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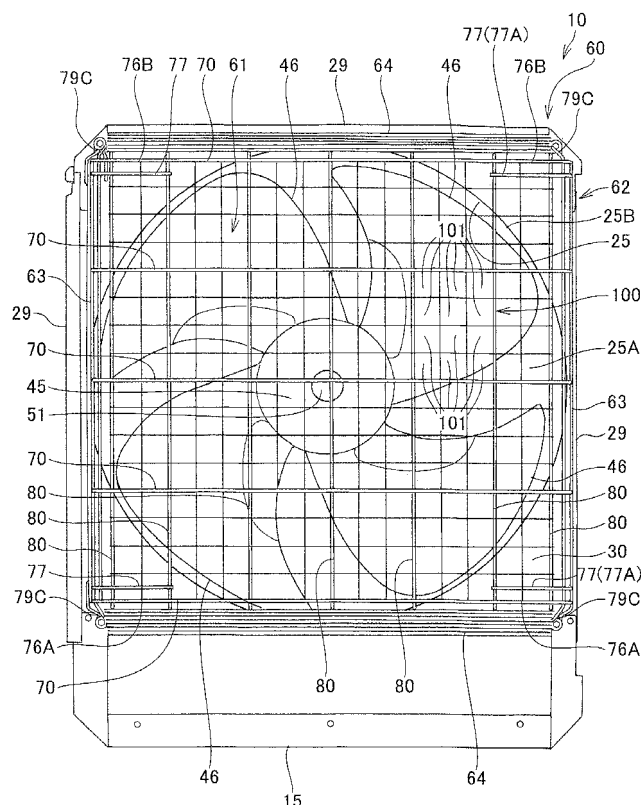
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(54) **Fan guard and air conditioner having the same**

(57) A fan guard (60, 160) includes a plurality of large-diameter wire rods (70, 80) and a plurality of small-diameter wire rods (90, 91) that are arranged so as to intersect

to one another, and the small-diameter wire rods are arranged in a grid pattern between the large-diameter wire rods. The fan guard is provided to an outdoor unit of an air conditioner.

FIG.3



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Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to a fan guard and an air conditioner having the same.

2. Description of the Related Art

[0002] An outdoor unit of an air conditioner has been hitherto constructed so that a fan guard formed by combining wire rods is provided to an air blow-out port to cover the fan of an air blower so that worker's fingers can be prevented from coming into contact with the fan (see Japanese patent No. 4,631,882, for example). In the fan guard disclosed in this Japanese patent publication, the fan guard is constructed by combining large-diameter wire rods and small-diameter wire rods, and plural small-diameter wire rods are arranged in parallel between large-diameter wire rods so as to be spaced from one another at predetermined intervals, so that plural rectangular openings are formed.

[0003] In the fan guard described above, the rectangular openings are arranged on a line between the large-diameter wire rods. Therefore, the interval between the small-diameter wire rods is required to be small so that such a thin and wide object as a palm or the like is prevented from being inserted through the openings. As a result, the occupation area of the wire rods in the openings increases and the resistance to air flow also increases.

SUMMARY OF THE INVENTION

[0004] The present invention has been attained in view of the foregoing situation, and has an object to provide a fan guard that can reduce resistance to air flow with preventing invasion of a hand or the like into the fan guard, and an air conditioner having the fan guard.

[0005] In order to attain the above object, according to a first aspect of the present invention, a fan guard (60, 160) constructed by a plurality of wire rods is **characterized in that** a plurality of large-diameter wire rods (70, 80) and a plurality of small-diameter wire rods (90, 91) are arranged so as to intersect to one another, and the small-diameter wire rods are arranged in a grid pattern between the large-diameter wire rods.

[0006] In the fan guard, the plurality of small-diameter wire rods are assembled with one another to form a grid-pattern small-diameter grid member (68), the plurality of large-diameter wire rods are assembled with one another to form a frame portion (67), and the small-diameter grid member is supported on the frame portion.

[0007] In the fan guard, the fan guard is configured in a box-shape and has a ventilation surface portion (61) and a vertical side surface portion (63), the ventilation

surface portion is provided with a band fixing portion (76A, 76B) to which a fixing band (110) is secured for the purpose of transport of the outdoor unit, and the band fixing portion is formed in the large-diameter wire rods.

5 [0008] In the fan guard, the ventilation surface portion is fixed to a fixing surface (30) of an air blow-out port (25A) of an air blower (22) through a side surface portion (62) extending from a peripheral edge of the ventilation surface portion to a peripheral edge portion (25B) of the air blow-out port, the side surface portion has the vertical side surface portion (63) extending vertically from the ventilation surface portion to the fixing surface, and the vertical side surface portion is provided at the outside of the peripheral edge portion of the air blow-out port.

10 [0009] In the fan guard, the wire rods are bent at a fixing portion at which the side surface portion is fixed to the fixing surface.

15 [0010] According to a second aspect of the present invention, an air conditioner having a fan guard (60, 160) that is provided at an air blow-out port (25A) of an outdoor unit (10) and covers a fan (24) of an air blower (22) is **characterized in that** the fan guard comprises a plurality of large-diameter wire rods (70, 80) and a plurality of small-diameter wire rods (90, 91) that are arranged so as to intersect to one another, and the small-diameter wire rods are arranged in a grid pattern between the large-diameter wire rods.

20 [0011] In the air conditioner, the plurality of small-diameter wire rods are assembled with one another to form a grid-pattern small-diameter grid member (68), the plurality of large-diameter wire rods are assembled with one another to form a frame portion (67), and the small-diameter grid member is supported on the frame portion.

25 [0012] In the fan guard, the fan guard is configured in a box-shape and has a ventilation surface portion (61) and a vertical side surface portion (63), the ventilation surface portion is provided with a band fixing portion (76A, 76B) to which a fixing band (110) is secured for the purpose of transport of the outdoor unit, and the band fixing portion is formed in the large-diameter wire rods.

30 [0013] In the air conditioner, the ventilation surface portion is fixed to a fixing surface (30) of the air blow-out port (25A) of the air blower (22) through a side surface portion (62) extending from a peripheral edge of the ventilation surface portion to a peripheral edge portion (25B) of the air blow-out port, the side surface portion has the vertical side surface portion (63) extending vertically from the ventilation surface portion to the fixing surface, and the vertical side surface portion is provided at the outside of the peripheral edge portion of the air blow-out port.

35 [0014] In the fan guard, the wire rods are bent at a fixing portion at which the side surface portion is fixed to the fixing surface.

40 [0015] According to the present invention, the resistance to air flow can be reduced with preventing invasion of a hand or the like into the fan guard.

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BRIEF DESCRIPTION OF THE DRAWINGS

[0016]

Fig. 1 is a longitudinally sectional view of an outdoor unit according to an embodiment of the present invention;

Fig. 2 is a cross-sectional view of the outdoor unit;

Fig. 3 is a plan view of the outdoor unit when the outdoor unit is viewed from the upper side;

Fig. 4 is a perspective view of a fan guard;

Fig. 5 is a perspective view of a frame member at a side surface side;

Fig. 6 is a perspective view of the frame member at a front-and-rear side;

Fig. 7 is a perspective view of a small-diameter grid member;

Fig. 8 is a front view showing a test finger used for a test of guard performance of the fan guard;

Fig. 9 is a perspective view showing the surrounding of a corner portion of the fan guard;

Fig. 10 is a perspective view showing a state that the outdoor unit is transported; and

Fig. 11 is a perspective view showing the surrounding of the corner portion of the fan guard according to a modification of the embodiment.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0017] Embodiments according to the present invention will be described with reference to the drawings.

[0018] An air conditioner according to an embodiment comprises an outdoor unit 10 and an indoor unit (not shown), and refrigerant is made to flow through a refrigerant circuit connected through a refrigerant pipe so as to perform cooling operation and heating operation. The outdoor unit 10 is disposed outdoors to heat-exchange refrigerant with outdoor air. Under cooling operation, the refrigerant is condensed to radiate the heat thereof to the outdoor air. Under heating operation, the refrigerant is vaporized to take the heat of the outdoor air. In the following description, the up-and-down (vertical) direction and the right-and-left (horizontal) direction are directions defined when the outdoor unit 10 is viewed from the front side thereof while installed.

[0019] Fig. 1 is a longitudinally sectional view of the outdoor unit 10, and Fig. 2 is a top view showing the internal construction of the outdoor unit 10. The outdoor unit 10 has a unit case (housing) 11 having a substantially rectangular parallelepiped box-like shape, and the unit case 11 is configured to have a bottom plate 12, support poles 14 extending vertically from the four corners of the bottom plate 12 and a front panel 15 (Fig. 2).

[0020] As shown in Fig. 2, a heat exchanger 21 which is configured to be bent in a substantially U-shape in top view is disposed on the bottom plate 12, and an air blower 22 is disposed at the upper side of the heat exchanger 21 as shown in Fig. 1. As shown in Fig. 2, the heat ex-

changer 21 constitutes a side surface portion of the unit case 11, and is arranged so as to extend from the left side surface of the unit case 11 along the rear surface and right side surface of the unit case 11.

[0021] As shown in Fig. 1, the air blower 22 is configured to have a fan motor (motor) 23 disposed at the upper side of the heat exchanger 21, and a propeller fan 24 (fan) secured to a motor shaft 51 of the fan motor 23.

