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- **IZAKI, Tomonobu**
Tokyo 1008310 (JP)
- **SATO, Kosuke**
Tokyo 1008310 (JP)
- **OISHI, Keisuke**
Tokyo 1008310 (JP)

(71) Applicant: **Mitsubishi Electric Corporation**
Tokyo 100-8310 (JP)

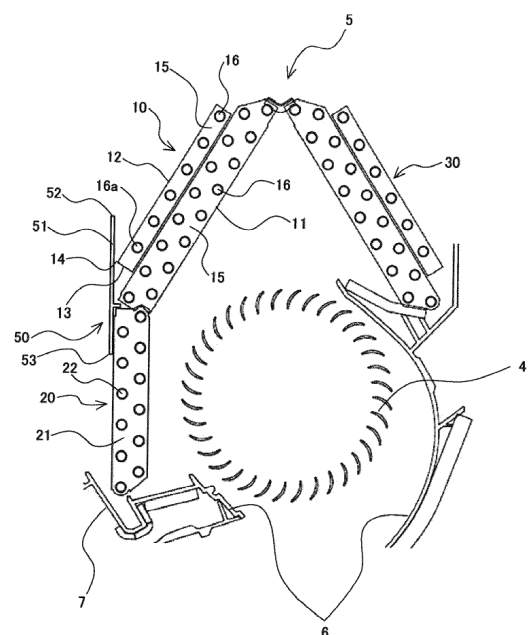
(74) Representative: **Pfenning, Meinig & Partner mbB**
Patent- und Rechtsanwälte
Joachimsthaler Straße 10-12
10719 Berlin (DE)

(72) Inventors:
• **OBARA, Koichi**
Tokyo 1008310 (JP)

(54) **INDOOR UNIT FOR AIR CONDITIONER**

(57) An indoor unit of an air-conditioning apparatus includes a first heat exchanger inclined forward and downward, a second heat exchanger provided below the first heat exchanger, a drain pan provided below the second heat exchanger, and a blocking member covering an area between the first heat exchanger and the second heat exchanger and also a part of the first heat exchanger from a front side. The first heat exchanger has at least one heat exchanging unit. An upper edge of the blocking member is higher than a front edge at a lower end of the heat exchanging unit disposed at a front-most side.

FIG. 3



Description

Technical Field

[0001] The present disclosure relates to indoor units of air-conditioning apparatuses that prevent dripping of condensate.

Background Art

[0002] An indoor unit of an air-conditioning apparatus is equipped with an indoor heat exchanger in a housing. With regard to this indoor heat exchanger, various configurations are proposed from the standpoint of, for example, the layout in the housing. For example, some indoor heat exchanger in the related art includes a first heat exchanger disposed above a fan and a second heat exchanger disposed in front of the fan (see Patent Literature 1). In detail, the first heat exchanger is provided above the fan in the diagonally forward direction from the fan and is inclined forward and downward. The second heat exchanger is provided in front of the fan and below the first heat exchanger. Furthermore, the indoor unit described in Patent Literature 1 is also provided with a seal member that covers an area between the first heat exchanger and the second heat exchanger and also a part of the second heat exchanger from the front side. The seal member of the indoor unit described in Patent Literature 1 adjusts the air volume to the second heat exchanger.

Citation List

Patent Literature

[0003] Patent Literature 1: Japanese Unexamined Patent Application Publication No. 2005-214561

Summary of Invention

Technical Problem

[0004] When the indoor heat exchanger is used as an evaporator, indoor air suctioned into the housing by the fan is cooled by refrigerant flowing through the indoor heat exchanger. In this case, the moisture in the indoor air condenses on the indoor heat exchanger, causing condensate to adhere to the indoor heat exchanger. Normally, in the above-described indoor unit equipped with the indoor heat exchanger including the first heat exchanger and the second heat exchanger, the condensate adhering to the first heat exchanger flows down along the first heat exchanger to the second heat exchanger and adheres to the second heat exchanger. Then, the condensate adhering to the second heat exchanger flows down along the second heat exchanger and is discharged to a drain pan disposed below the second heat exchanger. The condensate discharged to the drain pan

is discharged outdoors via, for example, a pipe.

[0005] For example, the degree of water repellency of the indoor heat exchanger may sometimes increase because of an environmental factor, such as the use of a large amount of spray having a water repelling function, such as hair spray, inside a room where the indoor unit is installed. In such a case, in the above-described indoor unit in the related art equipped with the indoor heat exchanger including the first heat exchanger and the second heat exchanger, the degree of water repellency of the first heat exchanger increases, causing an increase in the speed of the condensate flowing down along the first heat exchanger. Thus, the condensate flowing down along the first heat exchanger drops forward of the second heat exchanger without being able to reach the second heat exchanger. The condensate dropping forward of the second heat exchanger cannot be received by the drain pan. Therefore, in the above-described indoor unit in the related art including the first heat exchanger and the second heat exchanger, the condensate dropping forward of the second heat exchanger drips indoors. This is problematic in that a phenomenon called dripping of condensate occurs.

[0006] The present disclosure has been made to solve the aforementioned problem, and an object of the present disclosure is to obtain an indoor unit of an air-conditioning apparatus that can prevent dripping of condensate in the above-described indoor unit of the air-conditioning apparatus including the first heat exchanger and the second heat exchanger, as compared with the related art, even when the degree of water repellency of the first heat exchanger increases. **Solution to Problem**

[0007] An indoor unit of an air-conditioning apparatus according to an embodiment of the present disclosure includes a first heat exchanger inclined forward and downward, a second heat exchanger provided below the first heat exchanger, a drain pan provided below the second heat exchanger, and a blocking member covering an area between the first heat exchanger and the second heat exchanger and also a part of the first heat exchanger from a front side. The first heat exchanger has at least one heat exchanging unit. An upper edge of the blocking member is higher than a front edge at a lower end of the heat exchanging unit disposed at a front-most side. **Advantageous Effects of Invention**

[0008] In the indoor unit of the air-conditioning apparatus according to an embodiment of the present disclosure, even when the degree of water repellency of the first heat exchanger increases and the condensate flowing down along the first heat exchanger is about to drop forward of the second heat exchanger, the condensate that is about to drop forward of the second heat exchanger collides with the blocking member. Then, the condensate colliding with the blocking member flows down along the blocking member to the second heat exchanger and adheres to the second heat exchanger. The condensate adhering to the second heat exchanger then flows down along the second heat exchanger and is discharged to

the drain pan disposed below the second heat exchanger. Consequently, the indoor unit of the air-conditioning apparatus according to an embodiment of the present disclosure can prevent dripping of condensate more than that in the related art even when the degree of water repellency of the first heat exchanger increases.

Brief Description of Drawings

[0009]

[Fig. 1] Fig. 1 is a perspective view of an indoor unit of an air-conditioning apparatus according to Embodiment 1 of the present disclosure, as viewed from the front side.

[Fig. 2] Fig. 2 is a perspective view of the indoor unit of the air-conditioning apparatus according to Embodiment 1 of the present disclosure, as viewed from the front side, and illustrates a state where a front part of a housing has been removed.

[Fig. 3] Fig. 3 is a side view of an internal structure of the indoor unit of the air-conditioning apparatus according to Embodiment 1 of the present disclosure.

[Fig. 4] Fig. 4 is a perspective view of a blocking member in the indoor unit of the air-conditioning apparatus according to Embodiment 1 of the present disclosure, as viewed from the front side.

[Fig. 5] Fig. 5 is a perspective view of the blocking member in the indoor unit of the air-conditioning apparatus according to Embodiment 1 of the present disclosure, as viewed from the rear side.

[Fig. 6] Fig. 6 is a perspective view of a first claw unit of the blocking member and the vicinity of the first claw unit, as viewed from the front side, and illustrates a state where the blocking member is secured to an indoor heat exchanger in the indoor unit of the air-conditioning apparatus according to Embodiment 1 of the present disclosure.

[Fig. 7] Fig. 7 is a side view of a second claw unit of the blocking member and the vicinity of the second claw unit and illustrates a state where the blocking member is secured to the indoor heat exchanger in the indoor unit of the air-conditioning apparatus according to Embodiment 1 of the present disclosure.

