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(54) INDOOR AIR CONDITIONER

(57) There is suppressing of a phenomenon, where a suction opening in a lower surface does not function, being generated depending on different circumstances due to differences in environmental conditions. A casing (11) has a top surface suction opening (21) and a lower surface suction opening (22). An indoor fan (15) generates a flow of air which is sucked in from each of the suction openings (21, 22). An indoor heat exchanger (13) has a shape which is a shape like an inverted V with front side heat exchange sections (13a, 13b) and a rear side heat exchange section (13c), and a suction resistance section (50) impedes the flow of air which is sucked in from the top surface suction opening (21). In particular, the indoor fan (15) generates a flow of air which is sucked in from each of the suction openings (21, 22) and flows to the rear side heat exchange section (13c). The suction resistance section (50) is positioned in the top surface suction opening (21) which faces the rear side heat exchange section (13c).

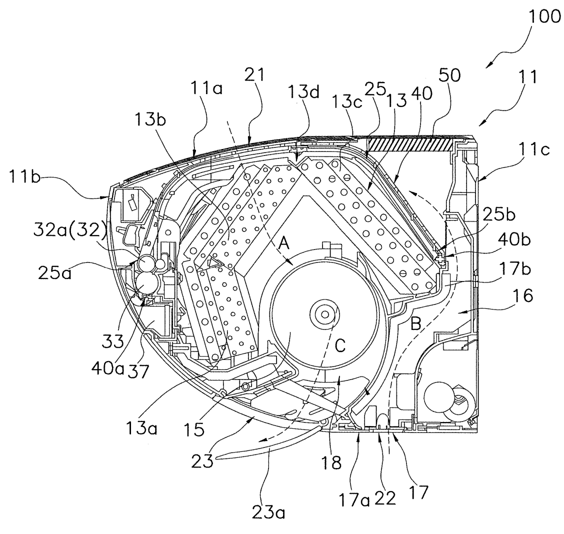

FIG. 2

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Description

TECHNICAL FIELD

[0001] The present invention relates to an air conditioner, and in particular, relates to an air conditioner which is a wall mounting type.

BACKGROUND ART

[0002] There are a separate type of air conditioner which is configured by an outdoor unit which is installed outside and an indoor unit which is installed indoors. In particular, as the indoor unit, there is a wall mounting type which is attached to an indoor wall surface or the like.

[0003] Indoor units which are a wall mounting type are known as shown in, for example, PTL 1 (Japanese Unexamined Patent Application Publication No. 2001-311530). The indoor unit according to PTL1 has a top surface suction opening in a top surface and has a lower surface suction opening and a vent opening in a lower surface. Due to the indoor unit, indoor air is vented into a room through the vent opening after the indoor air is sucked in from both of the suction openings and is subjected to heat exchanging with a heat exchanger.

SUMMARY OF THE INVENTION

<Technical Problem>

[0004] However, environmental conditions of the locations in which the indoor units are installed differ with each location. Due to this, in the indoor unit where there are suction openings in not only the top surface but also the lower surface as shown in PTL 1, there are cases where a phenomenon occurs where air is mainly sucked in from the suction opening in the top surface and hardly any air is sucked in from the suction opening in the lower surface depending on environmental conditions at the location in which the indoor unit is installed. In particular, the indoor unit which is a wall mounting type is installed indoors at a position which is relatively close to the ceiling and the gap between the top surface of the indoor unit and the ceiling is often narrow. As a result, there is variation in the performance of the indoor unit compared to a case where performance is evaluated in a state where the gap between the top surface of the indoor unit and the ceiling is large.

[0005] Therefore, the object of the present invention is to suppress a phenomenon, where the suction opening in the lower surface does not function, being generated depending on different circumstances due to differences in environmental conditions.

<Solution to Problem>

[0006] An air conditioner according to a first aspect of the present invention is an air conditioner which is a wall mounting type and is provided with a casing, a fan, a heat exchanger, and a suction resistance section. The casing has a top surface suction opening and a lower surface suction opening. The top surface suction opening is provided from the front side across to the rear side of the top surface. The lower surface suction opening is provided in the lower surface. The fan is positioned inside the casing and generates a flow of air which is sucked in from the top surface suction opening and the lower surface suction opening. The heat exchanger is formed inside the casing by combining front side heat exchange sections and a rear side heat exchange section as a shape like an inverted V in a side surface view. The front side heat exchange sections cover the front of the fan and the rear side heat exchange section covers the rear side of the fan. The suction resistance section impedes the flow of air which is sucked in from the top surface suction opening. Furthermore, in the suction resistance section, suction resistance at a portion of the top surface suction opening which faces the rear side heat exchange section is larger than suction resistance at a portion of the top surface suction opening which faces the front side heat exchange sections. Then, the fan generates a flow of air which is sucked in from the top surface suction opening and the lower surface suction opening and flows to the rear side heat exchange section. The suction resistance section is positioned in the top surface suction opening which faces the rear side heat exchange section.

[0007] Due to the air conditioner, the amount of indoor air which is sucked in from the top surface suction opening is suppressed due to the suction resistance section. As a result, the amount of increase in the indoor air which is sucked in from the top surface suction opening is suppressed to a certain extent due to the suction resistance section even in a case where the air conditioner is installed in environmental conditions such that there is an increase in the indoor air which is sucked in from the top surface suction opening. Accordingly, it is possible to reduce the degree of variation in the ratio of the amount of indoor air which is sucked in from the top surface suction opening and the amount of indoor air which is sucked in from the lower surface suction opening and it is possible to suppress a phenomenon, where the lower surface suction opening does not function, being generated depending on different circumstances due to differences in environmental conditions.

