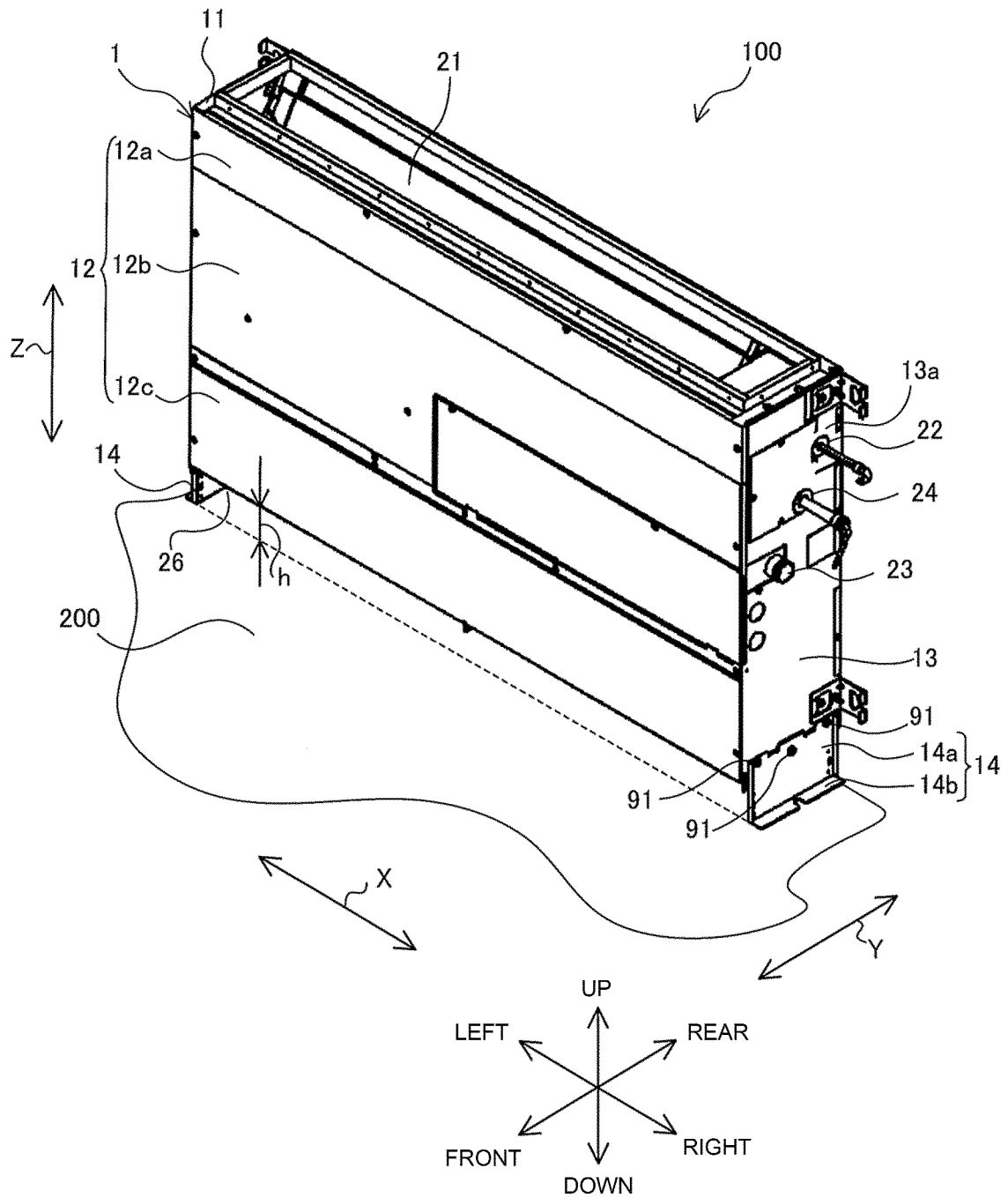


FIG. 2

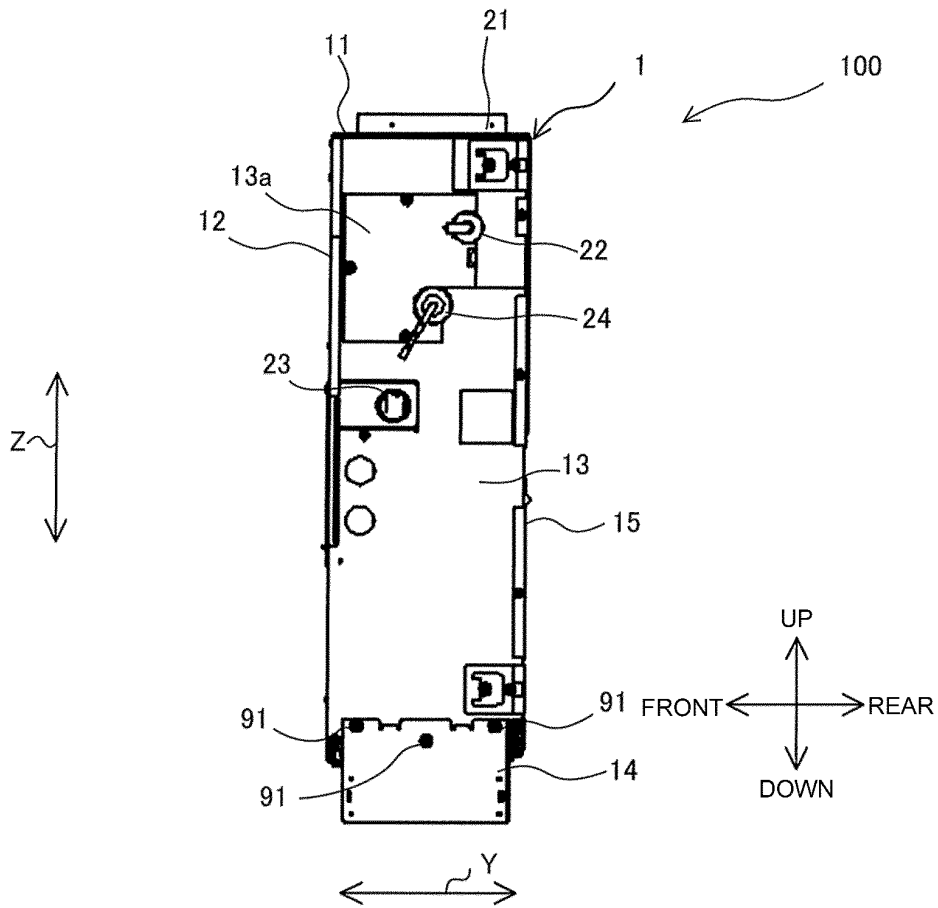


FIG. 3

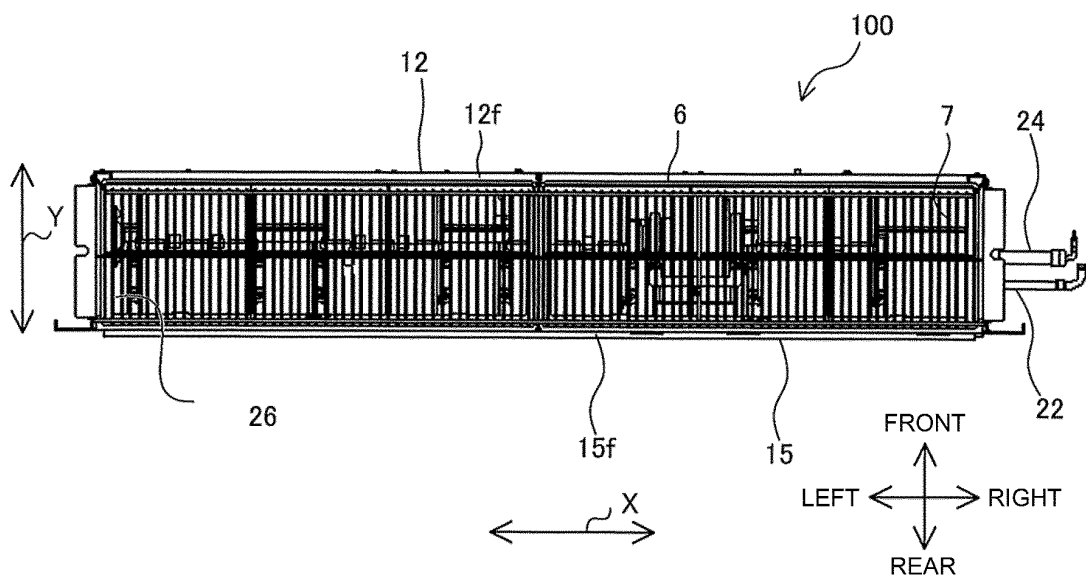


FIG. 4

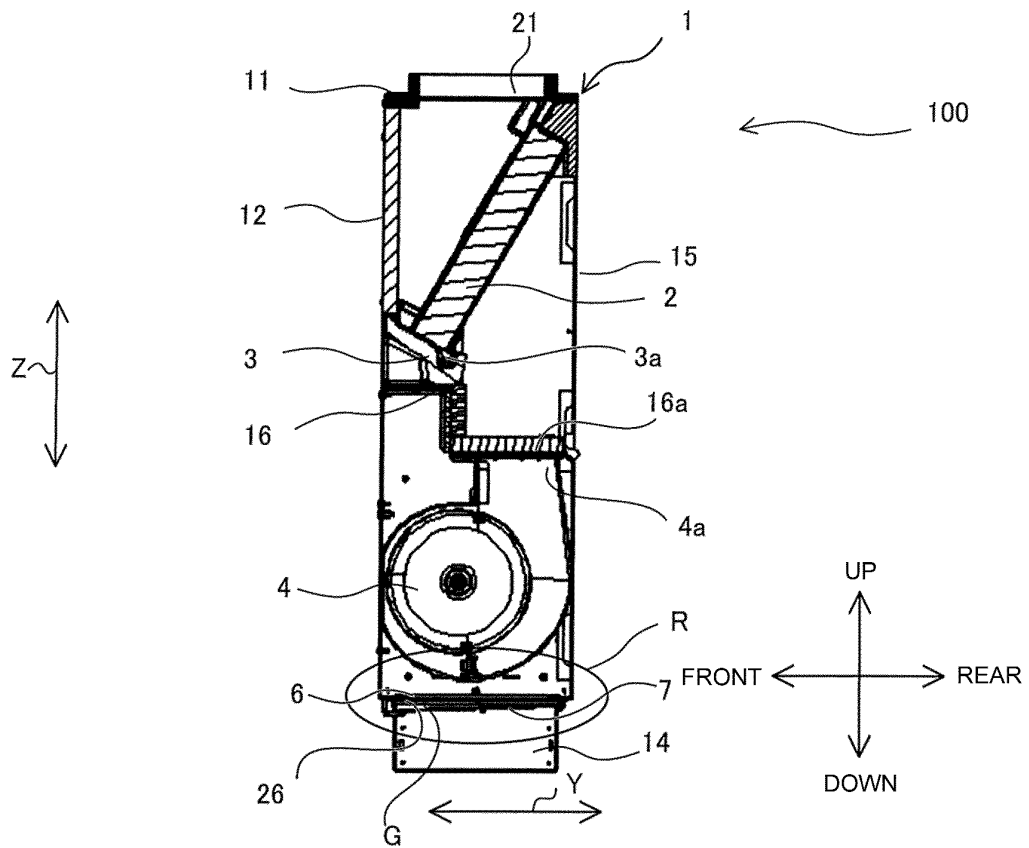


FIG. 5

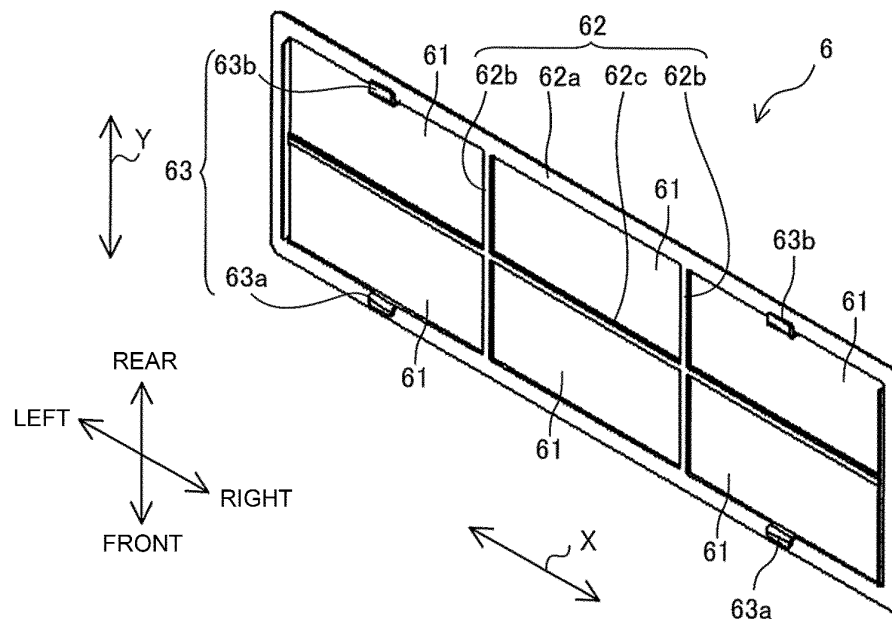


FIG. 6

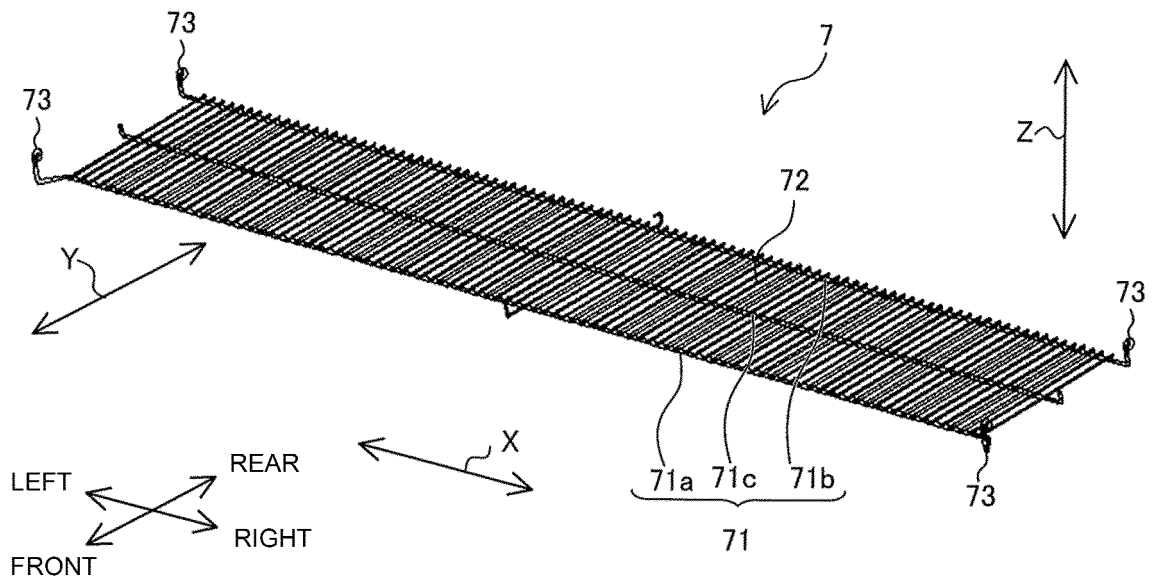


FIG. 7

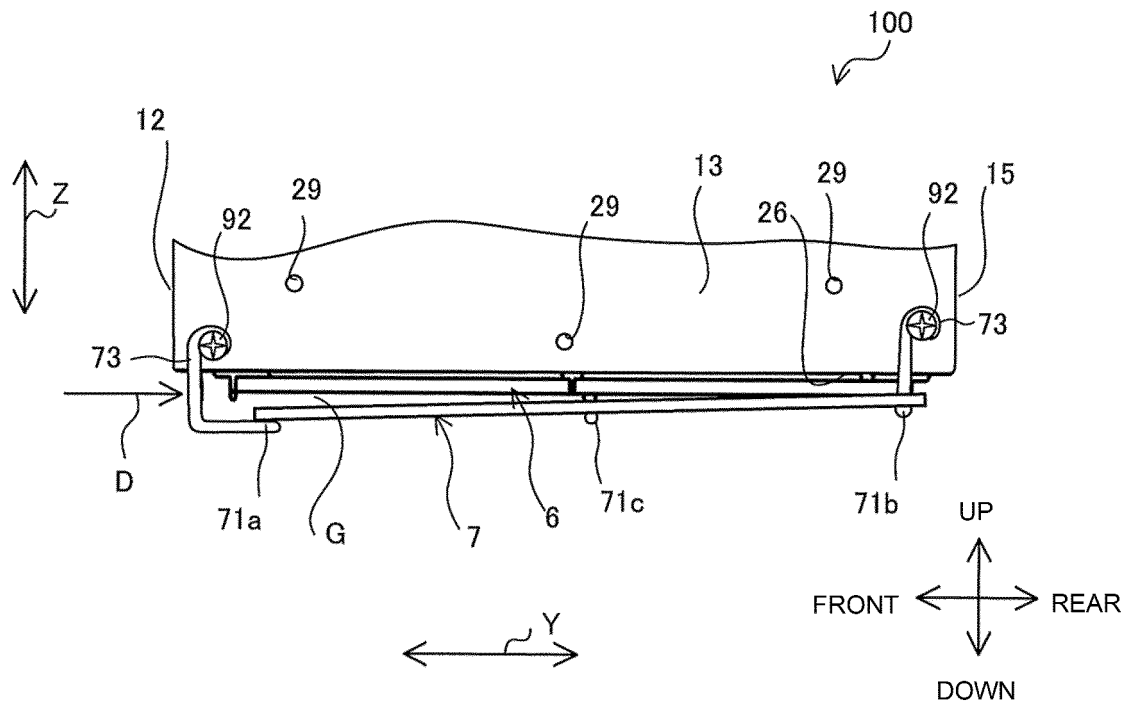


FIG. 8