[Fig. 8] Fig. 8 is a diagram for explaining condensate discharging operation in an indoor unit of an air-conditioning apparatus equipped with a seal member in the related art.

[Fig. 9] Fig. 9 is a diagram for explaining condensate discharging operation in the indoor unit of the air-conditioning apparatus according to Embodiment 1 of the present disclosure.

[Fig. 10] Fig. 10 is a side view of an internal structure of an indoor unit of an air-conditioning apparatus according to Embodiment 2 of the present disclosure.

Description of Embodiments

[0010] In each of Embodiment 1 and Embodiment 2 below, an example of an indoor unit of an air-conditioning apparatus according to the present disclosure will be described. A wall-mounted indoor unit to be mounted to a wall of a room that is an air-conditioned space will be described below as an example of the indoor unit of the air-conditioning apparatus according to the present disclosure.

Embodiment 1

[0011] Fig. 1 is a perspective view of an indoor unit of an air-conditioning apparatus according to Embodiment 1 of the present disclosure, as viewed from the front side. Fig. 2 is a perspective view of the indoor unit of the air-conditioning apparatus according to Embodiment 1 of the present disclosure, as viewed from the front side, and illustrates a state where a front part of a housing has been removed. Fig. 3 is a side view of an internal structure of the indoor unit of the air-conditioning apparatus according to Embodiment 1 of the present disclosure. In Fig. 3, the left side of the drawing is the front side of an indoor unit 100.

[0012] The indoor unit 100 of the air-conditioning apparatus includes, for example, a substantially cuboid housing 1. The upper surface of the housing 1 is provided with an air inlet 2. A lower part of the front surface of the housing 1 is provided with an air outlet 3. The housing 1 accommodates, for example, a fan 4 and an indoor heat exchanger 5.

[0013] In Embodiment 1, a cross-flow fan is used as the fan 4. The fan 4 is surrounded by a casing 6. The casing 6 has an opening provided from the front to an upper part of the casing 6, and also has an opening provided at a lower part of the casing 6. The opening at the lower part of the casing 6 communicates with the air outlet 3 mentioned above. When the fan 4 rotates, indoor air is suctioned into the housing 1 through the air inlet 2. The indoor air suctioned into the housing 1 is suctioned into the casing 6 through the opening provided from the front to the upper part of the casing 6. The indoor air suctioned into the casing 6 travels through the opening at the lower part of the casing 6 and is blown indoors through the air outlet 3. Alternatively, the fan 4 used may be a fan other than a cross-flow fan.

[0014] In a side view, the indoor heat exchanger 5 surrounds the fan 4 at a location upstream of the fan 4 in the flowing direction of airflow in the housing 1 produced by the rotation of the fan 4. The indoor heat exchanger 5 includes a first heat exchanger 10 and a second heat exchanger 20. The first heat exchanger 10 is provided above the fan 4 in the diagonally forward direction from the fan 4 and is inclined forward and downward. The second heat exchanger 20 is provided in front of the fan 4 and below the first heat exchanger 10. A drain pan 7 that receives condensate produced in the first heat exchanger

10 and the second heat exchanger 20 is provided below the second heat exchanger 20. The indoor heat exchanger 5 according to Embodiment 1 also includes a third heat exchanger 30. The third heat exchanger 30 is provided above the fan 4 in the diagonally rearward direction from the fan 4 and is inclined rearward and downward.

[0015] The first heat exchanger 10 has at least one heat exchanging unit. In Embodiment 1, the first heat exchanger 10 has a first heat exchanging unit 11 and a second heat exchanging unit 12. The second heat exchanging unit 12 is disposed in front of the first heat exchanging unit 11. Specifically, in Embodiment 1, the second heat exchanging unit 12 is the heat exchanging unit disposed at the front-most side of all the heat exchanging units included in the first heat exchanger 10. Alternatively, the first heat exchanger 10 may have a single heat exchanging unit, or the first heat exchanger 10 may include three or more heat exchanging units arranged in the front-rear direction. In a case where the first heat exchanger 10 has a single heat exchanging unit, the single heat exchanging unit is considered as the heat exchanging unit disposed at the front-most side of all the heat exchanging units included in the first heat exchanger 10.

[0016] In Embodiment 1, the first heat exchanging unit 11 and the second heat exchanging unit 12 are fin-tube-type heat exchanging units. In detail, the first heat exchanging unit 11 and the second heat exchanging unit 12 each include a plurality of first heat-transfer fins 15 and a plurality of first heat-transfer pipes 16 through which refrigerant flows. The plurality of first heat-transfer fins 15 are arranged apart from each other in the left-right direction. The plurality of first heat-transfer pipes 16 are arranged in the left-right direction and extend through the plurality of first heat-transfer fins 15. Alternatively, the first heat exchanging unit 11 and the second heat exchanging unit 12 may be heat exchanging units of a type other than a fin-tube type.

[0017] In Embodiment 1, the second heat exchanger 20 is a fin-tube-type heat exchanger. In detail, the second heat exchanger 20 includes a plurality of second heat-transfer fins 21 and a plurality of second heat-transfer pipes 22 through which refrigerant flows. The plurality of second heat-transfer fins 21 are arranged apart from each other in the left-right direction. The plurality of second heat-transfer pipes 22 are arranged in the left-right direction and extend through the plurality of second heat-transfer fins 21. Alternatively, the second heat exchanger 20 may be a heat exchanger of a type other than a fin-tube type. Moreover, as an alternative to Embodiment 1 in which the second heat exchanger 20 has a single heat exchanging unit, the second heat exchanger 20 may include two or more heat exchanging units.

[0018] Furthermore, the indoor unit 100 according to Embodiment 1 includes a blocking member 50 that covers an area between the first heat exchanger 10 and the second heat exchanger 20 and also a part of the first heat exchanger 10 from the front side. In detail, the block-

ing member 50 includes a plate-like blocking section 51 having, for example, a substantially rectangular shape. The blocking section 51 covers an area between the first heat exchanger 10 and the second heat exchanger 20 and also a part of the first heat exchanger 10 from the front side. The width of the blocking section 51 corresponds to the length that covers the range in which the first heat-transfer fins 15 are arranged in the first heat exchanger 10. An upper edge 52 of the blocking section 51 is positioned higher than a front edge 14 at a lower end 13 of the second heat exchanging unit 12 of the first heat exchanger 10. In other words, the upper edge 52 of the blocking section 51 is positioned higher than the front edge 14 at the lower end 13 of the heat exchanging unit disposed at the front-most side of all the heat exchanging units included in the first heat exchanger 10. As will be described later, the indoor unit 100 according to Embodiment 1 includes the blocking member 50 having this configuration so that dripping of condensate, that is, a phenomenon where condensate drips indoors, can be prevented more than that in the related art.

[0019] In the indoor unit 100 according to Embodiment 1, noise is reduced more than that in the related art by the blocking member 50. Thus, in Embodiment 1, the upper edge 52 of the blocking section 51 is positioned higher than the first heat-transfer pipe 16 disposed at the lowest position in the second heat exchanging unit 12 of the first heat exchanger 10. In other words, the upper edge 52 of the blocking section 51 is positioned higher than the first heat-transfer pipe 16 disposed at the lowest position in the heat exchanging unit disposed at the front-most side of all the heat exchanging units included in the first heat exchanger 10. In Fig. 3, the first heat-transfer pipe 16 disposed at the lowest position in the second heat exchanging unit 12 is defined as a first heat-transfer pipe 16a.

[0020] In Embodiment 1, the heat exchanging units of the first heat exchanger 10 and the second heat exchanger 20 are fin-tube-type heat exchangers. Therefore, in Embodiment 1, the blocking member 50 is secured as follows by using heat-transfer pipes.

[0021] Fig. 4 is a perspective view of the blocking member in the indoor unit of the air-conditioning apparatus according to Embodiment 1 of the present disclosure, as viewed from the front side. Fig. 5 is a perspective view of the blocking member in the indoor unit of the air-conditioning apparatus according to Embodiment 1 of the present disclosure, as viewed from the rear side. Fig. 6 is a perspective view of a first claw unit of the blocking member and the vicinity of the first claw unit, as viewed from the front side, and illustrates a state where the blocking member is secured to the indoor heat exchanger in the indoor unit of the air-conditioning apparatus according to Embodiment 1 of the present disclosure. Fig. 7 is a side view of a second claw unit of the blocking member and the vicinity of the second claw unit and illustrates a state where the blocking member is secured to the indoor heat exchanger in the indoor unit of the air-conditioning

apparatus according to Embodiment 1 of the present disclosure. In Fig. 7, the left side of the drawing is the front side of the indoor unit 100.