[0022] An upper frame 16 which is formed in a frame-shape along the U-shape of the heat exchanger 21 is provided to the upper surface of the heat exchanger 21. The upper frame 16 has plate-shaped frame plates 16A, 16B and 16C provided along the upper surfaces of the left side surface, rear surface and right side surfaces of the U-shaped heat exchanger 21 respectively, and a joint plate (not shown) for joining the front ends of the frame plates 15A and 16C. The four corners of the upper frame 16 are joined to the respective support poles 14.

[0023] A pair of motor support tables 17 extending substantially in parallel to the frame plates 16A and 16C are bridged between the frame plate 16B and the joint plate, and the fan motor 23 is fixed to the upper surfaces of the motor support tables 17.

[0024] The fan motor 23 has a cylindrical body portion 52 and a motor shaft 51 (Fig. 1) which extends upwardly from the body portion 52 and supports the propeller fan 24. The propeller fan 24 has a resin hub 45 and plural blades 46 which are integrally formed on the outer periphery of the hub 45 so as to have a predetermined blade angle and be spaced from one another at predetermined intervals.

[0025] The body portion 52 has radiation fins 53 formed on the outer peripheral portion thereof, and a pair of fixing stay pieces 54 extending substantially horizontally along the outer peripheral portion.

[0026] The fan motor 23 is fixedly fastened to the motor support tables 17 by bolts (not shown) while the body portion 52 is mounted between the motor support tables 17 and the fixing stay pieces 54 are mounted on the motor support tables 17.

[0027] As shown in Fig. 1, a cylindrical bell mouth 25 for guiding air at an air suction side of the propeller fan 24 to an air blow-out side is provided around the propeller fan 24, and the air blow-out port 25A of the bell mouth 25 is covered by a fan guard 60 for preventing a human body or the like from coming into contact with the propeller fan 24. Furthermore, a face panel 29 is provided around the bell mouth 25 so as to surround the bell mouth 25, and a heat insulating material 26 formed of foamed polystyrene or the like is provided between the outer peripheral surface of the bell mouth 25 and the face panel. The propeller 24 is disposed to be located at the center of the U-shaped heat exchanger 21.

[0028] When the propeller fan 24 is rotated by the fan motor 23, outdoor air is sucked into the unit case 11 from the periphery of the outdoor unit 10, more specifically, from the left side surface side, rear surface side and right side surface side, excluding the front side surface of the

unit case 11 as indicated by arrows X in Fig. 1. The sucked outdoor air is passed through the air blow-out port 25A of the bell mouth 25 provided to the upper surface portion of the unit case 11 and the fan guard 60. That is, the outdoor unit 10 is configured as a top air-blow type for blowing out heat-exchanged air from the upper (top) surface of the outdoor unit 10.

[0029] A compressor (not shown), an accumulator 31, an oil separator 32 and a receiver tank 33 constituting a part of the refrigerant circuit are provided on the bottom plate 12 in the unit case 11, and also refrigerant circuit constituent parts such as valve bodies such as a four-way valve (not shown), an expansion valve (not shown), etc. are connected to one another through a pipe and mounted in the unit case 11. One end side of the pipe for the refrigerant circuit constituent parts is pipe-connected to the indoor unit through the heat exchanger 21, and the other end side of the pipe for the refrigerant circuit constituent parts is pipe-connected to the indoor unit, thereby constructing the refrigerant circuit in which refrigerant is circulated. The accumulator 31 is located substantially at the center of the bottom plate 12 below the fan motor 23.

[0030] Furthermore, in this construction, the compressor is disposed at the front surface side of the unit case 11, and an electrical component box 34 in which various kinds of electrical component units such as a control board for controlling the air conditioner, etc. are mounted is disposed in a space above the compressor. Therefore, by detaching the front panel 15, a worker can easily perform a maintenance work of parts in the unit case 11 from the front side. Reference numeral 35 represents a cover plate which is provided above the compressor to prevent rain drops from directly impinging to the compressor.

[0031] Fig. 3 is a plan view of the outdoor unit 10 when the outdoor unit 10 is viewed from the upper side.

[0032] A top plate 30 (fixing face) is provided to the upper (top) surface of the outdoor unit 10 so as to block the gap between the peripheral edge portion 25B of the air blow-out port 25A of the bell mouth 25 and the face panel 29, and the fan guard 60 is fixed to the top plate 30. The fan guard 60 is formed in a substantially rectangular shape in plan view so as to cover the whole of the circular air blow-out port 25A.

[0033] Fig. 4 is a perspective view showing the fan guard 60.

[0034] As shown in Figs. 3 and 4, the fan guard 60 is formed by combining metal wire rods, and configured in such a box-like shape as to have a substantially rectangular ventilation (air flowing) surface portion 61 confronting the propeller fan 24 and a side surface ventilation (air flowing) surface portion 62 (side surface portion) comprising four surfaces extending from the peripheral edge of the ventilation surface portion 61 to the top plate 30 side.

[0035] The side surface ventilation portion 62 has a pair of vertical side surface portions 63 extending vertically from the ventilation surface portion 61 to the peripheral

eral edge portion 25B side of the air blow-out port 25A, and a pair of slope side surface portions 64 extending from the ventilation surface portion 61 while sloping so as to spread more widely (for example, gradually more widely) as it is nearer to the peripheral edge portion 25B side. The vertical side surface portions 63 are the side surface portions corresponding to the left and right surfaces of the outdoor unit 10. The slope side surface portions 64 are the side surface portions corresponding to the front and rear surfaces of the outdoor unit 10.

[0036] In this embodiment, the vertical side surface portions 63 are provided at the outside of the peripheral edge portion 25B of the air blow-out port 25A. Therefore, the vertical side surface portions 63 do not obstruct flow of air blown out from the peripheral edge portion 25B of the air blow-out port 25A, and the resistance to air flow can be reduced.

[0037] The fan guard 60 is formed by combining (assembling) a side surface frame member 65 (Fig. 5) having the vertical side surface portions 63 and a front-and-rear side surface frame member 66 (Fig. 6) having the slope side surface portions 64 to form a frame-shaped frame portion 67, and supporting a small-diameter grid member 68 (Fig. 7) formed in a grid pattern on the frame portion 67.

[0038] Fig. 5 is a perspective view showing the side surface frame member 65.

[0039] As shown in Figs. 4 and 5, the side surface side frame member 65 is configured to have plural (five in this embodiment) lateral-side large-diameter wire rods 70 (large-diameter wire rods) extending in parallel to the ventilation surface portion 61 and plural side surface side small-diameter wire rods 71 fixed to the lateral-side large-diameter wire rods 70. The lateral-side large-diameter wire rods 70 have a larger diameter than the side surface side small-diameter wire rods 71.

[0040] Each of the lateral-side large-diameter wire rods 70 has a support portion 72 extending in parallel to the ventilation surface portion 61, and support portions 73 which are formed by bending both the end sides of the support portion 72 substantially vertically so as to extend in the height direction of the fan guard 60. The lateral-side large-diameter wire rods 70 are arranged side by side in parallel to one another so as to be spaced from one another at a fixed interval under the state that the lateral-side large-diameter wire rods are erected by the support portions 73. The respective lateral-side large-diameter wire rods 70 arranged side by side are joined to one another by joining the plural side surface side small-diameter wire rods 71 to the respective support portions 73.

[0041] Each side surface side small-diameter wire rod 71 is disposed orthogonally to each support portion 73, and welded to each support portion 73 while brought into contact with each support portion 73 from the outside. The respective side surface side small-diameter wire rods 71 are arranged in parallel so as to be spaced from one another at predetermined intervals, and plural side surface side small-diameter wire rods 71 are arranged

in the height direction of the fan guard 60 at both the end sides of each lateral-side large-diameter wire rod 70, thereby constituting a pair of vertical side surface portions 63.

[0042] The respective side surface side small-diameter wire rods 71 are provided so that the respective end portions thereof protrude from the support portion 73A at one end side of the arrangement of the support portions 73 and the support portion 73B at the other end side of the arrangement of the support portions 73, and the respective end portions serve as clinch portions 71A which are bent to the inside of the fan guard 60.

[0043] Furthermore, base portions 75 which are bent inwardly so as to extend in parallel to the support portions 72 are formed at the lower ends of the support portions 73A and 73B.

[0044] Plural reinforcing wire rods 74 are provided above the vertical side surface portions 63 so as to extend in parallel to the side surface side small-diameter wire rods 71 from the support portion 72A of the lateral-side large-diameter wire rod 70 at one end side to the support portion 72B of the lateral-side large-diameter wire rod 70 at the other end side.

[0045] Plural reinforcing support portions 78 extending in parallel to the support portions 73 are provided between the respective support portions 73 at the center side, and the reinforcing support portions 78 are joined to the respective side surface side small-diameter wire rods 71.

[0046] Band fixing concave portions 76A are formed at both the end portions of the support portion 72A (band fixing portions) at one end side by concaving (recessing) both the end portions of the support portion 72A to the top plate 30 side. Furthermore, band fixing concave portions 76B (band fixing portions) are formed at both the end portions of the support portion 72B at the other end side by concaving (recessing) both the end portions of the support portion 72B to the top plate 30 side.

[0047] Reinforcing large-diameter wire rods 77 are provided to the side surface side frame members 65 so as to be adjacent to the respective band fixing concave portions 76A. Each of the reinforcing large-diameter wire rods 77 comprises a reinforcing support portion 77A extending in parallel to the support portion 72 at the same height as the support portion 72, a reinforcing support portion 77B which extends in parallel to the support portion 73B and is joined to the respective side surface side small-diameter wire rods 71, and a reinforcing base portion 77C which is bent inwardly and extends in parallel to the base portion 75 at the same height as the base portion 75. The reinforcing large-diameter wire rod 77 has the same diameter as the lateral-side large-diameter wire rod 70.