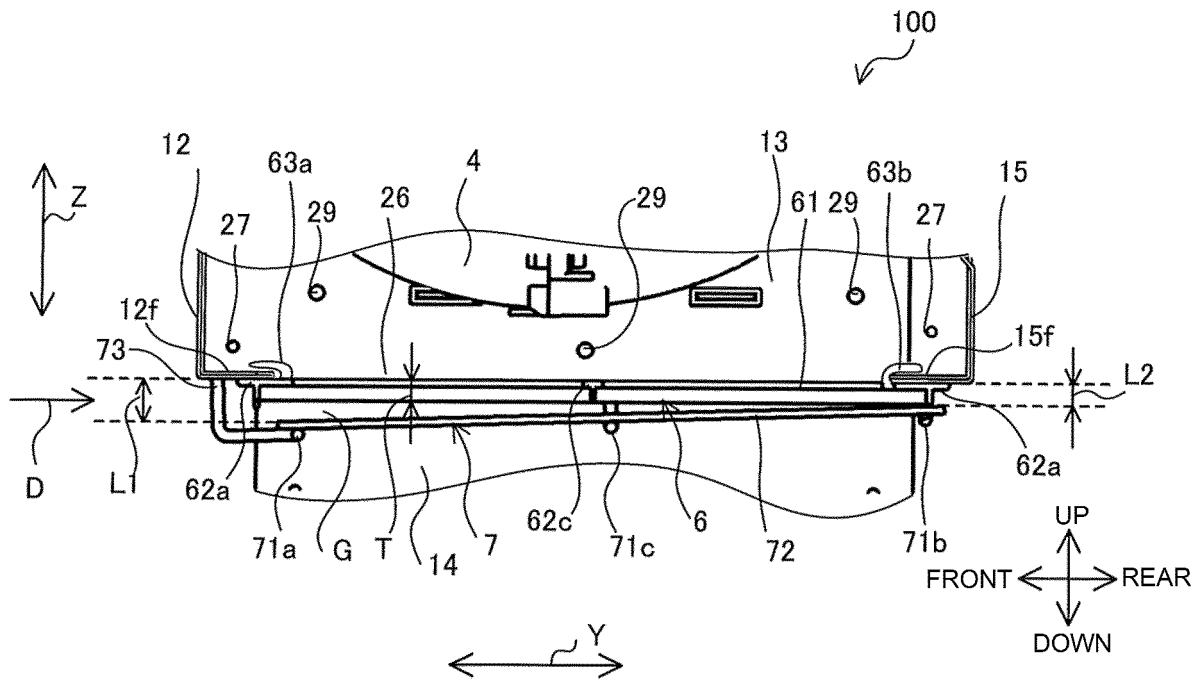
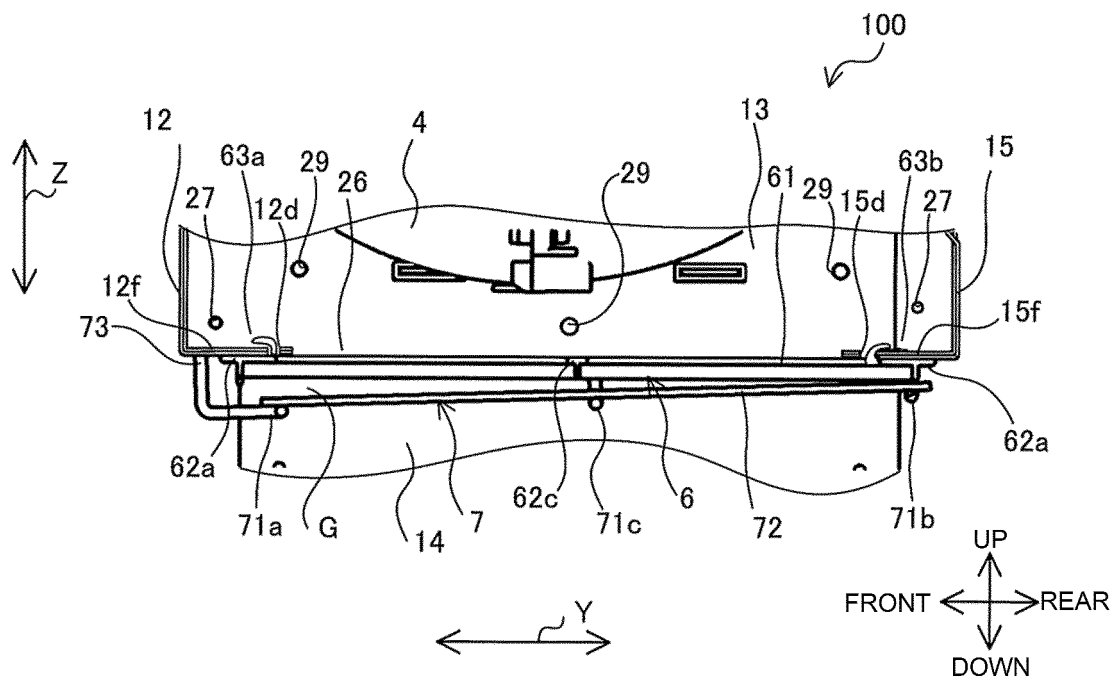


FIG. 9



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2018/022937

A. CLASSIFICATION OF SUBJECT MATTER

Int. Cl. F24F1/00 (2011.01) i, F24F13/20 (2006.01) i, F24F13/28 (2006.01) i

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. F24F1/00, F24F13/20, F24F13/28, B01D46/02, B60H3/06