[0022] The blocking member 50 includes a claw unit 55 that secures the blocking member 50 by being hooked to at least two of the plurality of first heat-transfer pipes 16 in the first heat exchanger 10 and the plurality of second heat-transfer pipes 22 in the second heat exchanger 20. In Embodiment 1, the claw unit 55 includes a first claw unit 56 and a second claw unit 57.

[0023] The first claw unit 56 includes a claw 56a and a claw 56b. The claw 56a is hooked to a first heat-transfer pipe 16 of the first heat exchanger 10 outside of the range in which the first heat-transfer fins 15 are arranged in the first heat exchanger 10. In other words, the claw 56a is hooked to the first heat-transfer pipe 16 of the first heat exchanger 10 outside of the first heat-transfer fin 15 disposed at the outermost side in the left-right direction. The claw 56b is hooked to a second heat-transfer pipe 22 of the second heat exchanger 20 outside of the range in which the second heat-transfer fins 21 are arranged in the second heat exchanger 20. In other words, the claw 56b is hooked to the second heat-transfer pipe 22 of the second heat exchanger 20 outside of the second heat-transfer fin 21 disposed at the outermost side in the left-right direction.

[0024] The second claw unit 57 includes a claw 57a and a claw 57b. The claw 57a is hooked to a first heat-transfer pipe 16 of the first heat exchanger 10 between neighboring first heat-transfer fins 15 of the first heat exchanger 10. The claw 57b is hooked to a second heat-transfer pipe 22 of the second heat exchanger 20 between neighboring second heat-transfer fins 21 of the second heat exchanger 20.

[0025] If a claw of the claw unit 55 is hooked to only a single heat-transfer pipe, the blocking member 50 cannot be secured as the blocking member 50 may rotate about the heat-transfer pipe used as a rotation axis. In contrast, by hooking claws of the claw unit 55 to two or more heat-transfer pipes, the blocking member 50 can be secured.

[0026] The following description relates to condensate discharging operation performed when condensation is produced in the first heat exchanger 10 of the indoor heat exchanger 5 in the indoor unit 100 according to Embodiment 1. To facilitate the recognition of the condensate-dripping prevention effect of the blocking member 50, condensate discharging operation performed when a seal member 150 in the related art is provided in place of the blocking member 50 in the indoor unit 100 according to Embodiment 1 will first be described below. Then, the condensate discharging operation in the indoor unit 100 according to Embodiment 1 will be described.

[0027] Fig. 8 is a diagram for explaining the condensate discharging operation in the indoor unit of the air-conditioning apparatus equipped with the seal member in the related art. The indoor unit illustrated in Fig. 8 is obtained by removing the blocking member 50 from the indoor unit 100 according to Embodiment 1 and attaching

the seal member 150 in the related art in place of the blocking member 50. Fig. 8 is a side view of an internal structure of the indoor unit. In Fig. 8, the left side of the drawing is the front side of the indoor unit.

[0028] Similar to the blocking member 50, the seal member 150 in the related art covers an area between the first heat exchanger 10 and the second heat exchanger 20 and also a part of the first heat exchanger 10 from the front side. However, an upper edge 152 of the seal member 150 in the related art is positioned lower than the upper edge 52 of the blocking member 50. In detail, the upper edge 152 of the seal member 150 in the related art is positioned lower than the front edge 14 at the lower end 13 of the second heat exchanging unit 12 of the first heat exchanger 10.

[0029] When the indoor heat exchanger 5 is used as an evaporator, indoor air suctioned into the housing 1 by the fan 4 is cooled by refrigerant flowing through the indoor heat exchanger 5. In this case, the moisture in the indoor air condenses on the indoor heat exchanger 5, causing condensate 60 to adhere to the indoor heat exchanger 5. Normally, the condensate 60 adhering to the first heat exchanger 10 flows down along the first heat exchanger 10 to the second heat exchanger 20 and adheres to the second heat exchanger 20. Then, the condensate 60 adhering to the second heat exchanger 20 flows down along the second heat exchanger 20 and is discharged to the drain pan 7 disposed below the second heat exchanger 20. The condensate 60 discharged to the drain pan 7 is discharged outdoors via, for example, a pipe, which is not illustrated.

[0030] For example, the degree of water repellency of the indoor heat exchanger 5 may sometimes increase because of an environmental factor, such as the indoor use of a large amount of spray having a water repelling function, such as hair spray. In such a case, the degree of water repellency of the first heat exchanger 10 increases, causing an increase in the speed of the condensate 60 flowing down along the first heat exchanger 10. Thus, the condensate 60 flowing down along the first heat exchanger 10 is about to drop forward of the second heat exchanger 20 without being able to reach the second heat exchanger 20.

[0031] In this case, as the upper edge 152 of the seal member 150 in the related art is located at a low position, the condensate 60 flowing down along the first heat exchanger 10 passes over the second heat exchanger 20 and the seal member 150, as indicated with a dashed arrow in Fig. 8. Then, the condensate 60 dropping forward of the second heat exchanger 20 and the seal member 150 cannot be received by the drain pan 7. Therefore, the condensate 60 dropping forward of the second heat exchanger 20 and the seal member 150 drips indoors, thus causing dripping of condensate to occur. It may be possible for the drain pan 7 to receive the condensate 60 dropping forward of the second heat exchanger 20 and the seal member 150 if the drain pan 7 is made larger in the front-rear direction. However, if the drain pan 7 is

made larger in the front-rear direction, the dimension of the housing 1 in the front-rear direction also increases. As the size of the housing 1 is limited, it is not practical to make the drain pan 7 larger in the front-rear direction for preventing dripping of condensate.

[0032] In contrast, in the indoor unit 100 according to Embodiment 1 equipped with the blocking member 50, the condensate 60 adhering to the first heat exchanger 10 is discharged as follows.

[0033] Fig. 9 is a diagram for explaining the condensate discharging operation in the indoor unit of the air-conditioning apparatus according to Embodiment 1 of the present disclosure. Fig. 9 is a side view of an internal structure of the indoor unit 100 according to Embodiment 1. In Fig. 9, the left side of the drawing is the front side of the indoor unit 100 according to Embodiment 1.

[0034] As mentioned above, when the degree of water repellency of the first heat exchanger 10 increases, the condensate 60 flowing down along the first heat exchanger 10 is about to drop forward of the second heat exchanger 20. In this case, the condensate 60 flowing down along the first heat exchanger 10 drops from the lower end of the first heat exchanger 10. Thus, of all the condensate 60 dropping from the first heat exchanger 10, the condensate 60 dropping from the highest position is the condensate 60 dropping from the highest location at the lower end of the first heat exchanger 10. Specifically, of all the condensate 60 dropping from the first heat exchanger 10, the condensate 60 dropping from the highest position is the condensate 60 dropping from the front edge 14 at the lower end 13 of the second heat exchanging unit 12.

[0035] As mentioned above, the upper edge 52 of the blocking section 51 is positioned higher than the front edge 14 at the lower end 13 of the second heat exchanging unit 12 of the first heat exchanger 10. Specifically, the upper edge 52 of the blocking section 51 is positioned higher than the condensate 60 dropping from the highest position of all the condensate 60 dropping from the first heat exchanger 10. Thus, in the indoor unit 100 according to Embodiment 1, even when the condensate 60 flowing down along the first heat exchanger 10 is about to drop forward of the second heat exchanger 20, the condensate 60 that is about to drop forward of the second heat exchanger 20 collides with the blocking member 50, as indicated with a dashed arrow in Fig. 9.