[0048] Fig. 6 is a perspective view showing the front-and-rear side frame member 66.

[0049] As shown in Figs. 4 and 6, the front-and-rear side frame member 66 has plural (seven in this embodiment) longitudinal-side large-diameter wire rods 80

(large-diameter wire rods) extending in parallel to the ventilation surface portion 61, and plural side surface side small-diameter wire rods 81 fixed to the longitudinal-side large-diameter wire rods 80. The longitudinal-side large-diameter wire rods 80 have a larger diameter than the side surface side small-diameter wire rods 81, and have the same diameter as the lateral-side large-diameter wire rods 70.

[0050] Each longitudinal-side large-diameter wire rod 80 comprises a support portion 82 extending in parallel to the ventilation surface portion 61, and support portions 83 formed by bending both the end portions of the support portion 82 so that the bent portions extend in the height direction of the fan guard 60. The longitudinal-side large-diameter wire rods 80 are arranged in parallel to one another so as to be spaced from one another at predetermined intervals while erected by the support portions 83. Each support portion 83 is bent at a smaller angle than the right angle, and extends downwardly while expanding outwardly (i.e., it slopes outwards and downwards to the lower end side thereof). The arranged longitudinal-side large-diameter wire rods 80 are joined to one another by bonding the plural side surface side small-diameter wire rods 81 to the respective support portions 83.

[0051] The respective side surface side small-diameter wire rods 81 are arranged so as to cross the respective support portions 83, and welded to the respective support portions 83 while brought into contact with the respective support portions 83 from the outside. The side surface side small-diameter wire rods 81 are arranged in parallel to one another so as to be spaced from one another at predetermined intervals, and plural side surface side small-diameter wire rods 81 are arranged side by side in the height direction of the fan guard 60 at both the end sides of each longitudinal-side large-diameter wire rod 80, thereby constituting a pair of slope side surface portions 64. Each support portion 83 is bent, and thus the slope side surface portions 64 expand outwards as the position thereof is nearer to the lower end side (i.e., the slope side surface portions extend downwards and outwards).

[0052] Reinforcing wire rods 84 are provided above the uppermost side surface side small-diameter wire rods 81 so as to extend in parallel to the side surface side small-diameter wire rods 81. Each reinforcing wire rod 84 has a parallel portion 84A which is joined to the outer surfaces of the support portions 83 from the support portion 83A at one end side to the support portion 83B at the other end side, pole portions 84B which are bent at the contact portions with the support portions 83A and 83B and extend downwardly, and base portions 84C which are outwards bent at the lower ends of the pole portions 84B and extend in parallel to the side surface side small-diameter wire rods 81.

[0053] Furthermore, reinforcing wire rods 85 are provided below the lowermost side surface side small-diameter wire rods 81 so as to extend in parallel to the side

surface side small-diameter wire rods 81. The reinforcing wire rods 85 have the same diameter as the longitudinal-side large-diameter wire rods 80.

[0054] Fig. 7 is a perspective view showing the small-diameter grid member 68.

[0055] As shown in Fig. 7, the small-diameter grid member 68 is formed in a reticular (grid) pattern by combining plural wire rods. Specifically, plural lateral-side small-diameter wire rods 91 (small-diameter wire rods) which are arranged in parallel to one another so as to be spaced from one another at predetermined intervals are arranged on plural longitudinal-side small-diameter wire rods 90 (small-diameter wire rods) which are arranged in parallel to one another so as to be spaced from one another at predetermined intervals so that the lateral-side small-diameter wire rods 91 are perpendicular to the longitudinal-side small-diameter wire rods 90. The longitudinal-side small-diameter wire rods 90 and the lateral-side small-diameter wire rods 91 are welded to one another and integrated with one another at intersection points thereof. The longitudinal-side small-diameter wire rods 90 and the lateral-side small-diameter wire rods 91 have the same diameter, and the diameter thereof is smaller than that of the lateral-side large-diameter wire rods 70 and the longitudinal-side large-diameter wire rods 80.

the longitudinal-side small-diameter wire rods 90 are arranged in parallel to the respective longitudinal-side large-diameter wire rods 80 of the front-and-rear side frame member 66 under the state that the fan guard 60 is installed. Portions of the small-diameter grid member 68 which are overlapped with the longitudinal-side large-diameter wire rods 80 are set as large-diameter wire rod arranging portions 92 at which the interval between the adjacent longitudinal-side small-diameter wire rods 90 is larger than the interval between the adjacent longitudinal-side small-diameter wire rods 90 at the other portions.

[0056] The lateral-side small-diameter wire rods 91 are arranged in parallel to the respective lateral-side large-diameter wire rods 70 of the side surface side frame member 65 under the state that the fan guard 60 is installed. Portions of the small-diameter grid member 68 which are overlapped with the lateral-side large-diameter wire rods 70 are set as large-diameter wire rod arranging portions 93 at which the interval between the adjacent lateral-side small-diameter wire rods 91 is larger than the adjacent lateral-side small-diameter wire rods 91 at the other portions.

[0057] When the fan guard 60 is installed, the small-diameter grid member 68 is first set on the support portions 82 of the respective longitudinal-side large-diameter wire rods 80 of the front-and-rear side frame member 66 as shown in Figs. 4 to 7. Under this state, the respective longitudinal-side large-diameter wire rods 80 are overlapped with the respective large-diameter wire rod arranging portion 92, and the longitudinal-side small-diameter wire rods 90 are arranged in parallel to the longitudinal-side large-diameter wire rods 80.

[0058] Subsequently, the side surface side frame member 65 is covered on the small-diameter grid member 68 so that the lateral-side large-diameter wire rods 70 are perpendicular to the longitudinal-side large-diameter wire rods 80, whereby the lateral-side large-diameter wire rods 70 are arranged at the large-diameter wire rod arranging portions 93. Accordingly, the grid-shaped ventilation surface portion 61 is formed at the upper surface portion of the fan guard 60. The front-and-rear side frame member 66, the small-diameter grid member 68 and the side surface side frame member 65 are joined to one another at the contact portions of the cross points thereof by spot welding.

[0059] Specifically, as shown in Figs. 3 and 4, the plural lateral-side large-diameter wire rods 70 and the plural longitudinal-side large-diameter wire rods 80 are orthogonal to one another at the ventilation surface portion 61, whereby plural large grids 100 are formed. Furthermore, the plural longitudinal-side small-diameter wire rods 90 and the lateral-side small-diameter wire rods 91 are orthogonal to one another between the large grids 100, whereby plural small grids 101 which are smaller in aperture than the large grids 100 are formed. Each large grid 100 contains plural small grids 101 arranged in both of longitudinal and lateral directions, that is, plural arrays of small grids 101 are arranged, not on a line, but in a grid pattern in each large grid 100. In Figs. 3 and 4, reference numerals 100 and 101 are allocated to only one large grid and only a set of small grids respectively in order to simplify the illustration of the drawing.

[0060] Fig. 8 is a front view showing a test finger T for guard performance of the fan guard 60.

[0061] The small grid 101 is configured in a substantially square shape, and the small grid 101 is configured to have such a size that the test finger T having a predetermined shape cannot pass through the small grid 101. The test finger T has a cylindrical portion T1 formed by imitating a human's finger, and a stopper portion T2 which is larger in diameter than the cylindrical portion T1 and formed like a circular disc coaxial with the cylindrical portion T1. The fan guard 60 is required to be configured so that the cylindrical portion T1 does not come into contact with the propeller fan 24 when the test finger T is inserted until the stopper portion T2 comes into contact with the fan guard 60.

[0062] In this embodiment, the small grids 101 are formed in a grid pattern in each large grid 100. Therefore, the size of the aperture (opening) of the small grid 101 can be increased to a size which is slightly smaller than the diameter of the stopper portion T2 so that it is impossible for the stopper portion T2 to pass through the small grid 101. Accordingly, the numbers of the longitudinal-side and lateral-side small-diameter wire rods 90 and 91 can be reduced, and the aperture (opening) area of the ventilation surface portion 61 can be increased, whereby the resistance to air flow can be reduced. In a case where the small grids 101 are not provided in a grid pattern in

each large grid 100, but plural slender apertures (openings) are provided on a line in each large grid 100, when the width of the apertures (openings) is increased to a size which is slightly smaller than the diameter of the stopper portion T2, the size of the apertures (openings) is excessively large, and there is a risk that a palm or the like may pass through the aperture. Accordingly, it is impossible to increase the aperture size to a slightly smaller size than the diameter of the stopper portion T2, so that the resistance to air flow increases. However, according to this embodiment, the small grids 101 are provided in a grid pattern in the large grids 100, and a thin and wide object such as a palm or the like can be prevented from passing through the fan guard 60 with increasing the aperture size of the small grid 101 to a slightly smaller size than the diameter of the stopper portion T2.

[0063] Here, as an example, the aperture of the small grid 101 is a square of 41 (mm) on a side, and the diameter of the stopper portion t2 of the test finger T is equal to 50 (mm).

[0064] Fig. 9 is an enlarged perspective view showing a corner portion of the fan guard 60.