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 1971-2018
 Registered utility model specifications of Japan 1996-2018
 Published registered utility model applications of Japan 1994-2018

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	Microfilm of the specification and drawings	1
Y	annexed to the request of Japanese Utility Model Application No. 128696/1984 (Laid-open No. 44120/1986) (TOSHIBA CORP.) 24 March 1986, description, page 3, line 20, to page 8, line 20, fig. 1, 2 (Family: none)	2-5
Y	JP 11-101498 A (FUJITSU GENERAL LTD.) 13 April 1999, paragraphs [0020]-[0030], fig. 1-7 (Family: none)	2-5
Y	JP 11-276827 A (SHARP CORP.) 12 October 1999, fig. 3 (Family: none)	4-5



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents:

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search
15.08.2018Date of mailing of the international search report
28.08.2018

Name and mailing address of the ISA/
 Japan Patent Office
 3-4-3, Kasumigaseki, Chiyoda-ku,
 Tokyo 100-8915, Japan

Authorized officer

Telephone No.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2018/022937

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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 102818/1978 (Laid-open No. 20069/1980) (MITSUBISHI ELECTRIC CORP.) 08 February 1980, description, page 1, line 10, to page 4, line 15, fig. 1-7 (Family: none)	1-5

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2016205722 A [0004]