[0036] Then, the condensate 60 colliding with the blocking member 50 flows down along the blocking member 50 to the second heat exchanger 20 and adheres to the second heat exchanger 20. Then, the condensate 60 adhering to the second heat exchanger 20 flows down along the second heat exchanger 20 and is discharged to the drain pan 7 disposed below the second heat exchanger 20. Consequently, the indoor unit 100 according to Embodiment 1 can prevent dripping of condensate more than that in the related art even when the degree of water repellency of the first heat exchanger 10 increases.

[0037] In view of the size of the condensate 60, it is more preferable that the upper edge 52 of the blocking section 51 be positioned higher than the front edge 14 at the lower end 13 of the second heat exchanging unit 12 of the first heat exchanger 10 by an extent greater than or equal to the size of the condensate 60. For example, the size of the condensate 60 is defined to be 5 mm. In this case, it is more preferable that the upper edge 52 of the blocking section 51 be positioned higher than the front edge 14 at the lower end 13 of the second heat exchanging unit 12 of the first heat exchanger 10 by 5 mm or more. Accordingly, the condensate 60 can be captured more reliably by the blocking member 50 so that dripping of condensate can be further prevented.

[0038] Furthermore, in the indoor unit 100 according to Embodiment 1, the upper edge 52 of the blocking section 51 of the blocking member 50 is positioned higher than the first heat-transfer pipe 16 disposed at the lowest position in the second heat exchanging unit 12 of the first heat exchanger 10. Therefore, in the indoor unit 100 according to Embodiment 1, noise coming from the fan 4 can be reduced more than that in the related art.

[0039] In detail, when airflow with uneven air-volume distribution enters the fan 4, the noise coming from the fan 4 increases. In the case of the indoor unit 100 according to Embodiment 1, an area indicated with an arrow A in Figs. 8 and 9 only has the first heat exchanging unit 11 in the direction of the airflow caused by the rotation of the fan 4 to pass through the first heat exchanger 10. In other words, the airflow passing through the area indicated with the arrow A in Figs. 8 and 9 travels through a heat exchanger having two rows of first heat-transfer pipes 16 arranged in the direction of the airflow. On the other hand, an area indicated with an arrow B in Figs. 8 and 9 has the first heat exchanging unit 11 and the second heat exchanging unit 12 in the direction of the airflow caused by the rotation of the fan 4 to pass through the first heat exchanger 10. In other words, the airflow passing through the area indicated with the arrow B in Figs. 8 and 9 travels through a heat exchanger having three rows of first heat-transfer pipes 16 arranged in the direction of the airflow. Specifically, the area indicated with the arrow A has lower air resistance than that in the area indicated with the arrow B.

[0040] As mentioned above, the upper edge 152 of the seal member 150 in the related art is located at a low position. Therefore, as illustrated in Fig. 8, in the case where the seal member 150 in the related art is provided, the airflow passes through the area indicated with the arrow A. In this case, as the area indicated with the arrow A has lower air resistance than that in the area indicated with the arrow B, the speed of the air flowing through the area indicated with the arrow A is higher than the speed of the air flowing through the area indicated with the arrow B. Thus, the flow rate of air flowing through the area indicated with the arrow A becomes greater than the flow rate of air flowing through the area indicated with the arrow B. Consequently, in the case where the seal mem-

ber 150 in the related art is provided, the air that has passed through the area indicated with the arrow A and the air that has passed through the area indicated with the arrow B flow into the fan 4. Thus, in the case where the seal member 150 in the related art is provided, airflow with uneven air-volume distribution enters the fan 4, thus causing the noise coming from the fan 4 to increase.

[0041] In contrast, the upper edge 52 of the blocking section 51 of the blocking member 50 according to Embodiment 1 is positioned higher than the first heat-transfer pipe 16 disposed at the lowest position in the second heat exchanging unit 12 of the first heat exchanger 10. Specifically, as illustrated in Fig. 9, the blocking section 51 of the blocking member 50 according to Embodiment 1 is configured to cover the area indicated with the arrow A from the front. Thus, in the indoor unit 100 according to Embodiment 1, the air that has passed through the area indicated with the arrow B flows into the fan 4. Therefore, in the indoor unit 100 according to Embodiment 1, airflow with air-volume distribution that is more even than that in the related art enters the fan 4, so that the noise coming from the fan 4 can be reduced more than that in the related art.

[0042] In a case where the air resistance of the first heat exchanger 10 and the air resistance of the second heat exchanger 20 are different from each other, the air tends to flow more to the heat exchanger with the lower air resistance. For example, in the case of Embodiment 1, the second heat exchanger 20 has the second heat-transfer pipes 22 arranged in two rows in the direction of the airflow caused by the rotation of the fan 4 to pass through the second heat exchanger 20. On the other hand, in the range in which the first heat exchanging unit 11 and the second heat exchanging unit 12 are arranged in parallel, the first heat exchanger 10 has the first heat-transfer pipes 16 arranged in three rows in the direction of the airflow caused by the rotation of the fan 4 to pass through the first heat exchanger 10. Therefore, in the case of Embodiment 1, the air resistance of the second heat exchanger 20 is lower than the air resistance of the first heat exchanger 10. Consequently, the air tends to flow more to the second heat exchanger 20 than to the first heat exchanger 10.

[0043] Therefore, because of a difference between the flow rate of air flowing through the second heat exchanger 20 and the flow rate of air flowing through the first heat exchanger 10, airflow with uneven air-volume distribution may enter the fan 4, sometimes causing the noise coming from the fan 4 to increase. In this case, as illustrated in Figs. 3 and 9, the blocking member 50 may cover a part of the second heat exchanger 20 from the front side so that air is less likely to flow to the second heat exchanger 20. Consequently, unevenness in the air-volume distribution of the air flowing into the fan 4 can be reduced, and the noise coming from the fan 4 can be reduced more than that in the related art. The required range for covering the second heat exchanger 20 for reducing unevenness in the air-volume distribution of the air flowing

into the fan 4 varies depending on the capacity of the fan 4. Thus, the position of a lower edge 53 of the blocking section 51 of the blocking member 50 varies depending on the capacity of the fan 4.

[0044] The material of the blocking member 50 is not particularly limited, but is preferably of a type that does not deform in response to airflow caused by the rotation of the fan 4. A preferred example of the material of the blocking member 50 is resin or metal. Specifically, the blocking member 50 is preferably made of at least one of resin and metal.

[0045] As described above, the indoor unit 100 of the air-conditioning apparatus according to Embodiment 1 includes the first heat exchanger 10, the second heat exchanger 20, the drain pan 7, and the blocking member 50. The first heat exchanger 10 is inclined forward and downward. The second heat exchanger 20 is provided below the first heat exchanger 10. The drain pan 7 is provided below the second heat exchanger 20. The blocking member 50 covers an area between the first heat exchanger 10 and the second heat exchanger 20 and also a part of the first heat exchanger 10 from the front side. The first heat exchanger 10 has at least one heat exchanging unit. The upper edge 52 of the blocking member 50 is higher than the front edge at the lower end of the heat exchanging unit disposed at the front-most side of all the heat exchanging units of the first heat exchanger 10.

[0046] In the indoor unit 100 of the air-conditioning apparatus according to Embodiment 1, even when the degree of water repellency of the first heat exchanger 10 increases and the condensate 60 flowing down along the first heat exchanger 10 is about to drop forward of the second heat exchanger 20, the condensate 60 collides with the blocking member 50. Then, the condensate 60 colliding with the blocking member 50 flows down along the blocking member 50 to the second heat exchanger 20 and adheres to the second heat exchanger 20. The condensate 60 adhering to the second heat exchanger 20 then flows down along the second heat exchanger 20 and is discharged to the drain pan 7 disposed below the second heat exchanger 20. Consequently, the indoor unit 100 of the air-conditioning apparatus according to Embodiment 1 can prevent dripping of condensate more than that in the related art even when the degree of water repellency of the first heat exchanger 10 increases.

Embodiment 2

[0047] The shape of the blocking member 50 is not limited to the shape shown in Embodiment 1. For example, the blocking member 50 may have a shape as shown in Embodiment 2. In Embodiment 2, items not described in particular are identical to those in Embodiment 1, and functions and components identical to those in Embodiment 1 are described with the same reference signs.

[0048] Fig. 10 is a side view of an internal structure of the indoor unit of the air-conditioning apparatus accord-

ing to Embodiment 2 of the present disclosure. In Fig. 10, the left side of the drawing is the front side of the indoor unit 100.