[0065] As shown in Fig. 9, at the side surface ventilation surface portion 62, the clinch portions 71A of the respective side surface side small-diameter wire rods 71 are joined to the pole portions 84B of the reinforcing wire rods 84 of the slope side surface portion 64, whereby the slope side surface portions 64 and the vertical side surface portions 63 are joined to each other. As described above, the gap between the slope side surface portion 64 and the vertical side surface portion 63 are occluded by the plural clinch portions 71A, so that the test finger T can be prevented from passing through the four corner portions of the fan guard 60.

[0066] The gap between each side surface side small-diameter wire rod 71 and each side surface side small-diameter wire rod 81 is set to such a size that the test finger T cannot pass through the gap.

[0067] A lower large-diameter wire rod 79 (fixing portion) extending along the side surface side small-diameter wire rods 71 is provided to the lower end of each vertical side surface portion 63. The lower large-diameter wire rod 79 serves as a fixing portion of the fan guard 60 for the top plate 30 of the outdoor unit 10, and it is fixed to the top plate 30 while brought into contact with the top plate 30.

[0068] The lower large-diameter wire rods 79 have plural bent portions 79A so as to be enhanced in strength and rigidity. The end portion of the lower large-diameter wire rod 79 has a U-shaped bent portion 79B which is bent in U-shape. A reinforcing base portion 77C, a base portion 75 and a base portion 84C are joined to the U-shaped bent portion 79B of the lower large-diameter wire rod 79, and the lower large-diameter wire rod 79 is joined to the lower ends of the respective support portions 73, whereby the lower large-diameter wire rod 79 is fixed. A bolt (not shown) is inserted in a hole 79C formed inside the U-shaped bent portion 79B, and the fan guard 60 is

fixed to the top plate 30 through the holes 79C formed at the respective four corner portions thereof by bolts.

[0069] Fig. 10 is a perspective view showing the transport state of the outdoor unit 10.

[0070] As shown in Fig. 10, when the outdoor unit 10 is transported, the outdoor unit 10 is supported by a pair of fixing bands 110 while the upper surface of the outdoor unit 10 is bound by the fixing bands 110. The fixing bands 110 is folded around the upper surface of the outdoor unit 10 so as to extend in the front-and-rear direction of the outdoor unit 10 along the right and left side edge portions of the ventilation surface portion 61 of the fan guard 60. Specifically, the fixing bands 110 are inserted through the band fixing concave portions 76A and 76B provided to the front and rear portions of the ventilation surface portion 61 and engaged fitted in the band fixing concave portions 76A and 76B. Therefore, the displacement of the fixing bands 110 can be prevented, and the fixing bands 110 can be surely fixed.

[0071] Furthermore, the fixing bands 110 are bound around the upper surfaces of the band fixing concave portions 76A and 76B, the reinforcing support portions 77A of the reinforcing large-diameter wire rods 77 and the lateral-side large-diameter wire rods 70, and the fixing bands 110 do not come into contact with the longitudinal-side small-diameter wire rods 90 and the lateral-side small-diameter wire rods 91 which are located below these large-diameter wire rods. As described above, the fixing bands 110 are received by the large-diameter wire rods having high strength and rigidity, so that the fixing bands 110 can be strongly fixed and firmly fixed to the outdoor unit 10. Furthermore, the reinforcing supporting portions 77A are provided to be adjacent to the band fixing concave portions 76A and 76B on which strong binding force acts, and the binding force of the fixing bands 110 is dispersed to the reinforcing support portions 77A, so that the fixing bands 110 can be firmly fixed.

[0072] As described above, according to the embodiment to which the present invention is applied, the fan guard 60 is formed by intersecting the plural lateral-side and longitudinal-side small-diameter wire rods 91 and 90 to the plural lateral-side and longitudinal-side large-diameter wire rods 70 and 80, and the small grids 101 constructed by the lateral-side and longitudinal-side small-diameter wire rods 91 and 90 are arranged in a grid pattern in the large grids 100 constructed by the lateral-side and longitudinal-side large-diameter wire rods 70 and 80. Therefore, a hand or the like can be prevented from invading into the fan guard by the small grids 101 without reducing the interval between the lateral-side small-diameter wire rods 91 and the interval between the longitudinal-side small-diameter wire rods 90, and the numbers of the lateral-side and longitudinal-side small-diameter wire rods 91 and 90 can be reduced. Therefore, the resistance to air flow can be reduced with preventing invasion of a hand or the like into the fan guard 60.

[0073] Furthermore, the lateral-side and longitudinal-side small-diameter wire rods 91 and 90 are assembled

(combined) with one another to form the grid-pattern small-diameter grid member 68, and the small-diameter grid member 68 is supported by the frame portion 67 comprising the lateral-side and longitudinal-side large-diameter wire rods 70 and 80. Therefore, the small-diameter grid member 68 is formed by the lateral-side small-diameter wire rods 91 and the longitudinal-side small-diameter wire rods 90, and the small-diameter grid member 68 is supported by the frame portion 67 to form the ventilation surface portion 61. Therefore, the ventilation surface portion 61 can be simply formed, and also the strength and rigidity of the ventilation surface portion 61 can be enhanced.

[0074] Furthermore, the ventilation surface portion 61 is provided to the band fixing concave portions 76A and 76B to which the fixing bands 110 used when the outdoor unit 10 is transported, and the band fixing concave portions 76A and 76B are formed in the lateral-side large-diameter wire rods 70. Therefore, the fixing bands 110 can be secured to the band fixing concave portions 76A and 76B of the lateral-side large-diameter wire rods 70 having high strength and rigidity, and firmly fixed to the outdoor unit 10. It is difficult to provide the fixing bands 110 to the vertical side surface portions 63. However, the band fixing concave portions 76A and 76B are provided to (i.e., pressed against) the lateral-side large-diameter wire rods 70, and thus the fixing bands 110 can be fixed to the ventilation surface portion 61. Therefore, the fixing bands 110 can be fixed to the fan guard 60, and it is unnecessary to provide a special-purpose member to the fixing bands 110.

[0075] The ventilation surface portion 61 is fixed to the top plate 30 of the air blow-out port 25A through the side surface ventilation surface portion 62 extending from the peripheral edge of the ventilation surface portion 61 to the peripheral edge portion 25B of the air blow-out port 25A of the air blower 22, the side surface ventilation surface portion 62 has the vertical side surface portions 63 extending vertically from the ventilation surface portion 61 to the top plate 30, and the vertical side surface portions 63 are provided at the outside of the peripheral edge portion. Therefore, the vertical side surface portions 63 do not disturb flow of air blown out from the peripheral edge portion 25B of the air blow-out port 25A, and thus the resistance to air flow can be reduced.

[0076] In this embodiment, the vertical side surface portions 63 are provided on extension lines of the right and left face panels 29, and thus the vertical side surface portions 63 are provided at the outside of the peripheral edge portion 25B, so that the resistance to air flow can be reduced. However, it is difficult to fix the fixing bands 110 to the upper surface side of the outdoor unit 10. However, the band fixing concave portions 76A and 76B are provided to the lateral-side large-diameter wire rods 70 of the ventilation surface portion 61, so that the fixing bands 110 can be fixed to the upper surface of the outdoor unit 10 with reducing the resistance to air flow.

[0077] Furthermore, the lower large-diameter wire

rods 79 serving as the fixing portions through which the side surface ventilation surface portion 62 is fixed to the top plate 30 are bent (crooked), so that the strength and rigidity of the fan guard 60 can be enhanced.

[0078] The present invention is not limited to the above embodiment, and various modifications and applications may be made without departing from the subject matter of the present invention.

[0079] In the above embodiment, the small grids 101 are provided in a grid pattern in the large grid 100. However, the present invention is not limited to this embodiment. For example, the above embodiment may be modified so that the plural support portions 82 of the longitudinal-side large-diameter wire rods 80 are not provided, and only plural lateral-side large-diameter wire rods 70 are provided, so that the small grids 101 are provided in a grid pattern between the plural lateral-side large-diameter wire rods 70.

[0080] Furthermore in the above embodiment, the fan guard 60 is provided to the top air blow-out type outdoor unit 10. However, the present invention is not limited to this style. The fan guard 60 of this invention may be applied to any type outdoor unit insofar as it is covered on a fan, and for example, the fan guard 60 may be provided to a lateral air blow-out type outdoor unit.

[Modifications]

[0081] Fig. 11 is a perspective view showing a corner portion of a fan guard 160 in a modification of the above embodiment.

[0082] In the above embodiment, the gap between the slope side surface portion 64 and the vertical side surface portion 63 are occluded (blocked) by the plural clinch portions 71A of the side surface side small-diameter wire rods 71. However, in this modification, the gap is blocked by one reinforcing wire rod 120. In this modification, the same parts as the above embodiment are represented by the same reference numerals, and the description thereof is omitted.

[0083] As shown in Fig. 11, one reinforcing wire rod 120 extending in parallel to the side surface side small-diameter wire rods 71 is joined to the upper portion of each support portion 73, and both the endportions of each reinforcing wire rod 120 serve as extension portions 121 each of which extends to the gap between the slope side surface portion 64 and the vertical side surface portion 63. The extension portion 121 has a first bent portion 121A which extends obliquely downwardly from the support portion 73 side and comes into contact with the support portion 83 of the slope side surface portion 64, and a second bent portion 121B which is folded back from the first bent portion 121A and comes into contact with the support portion 73. The first bent portion 121A is joined to the support portion 83, and the second bent portion 121B is joined to the support portion 73.