[0049] In Embodiment 2, a part including the upper edge 52 of the blocking section 51 of the blocking member 50 is inclined and extends rearward as the part extends upward. Specifically, an upper part of the blocking section 51 of the blocking member 50 is inclined and extends rearward as the upper part extends upward. For example, the part including the upper edge 52 of the blocking section 51 of the blocking member 50 is inclined and extends rearward as the part extends upward, in such a manner that the part extends along the front surface of the first heat exchanger 10.

[0050] In a case where the blocking member 50 is configured in this manner, the condensate 60 flowing down along the first heat exchanger 10 flows under the upper part of the blocking section 51 before dropping from the first heat exchanger 10. Therefore, as compared with the blocking member 50 described in Embodiment 1, the blocking member 50 according to Embodiment 2 can further prevent the condensate 60 dropping from the first heat exchanger 10 from passing over the blocking member 50. Consequently, the indoor unit 100 according to Embodiment 2 can prevent dripping of condensate more than that in Embodiment 1.

Reference Signs List

[0051] 1 housing 2 air inlet 3 air outlet 4 fan 5 indoor heat exchanger 6 casing 7 drain pan 10 first heat exchanger 11 first heat exchanging unit 12 second heat exchanging unit 13 lower end 14 front edge 15 first heat-transfer fin 16 first heat-transfer pipe 20 second heat exchanger 21 second heat-transfer fin 22 second heat-transfer pipe 30 third heat exchanger 50 blocking member 51 blocking section 52 upper edge 53 lower edge 55 claw unit 56 first claw unit 56a claw 56b claw 57 second claw unit 57a claw 57b claw 60 condensate 100 indoor unit 150 seal member (related art) 152 upper edge (related art)

Claims

1. An indoor unit of an air-conditioning apparatus, the indoor unit comprising:

a first heat exchanger inclined forward and downward;
a second heat exchanger provided below the first heat exchanger;
a drain pan provided below the second heat exchanger; and
a blocking member covering an area between the first heat exchanger and the second heat exchanger and also a part of the first heat exchanger from a front side,

the first heat exchanger having at least one heat exchanging unit,
an upper edge of the blocking member being higher than a front edge at a lower end of the heat exchanging unit disposed at a front-most side.

2. The indoor unit of an air-conditioning apparatus of claim 1,
wherein the heat exchanging unit includes a plurality of first heat-transfer fins arranged apart from each other in a left-right direction, and a plurality of first heat-transfer pipes extending through the plurality of first heat-transfer fins.
3. The indoor unit of an air-conditioning apparatus of claim 2,
wherein the upper edge of the blocking member is higher than a first heat-transfer pipe disposed at a lowest position among the plurality of first heat-transfer pipes in the heat exchanging unit disposed at the front-most side.
4. The indoor unit of an air-conditioning apparatus of claim 2 or 3,
wherein the second heat exchanger includes a plurality of second heat-transfer fins arranged apart from each other in the left-right direction, and a plurality of second heat-transfer pipes extending through the plurality of second heat-transfer fins, and wherein the blocking member includes a claw unit for securing the blocking member, the claw unit being hooked to at least two of the plurality of first heat-transfer pipes and the plurality of second heat-transfer pipes.
5. The indoor unit of an air-conditioning apparatus of any one of claims 1 to 4,
wherein the blocking member is made of at least one of resin and metal.
6. The indoor unit of an air-conditioning apparatus of any one of claims 1 to 5,
wherein a part including the upper edge of the blocking member is inclined and extends rearward as the part extends upward.

FIG. 1

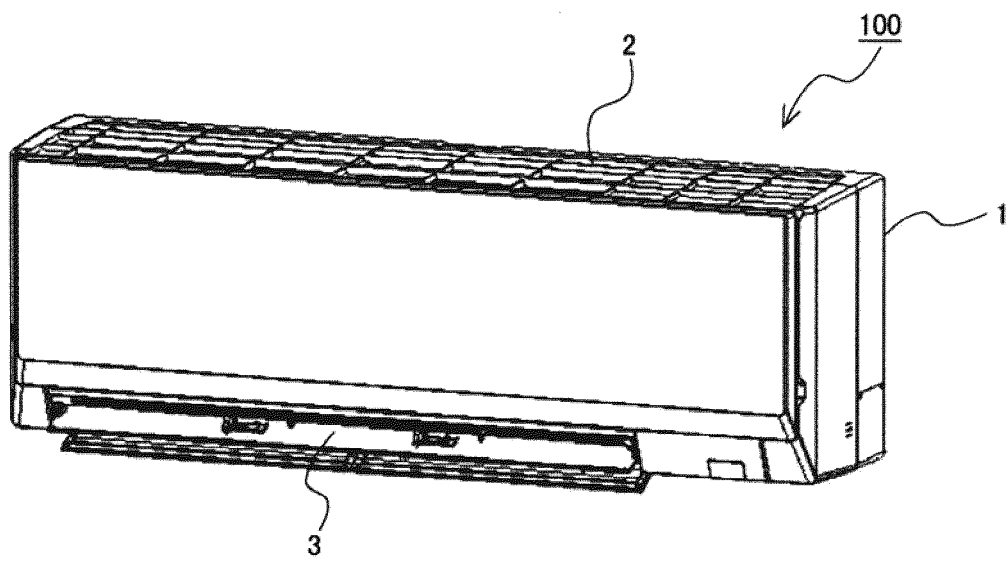


FIG. 2

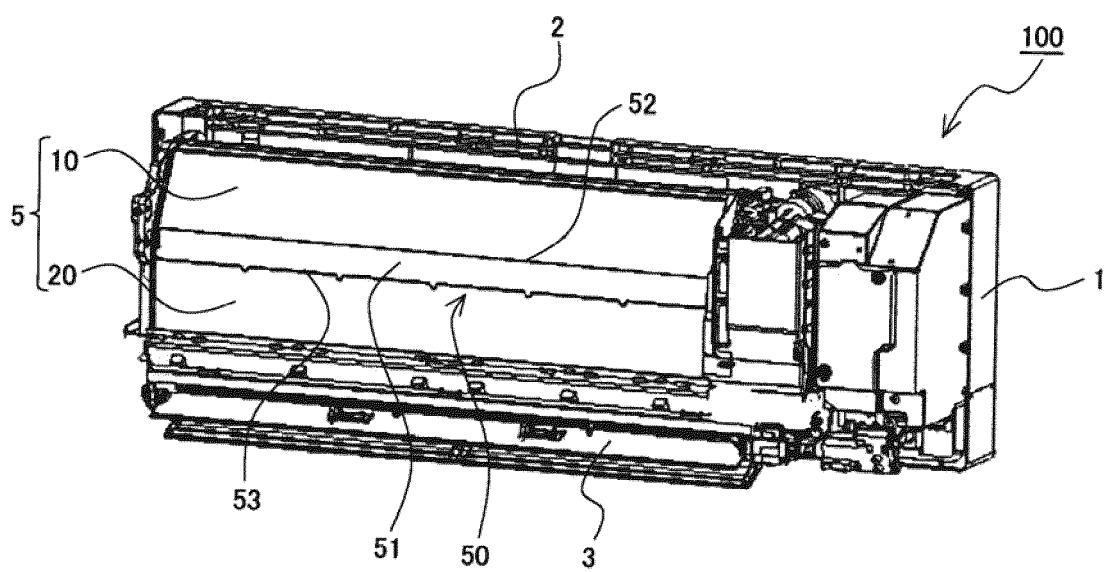


FIG. 3

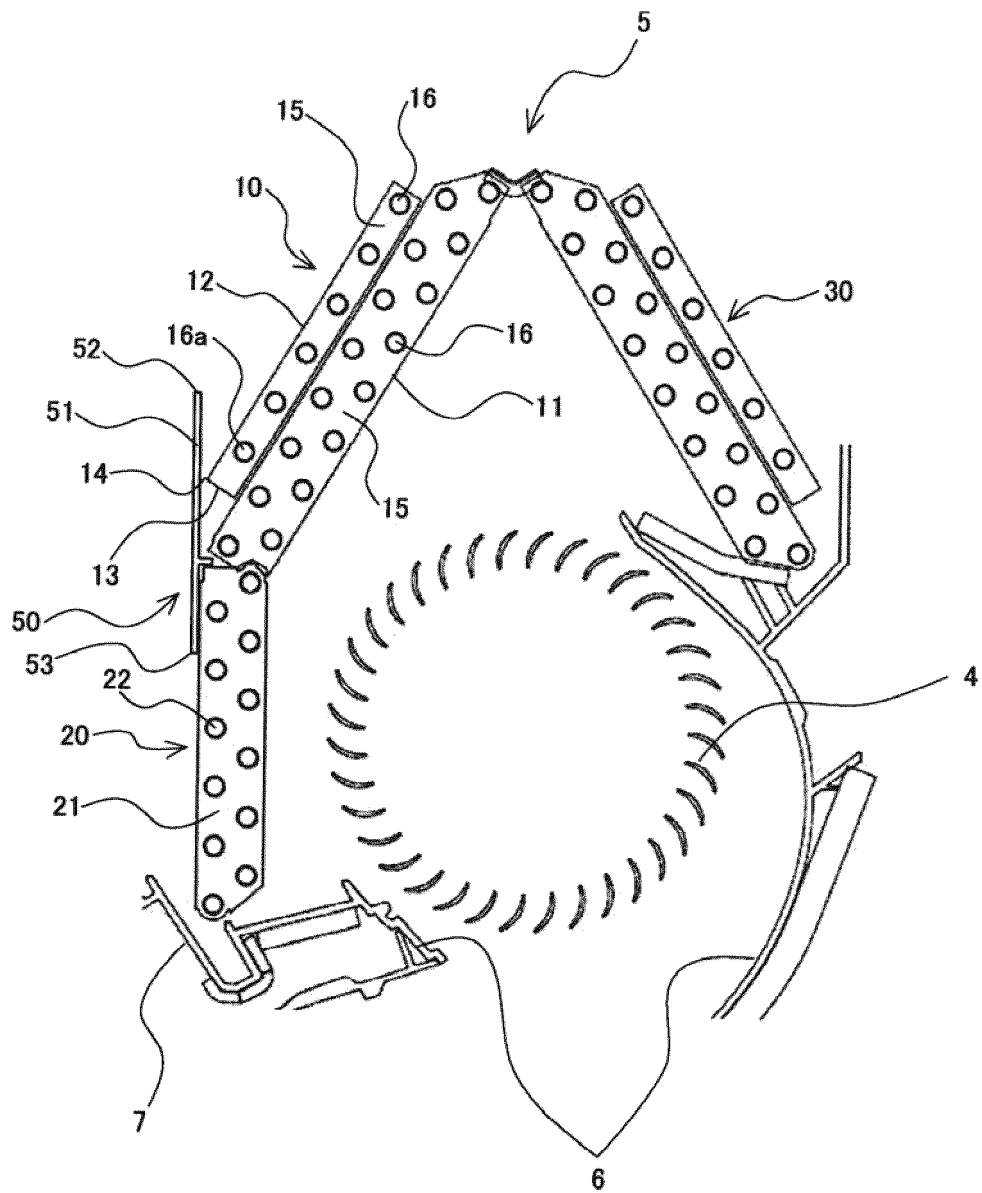


FIG. 4

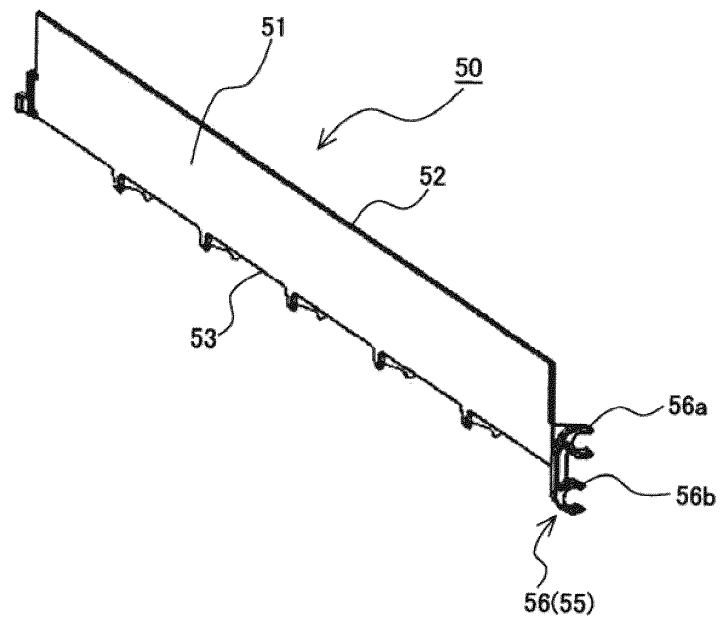


FIG. 5

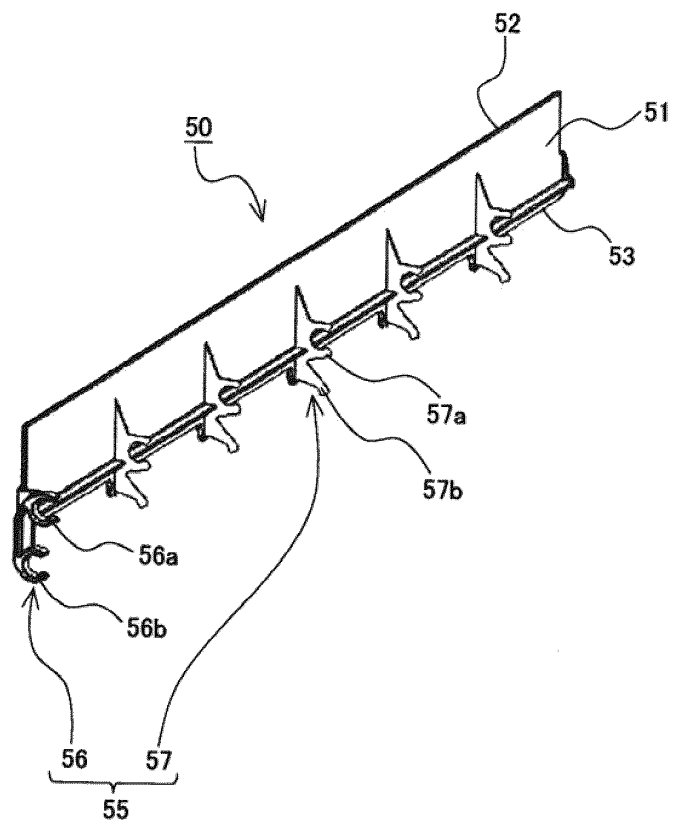


FIG. 6

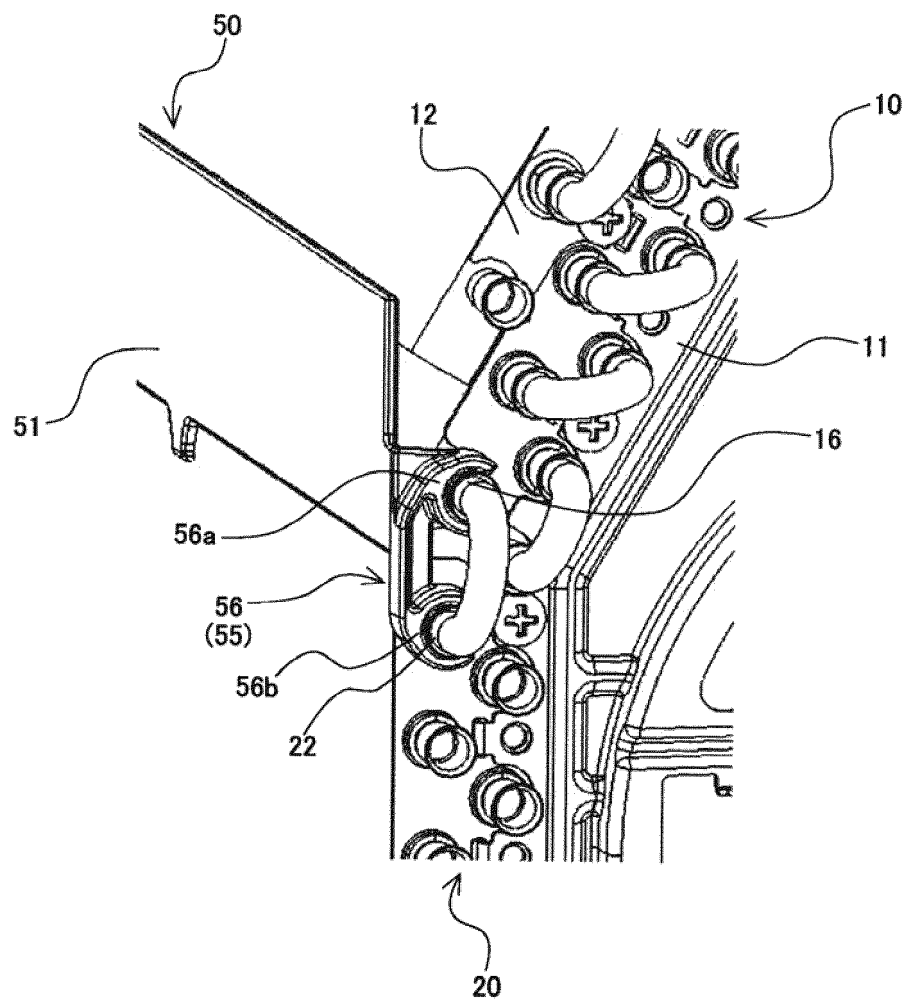


FIG. 7

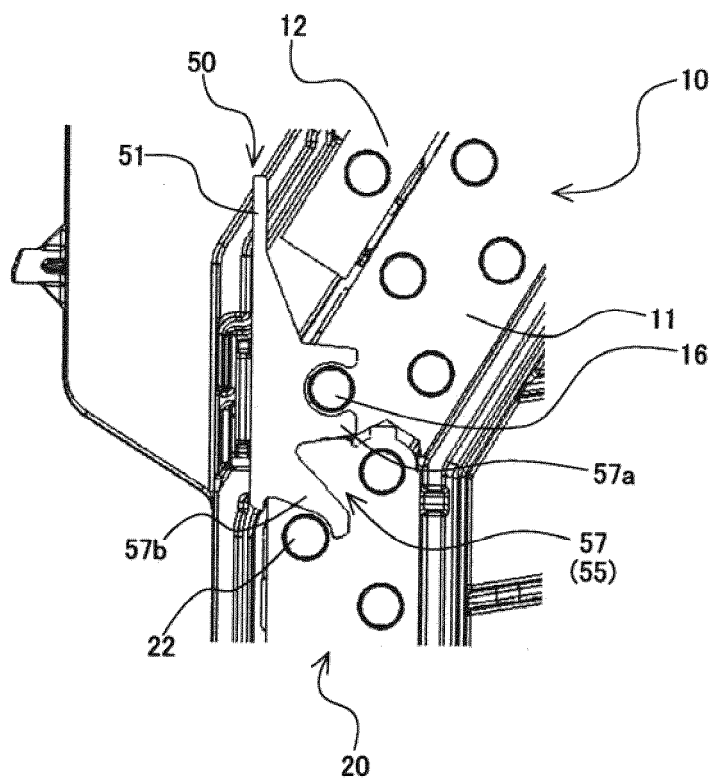


FIG. 8

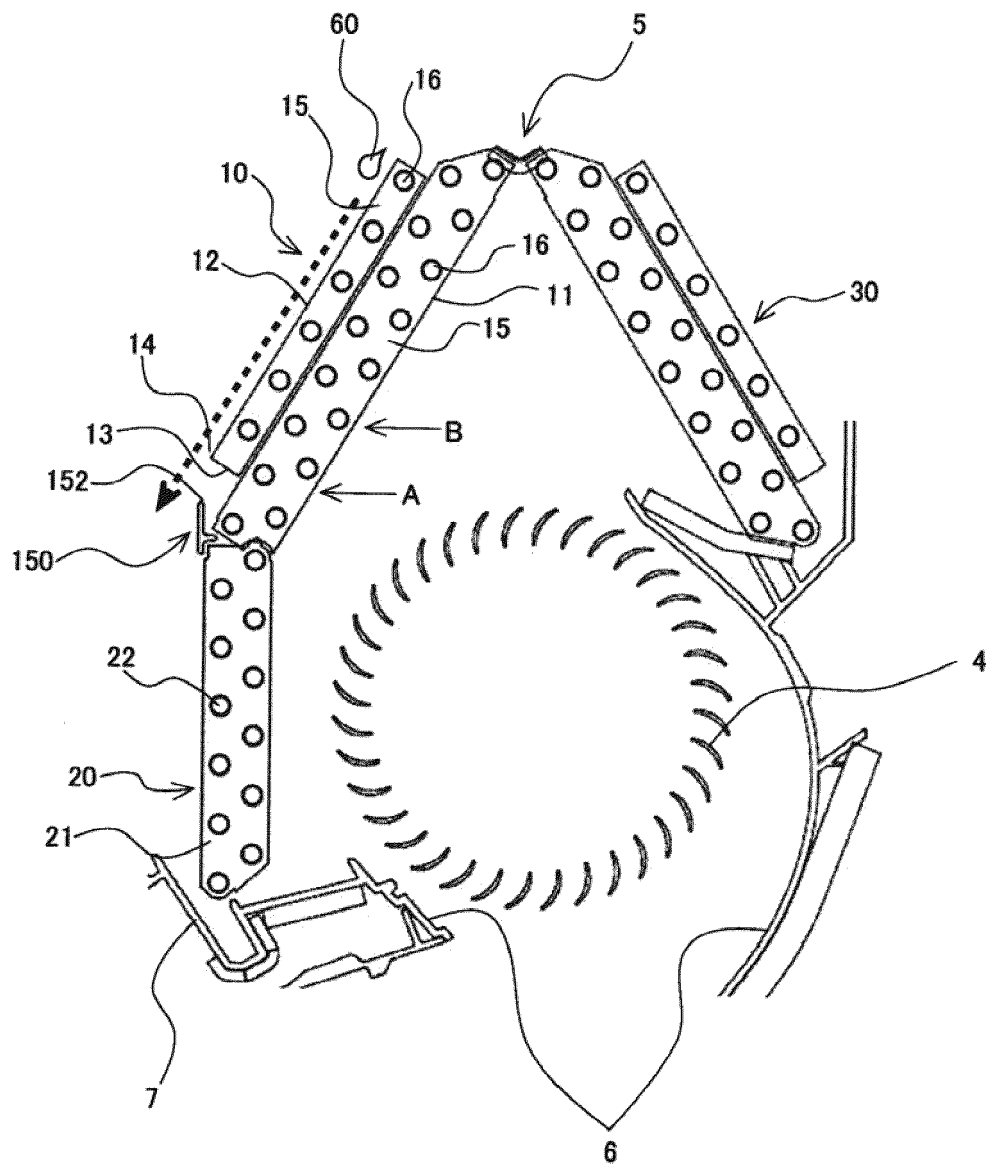


FIG. 9

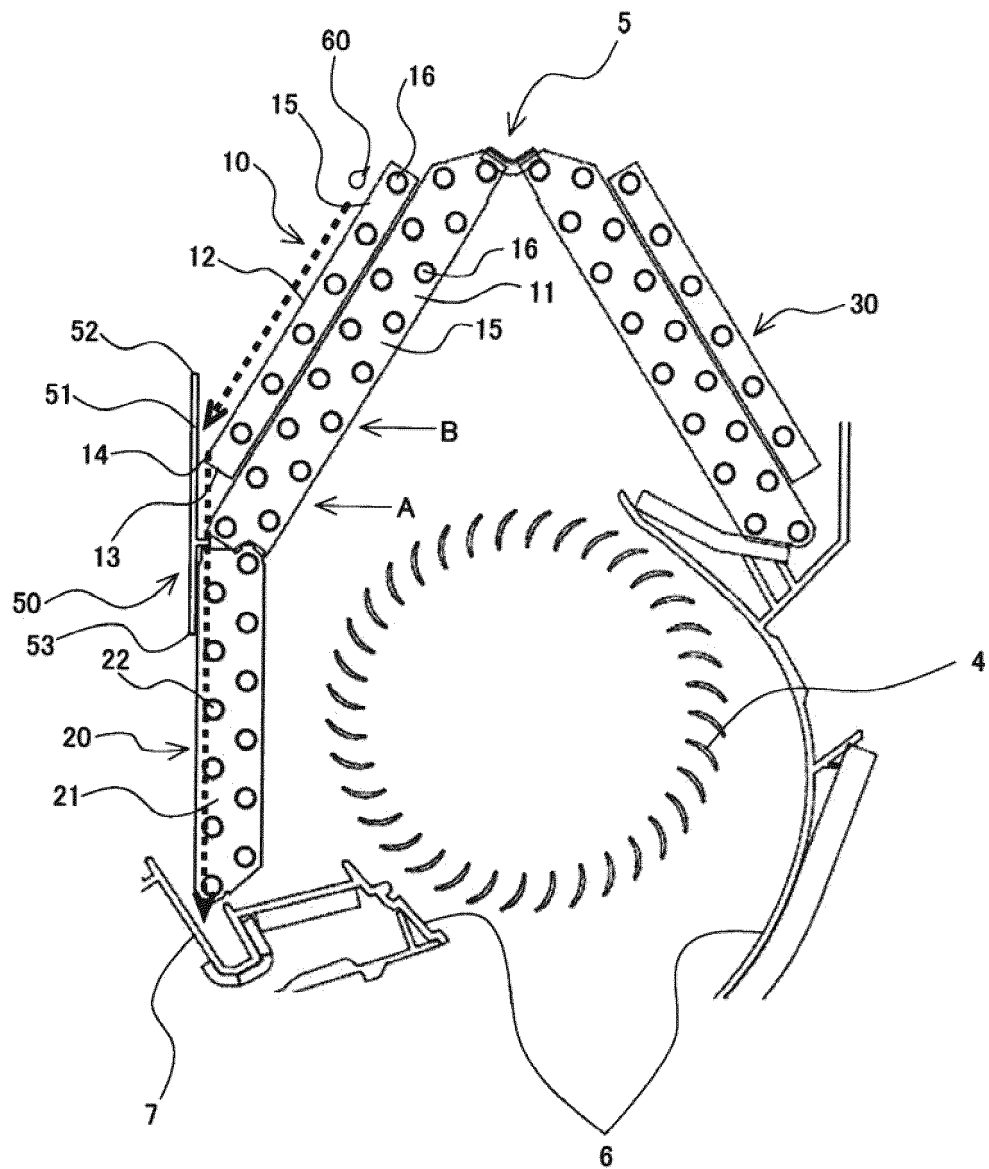
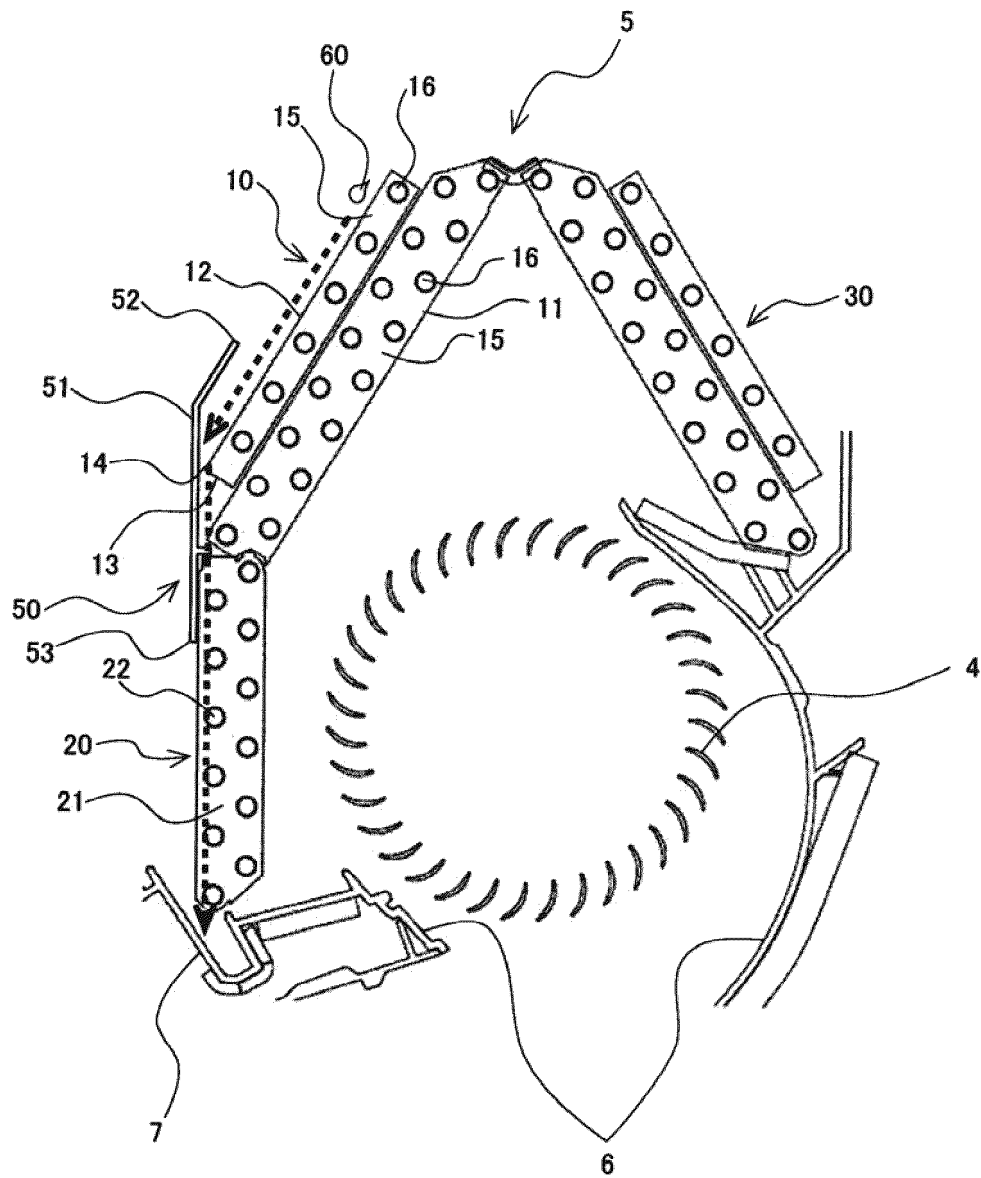


FIG. 10



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2018/011045

A. CLASSIFICATION OF SUBJECT MATTER
Int. Cl. F24F13/22 (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. F24F13/22