[0084] As described above, the gap between the slope side surface portion 64 and the vertical side surface por-

tion 63 can be simply blocked by the extension portion 121 of the reinforcing wire rod 120. By providing the extension portion 121, the stopper portion T2 of the test finger T can be prevented from invading through the gap. The first bent portion 121A and the second bent portion 121B are joined to the support portions 83 and 73, whereby the strength and rigidity of the corner portions of the fan guard 160 can be secured. Therefore, the fixing bands 110 can be firmly fixed to the band fixing concave portions 76A and 76B.

Claims

1. A fan guard (60, 160) constructed by a plurality of wire rods, **characterized in that** a plurality of large-diameter wire rods (70, 80) and a plurality of small-diameter wire rods (90, 91) are arranged so as to intersect to one another, and the small-diameter wire rods are arranged in a grid pattern between the large-diameter wire rods.
2. The fan guard according to claim 1, wherein the plurality of small-diameter wire rods are assembled with one another to form a grid-pattern small-diameter grid member (68), the plurality of large-diameter wire rods are assembled with one another to form a frame portion (67), and the small-diameter grid member is supported on the frame portion.
3. The fan guard according to claim 1 or 2, wherein the fan guard is configured in a box-shape and has a ventilation surface portion (61) and a vertical side surface portion (63), the ventilation surface portion is provided with a band fixing portion (76A, 76B) to which a fixing band (110) is secured for the purpose of transport of the outdoor unit, and the band fixing portion is formed in the large-diameter wire rods.
4. The fan guard according to claim 3, wherein the ventilation surface portion is fixed to a fixing surface (30) of an air blow-out port (25A) of an air blower (22) through a side surface portion (62) extending from a peripheral edge of the ventilation surface portion to a peripheral edge portion (25B) of the air blow-out port, the side surface portion has the vertical side surface portion (63) extending vertically from the ventilation surface portion to the fixing surface, and the vertical side surface portion is provided at the outside of the peripheral edge portion of the air blow-out port.
5. The fan guard according to claim 4, wherein the wire rods are bent at a fixing portion at which the side surface portion is fixed to the fixing surface.
6. An air conditioner having a fan guard (60, 160) that is provided at an air blow-out port (25A) of an outdoor unit (10) and covers a fan (24) of an air blower (22), **characterized in that** the fan guard comprises a plurality of large-diameter wire rods (70, 80) and a plurality of small-diameter wire rods (90, 91) that are arranged so as to intersect to one another, and the small-diameter wire rods are arranged in a grid pattern between the large-diameter wire rods.
7. The air conditioner according to claim 6, wherein the plurality of small-diameter wire rods are assembled with one another to form a grid-pattern small-diameter grid member (68), the plurality of large-diameter wire rods are assembled with one another to form a frame portion (67), and the small-diameter grid member is supported on the frame portion.
8. The fan guard according to claim 6 or 7, wherein the fan guard is configured in a box-shape and has a ventilation surface portion (61) and a vertical side surface portion (63), the ventilation surface portion is provided with a band fixing portion (76A, 76B) to which a fixing band (110) is secured for the purpose of transport of the outdoor unit, and the band fixing portion is formed in the large-diameter wire rods.
9. The air conditioner according to claim 8, wherein the ventilation surface portion is fixed to a fixing surface (30) of the air blow-out port (25A) of the air blower (22) through a side surface portion (62) extending from a peripheral edge of the ventilation surface portion to a peripheral edge portion (25B) of the air blow-out port, the side surface portion has the vertical side surface portion (63) extending vertically from the ventilation surface portion to the fixing surface, and the vertical side surface portion is provided at the outside of the peripheral edge portion of the air blow-out port.
10. The fan guard according to claim 9, wherein the wire rods are bent at a fixing portion at which the side surface portion is fixed to the fixing surface.