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	JP 2004-108702 A (MITSUBISHI ELECTRIC CORP.) 08	1
Y	April 2004, paragraphs [0010]-[0018], fig. 1-5 (Family: none)	2-6
X	CD-ROM of the specification and drawings annexed	1
Y	to the request of Japanese Utility Model Application No. 1075/1993 (Laid-open No. 59720/1994) (FUJITSU GENERAL LTD.) 19 August 1994, paragraph [0003], fig. 4 (Family: none)	2-6
Y	JP 2014-77591 A (MITSUBISHI HEAVY INDUSTRIES, LTD.) 01 May 2014, paragraph [0022] & EP 2719970 A2, paragraph [0022]	2-6

☒ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

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Date of the actual completion of the international search
05.06.2018

Date of mailing of the international search report
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INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2018/011045

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 2001-90978 A (MITSUBISHI ELECTRIC CORP.) 03 April 2001, fig. 2 (Family: none)	4-6
Y	JP 2016-90162 A (MITSUBISHI HEAVY INDUSTRIES, LTD.) 23 May 2016, fig. 3 (Family: none)	4-6
Y	JP 3-5637 A (MATSUSHITA ELECTRIC INDUSTRIAL CO., LTD.) 11 January 1991, page 2, left column, lines 1-3 (Family: none)	5-6
A	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 144940/1988 (Laid-open No. 67816/1990) (MITSUBISHI HEAVY INDUSTRIES, LTD.) 23 May 1990, description, page 6, line 6, to page 10, line 1, fig. 1, 2 (Family: none)	1-6

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2005214561 A [0003]