FIG.1

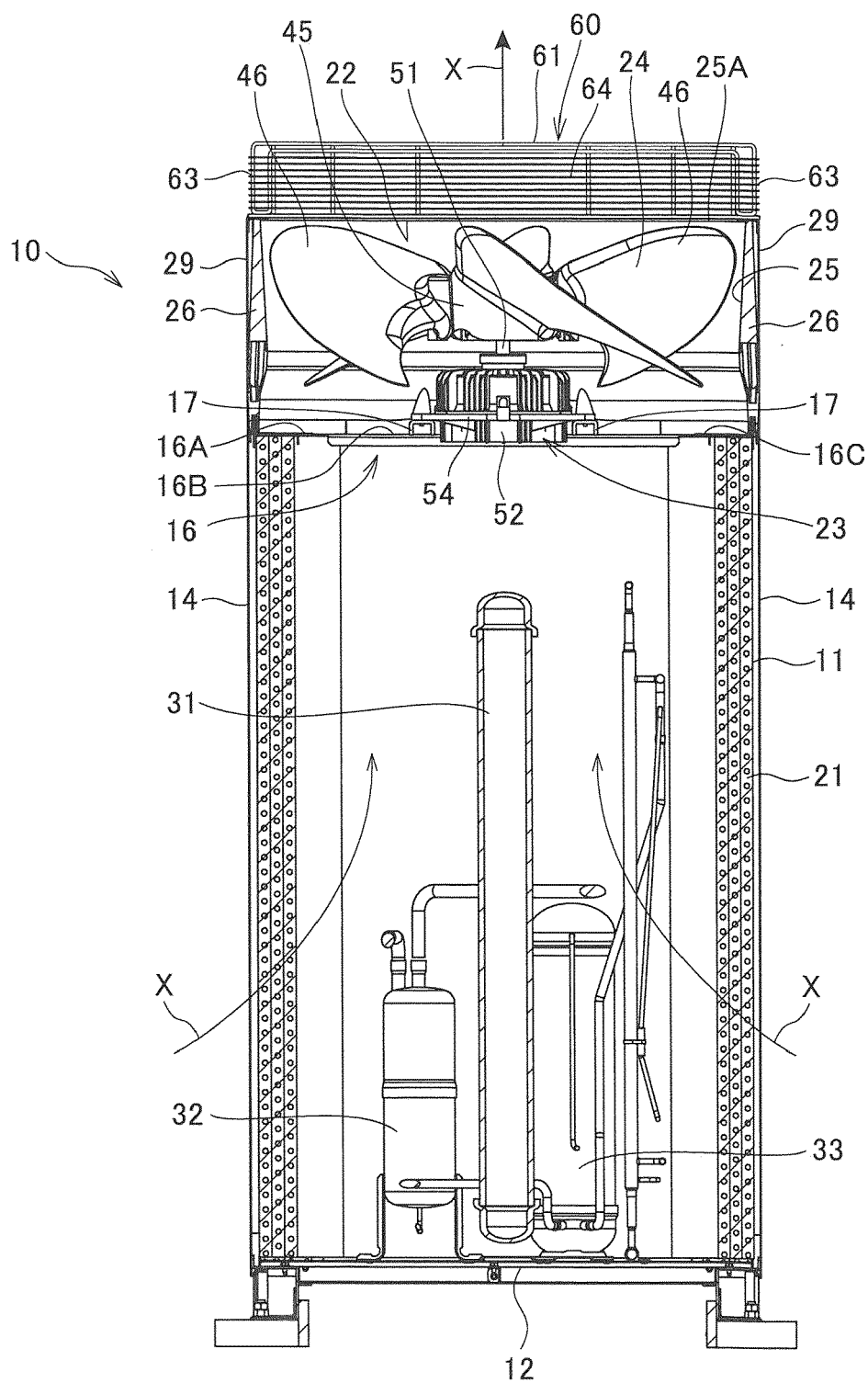


FIG.2

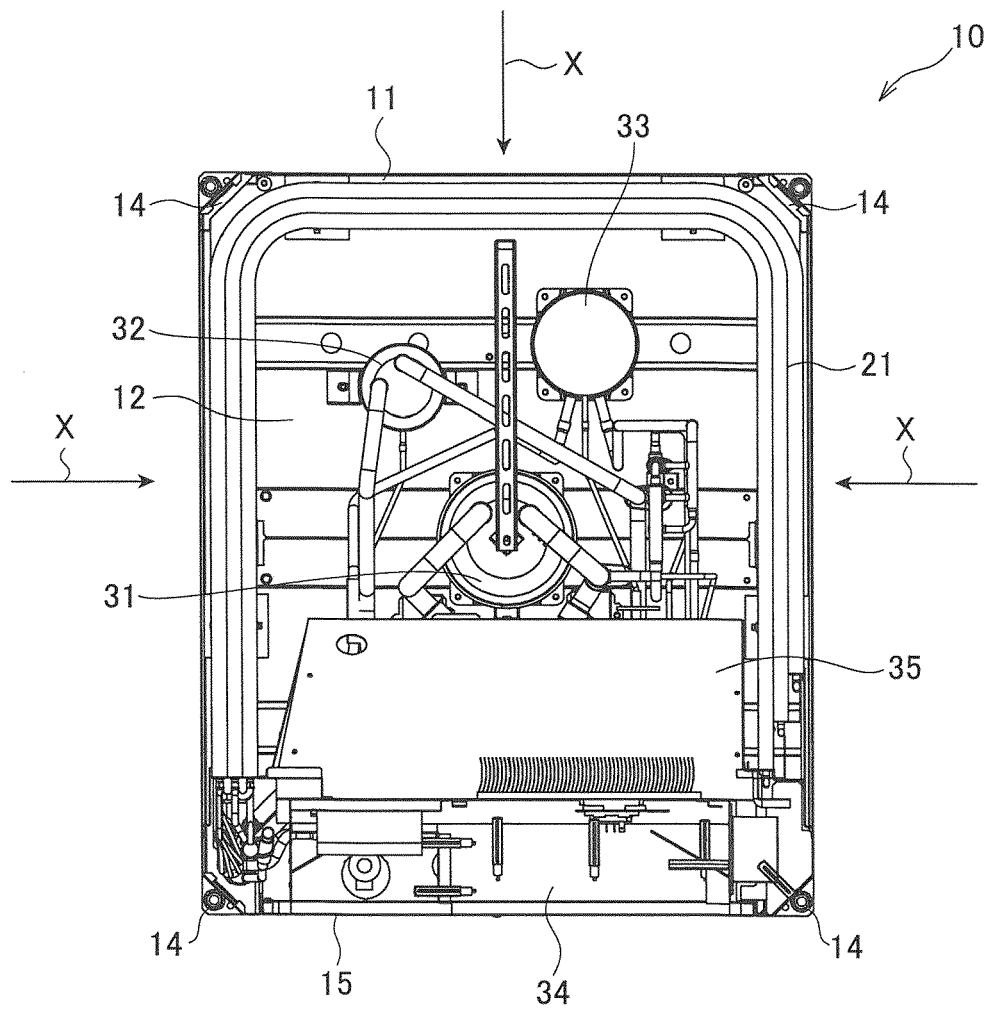


FIG. 3

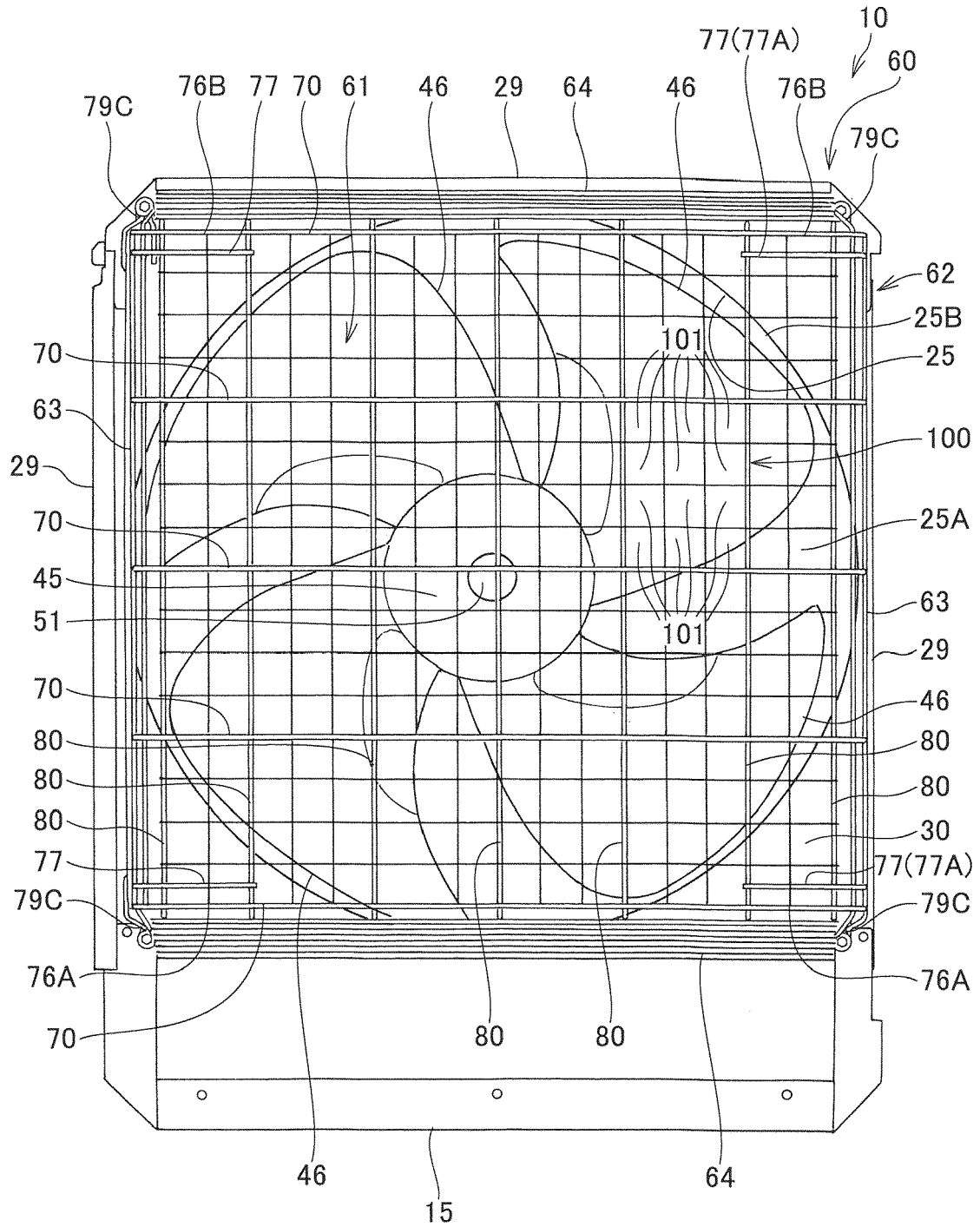


FIG.4

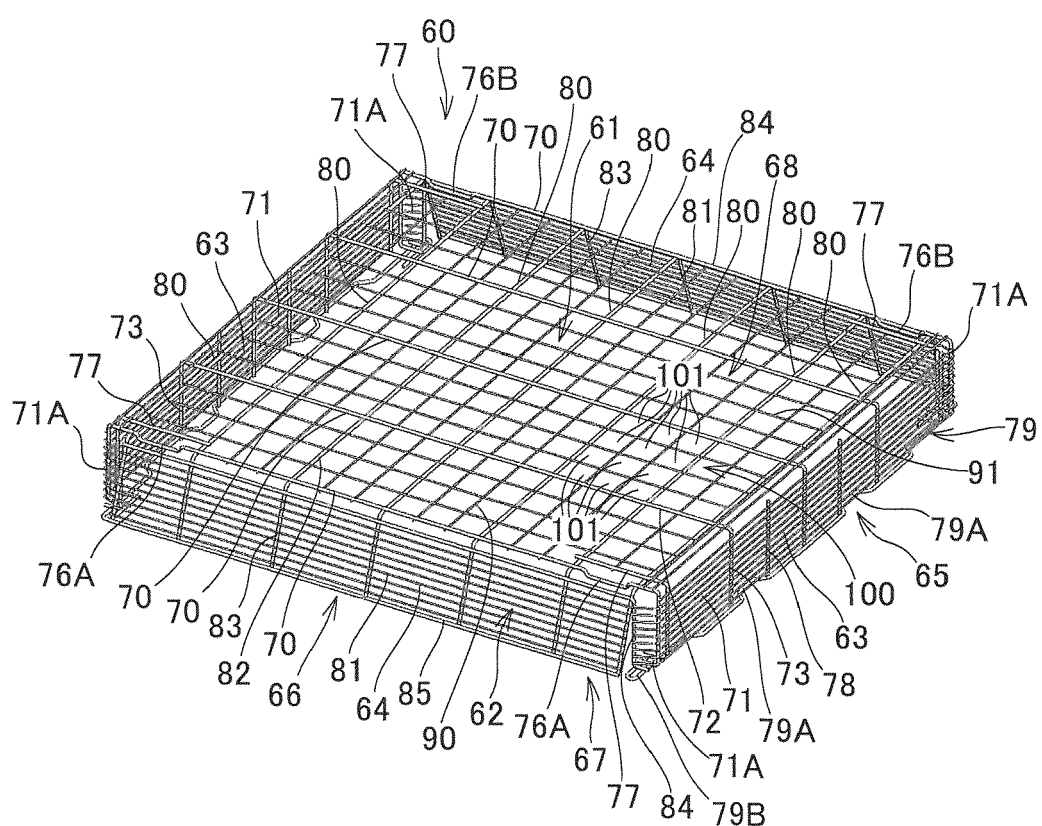


FIG.5

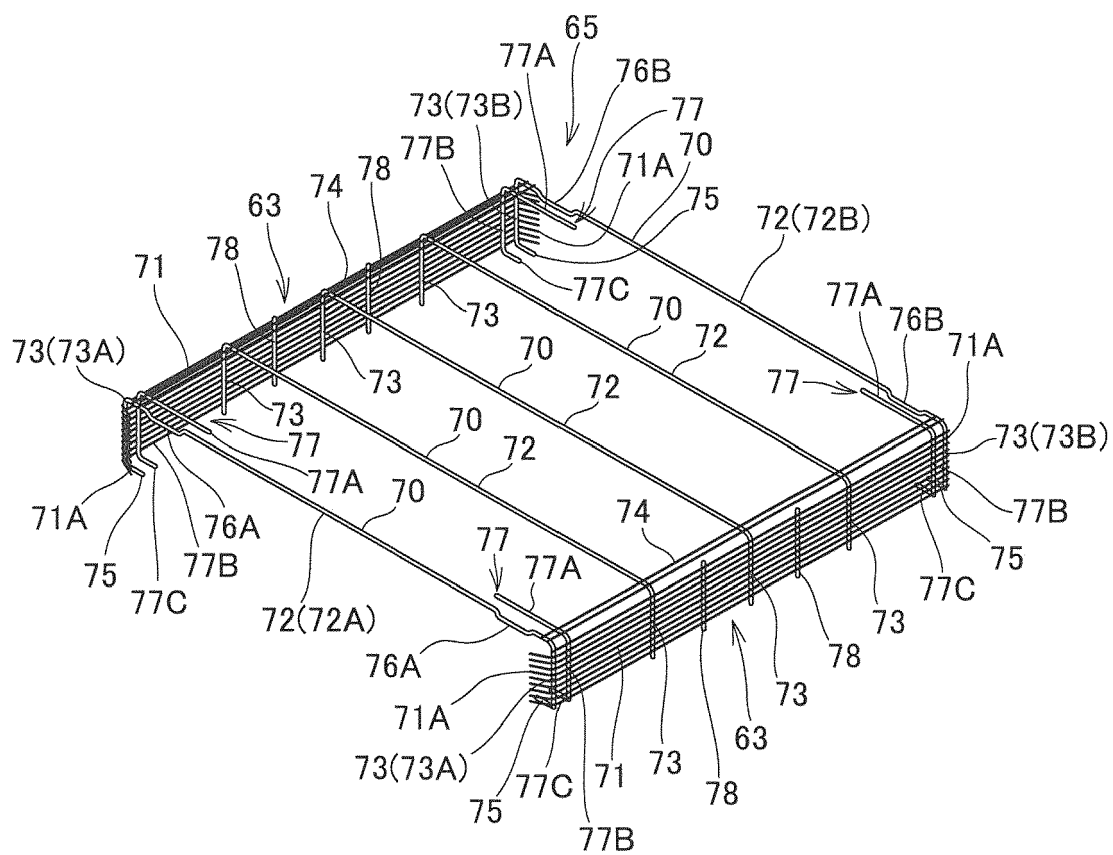


FIG. 6

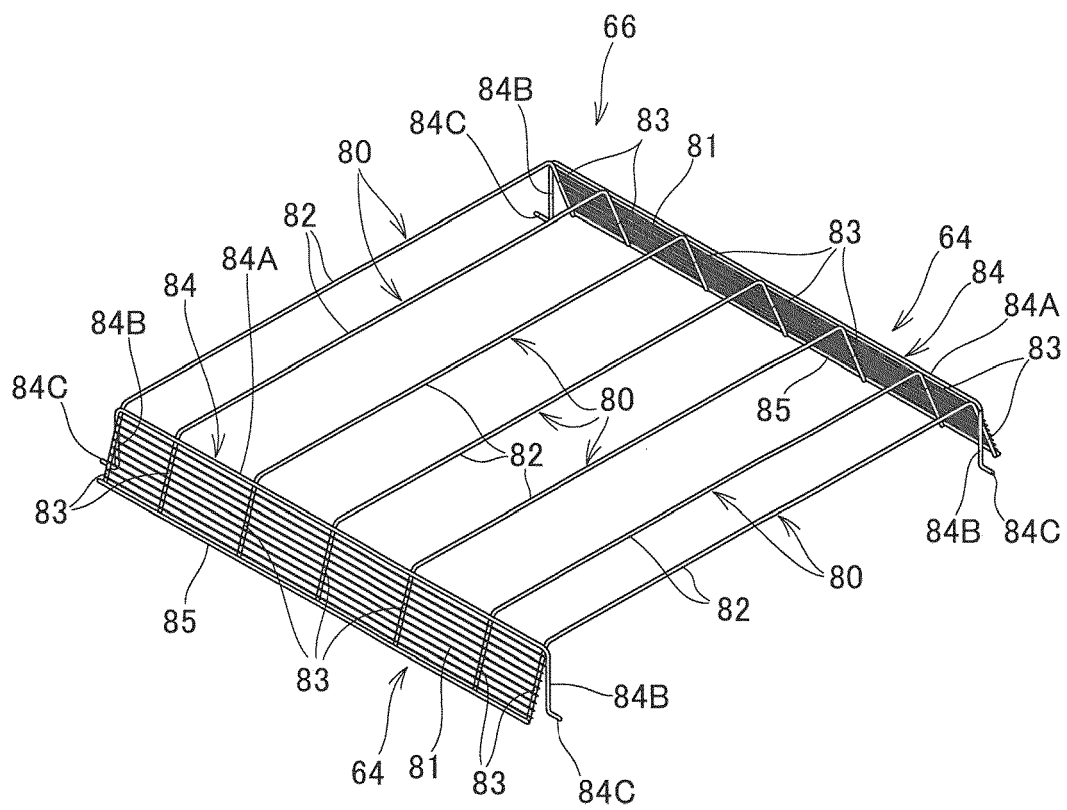


FIG.7

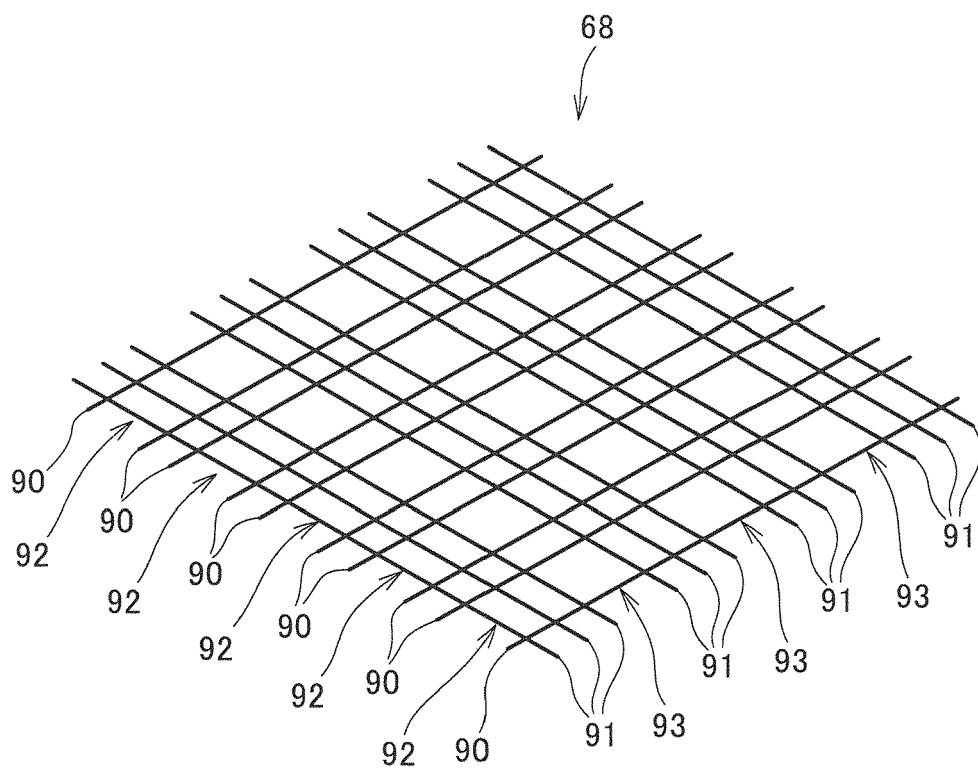


FIG.8

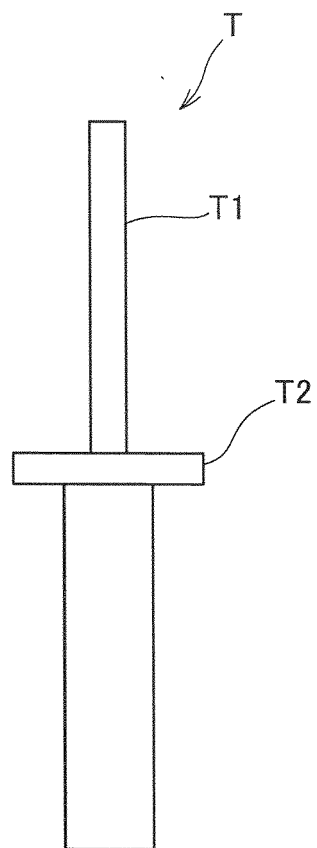


FIG. 9

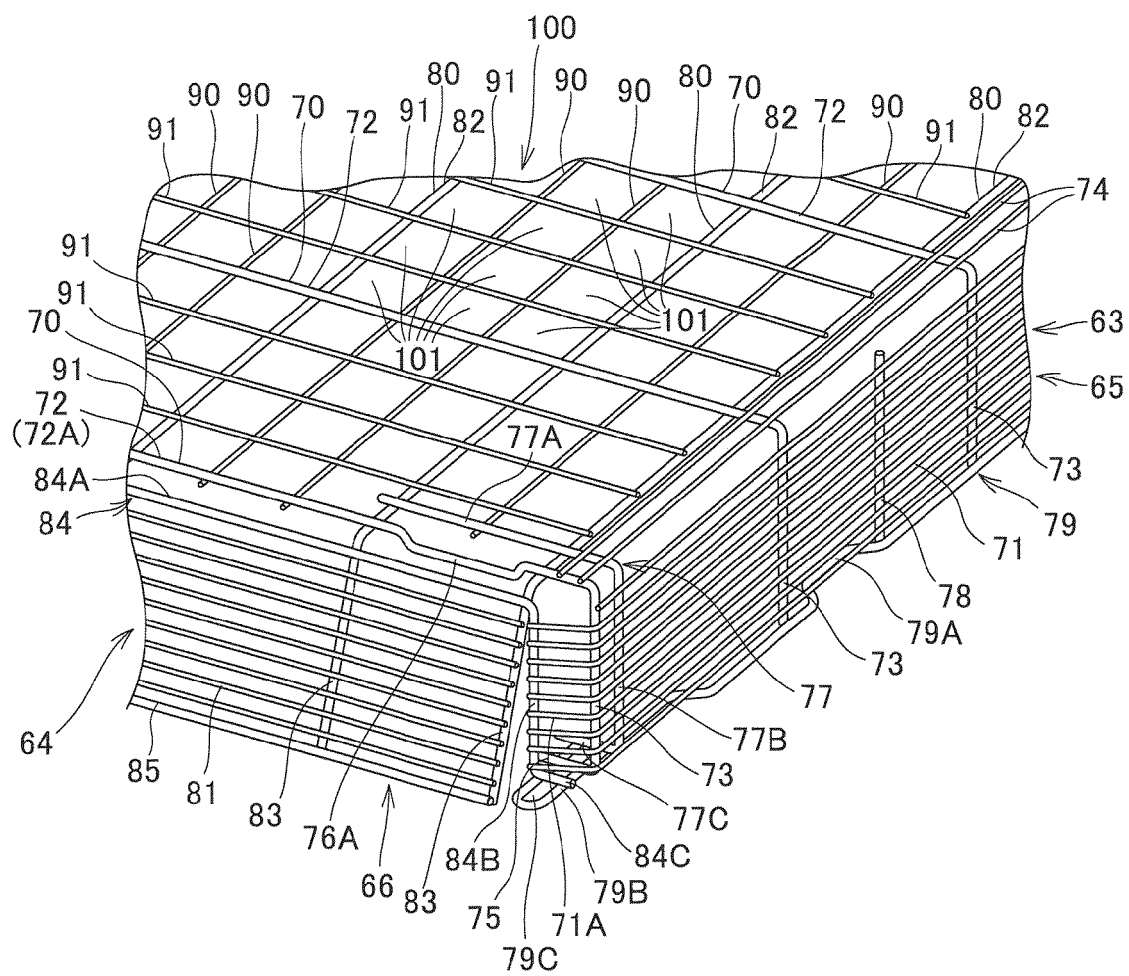


FIG.10

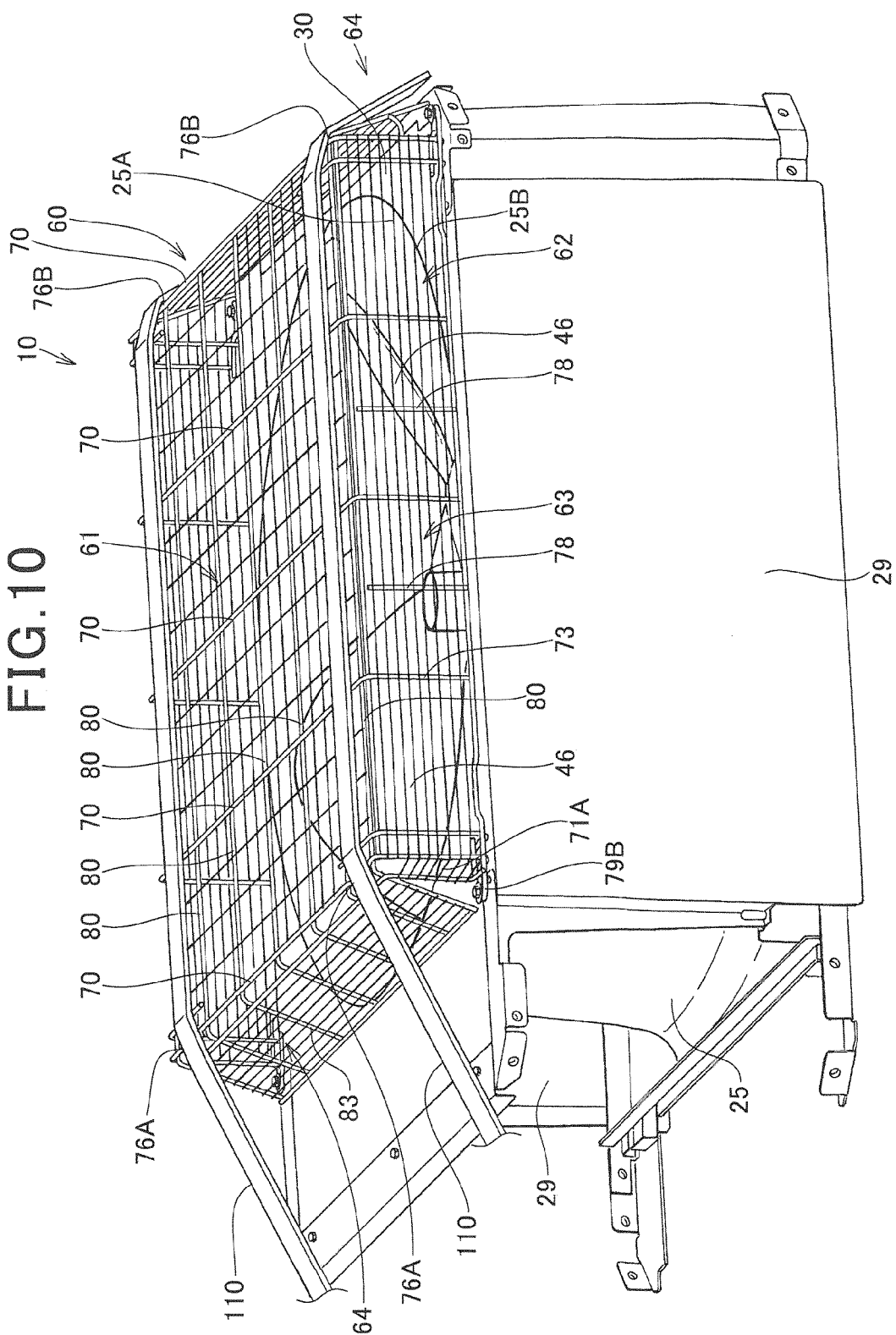
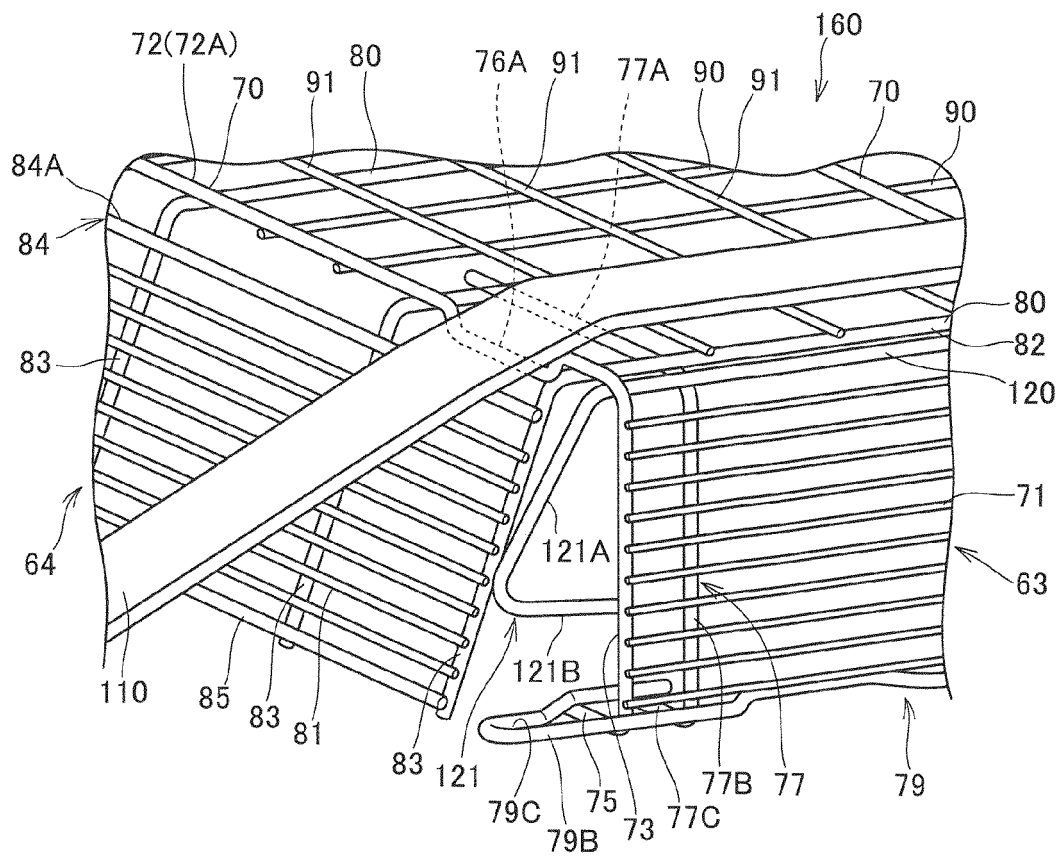


FIG.11





EUROPEAN SEARCH REPORT

Application Number
EP 12 17 5689

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	EP 1 956 307 A1 (DAIKIN IND LTD [JP]) 13 August 2008 (2008-08-13) * paragraph [0034] - paragraph [0042] * * figures *	1-10	INV. F24F13/20 F04D29/70 F24F1/38
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The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 6 September 2012	Examiner Mattias Grenbäck
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
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06-09-2012

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