[0008] An air conditioner according to a second aspect of the present invention is the air conditioner according to the first aspect of the present invention wherein the suction resistance section is positioned in a rear side portion of the top surface suction opening which faces the rear side heat exchange section.

[0009] Due to this, the amount of indoor air which is sucked in from the rear side portion of the top surface suction opening is reduced. As a result, it is possible to further reduce the degree of variation in the ratio of the amount of indoor air which is sucked in from the top surface suction opening and the amount of indoor air which is sucked in from the lower surface suction opening.

[0010] An air conditioner according to a third aspect of the present invention is the air conditioner according to the first aspect or the second aspect of the present invention wherein the suction resistance section is configured using a portion of the casing.

[0011] Due to this, it is possible to configure the suction resistance section in a simple manner and costs can be limited compared to a case where the suction resistance section is formed with a different member.

[0012] An air conditioner according to a fourth aspect of the present invention is the air conditioner according to the first aspect or the second aspect of the present invention wherein the suction resistance section is configured by a different member to the casing and is mounted in the top surface suction opening.

[0013] Due to this, it is possible to provide the suction resistance section in a simple manner.

[0014] An air conditioner according to a fifth aspect of the present invention is the air conditioner according to any of the first aspect to the fourth aspect of the present invention wherein the suction resistance section is provided to span across the entire length of the top surface suction opening in the longitudinal direction.

[0015] Due to this, it is possible for the suction resistance section to close off across the entire length of the top surface suction opening in the longitudinal direction.

[0016] An air conditioner according to a sixth aspect of the present invention is the air conditioner according to any of the first aspect to the fifth aspect of the present invention wherein the suction resistance section closes off approximately 30% or more of the rear side portion of the top surface suction opening.

[0017] Due to this, it is possible to reduce the degree of variation in the ratio of the amount of indoor air which is sucked in from the top surface suction opening and the amount of indoor air which is sucked in from the lower surface suction opening and for the lower surface suction opening to reliably function.

[0018] An air conditioner according to a seventh aspect of the present invention is the air conditioner according to the sixth aspect of the present invention wherein the suction resistance section closes off approximately 50% or more of the rear side portion of the top surface suction opening.

[0019] Due to this, it is possible to further reduce the degree of variation in the ratio of the amount of indoor air which is sucked in from the top surface suction opening and the amount of indoor air which is sucked in from the lower surface suction opening.

[0020] An air conditioner according to an eighth aspect of the present invention is the air conditioner according to any of the first aspect to the seventh aspect of the present invention wherein the speed of air which is sucked in from the lower surface suction opening is approximately 0.5 m/sec or more.

[0021] Here, the suction resistance section impedes the indoor air which is sucked in from at least a portion of the top surface suction opening which faces the rear side heat exchange section to the extent that the speed of air which is sucked in from the lower surface suction opening is approximately 0.5 m/sec or more. Due to this, it is possible to reliably suppress the degree of variation, in the ratio of the amount of indoor air which is sucked in from the top surface suction opening and the amount of indoor air which is sucked in from the lower surface suction opening, which depends on environmental conditions in which the air conditioner is installed.

<Advantageous Effects of Invention>

[0022] Due to the air conditioner according to the first aspect of the present invention, it is possible to reduce the degree of variation in the ratio of the amount of indoor air which is sucked in from the top surface suction opening and the amount of indoor air which is sucked in from the lower surface suction opening and it is possible to suppress a phenomenon, where the lower surface suction opening does not function, being generated depending on different circumstances due to differences in environmental conditions.

[0023] Due to the air conditioner according to the second aspect of the present invention, it is possible to further reduce the degree of variation in the ratio of the amount of indoor air which is sucked in from the top surface suction opening and the amount of indoor air which is sucked in from the lower surface suction opening.

[0024] Due to the air conditioner according to the third aspect of the present invention, it is possible to configure the suction resistance section in a simple manner and costs can be limited compared to a case where the suction resistance section is formed with a different member.

[0025] Due to the air conditioner according to the fourth aspect of the present invention, it is possible to provide the suction resistance section in a simple manner.

[0026] Due to the air conditioner according to the fifth aspect of the present invention, it is possible for the suction resistance section to close off across the entire length of the top surface suction opening in the longitudinal direction.

[0027] Due to the air conditioner according to the sixth aspect of the present invention, it is possible to reduce the degree of variation in the ratio of the amount of indoor air which is sucked in from the top surface suction opening and the amount of indoor air which is sucked in from the lower surface suction opening and for the lower surface suction opening to reliably function.

[0028] Due to the air conditioner according to the seventh aspect of the present invention, it is possible to further reduce the degree of variation in the ratio of the amount of indoor air which is sucked in from the top surface suction opening and the amount of indoor air which is sucked in from the lower surface suction opening.

[0029] Due to the air conditioner according to the eighth aspect of the present invention, it is possible to reliably suppress the degree of variation, in the ratio of the amount of indoor air which is sucked in from the top surface suction opening and the amount of indoor air which is sucked in from the lower surface suction opening, which depends on environmental conditions in which the air conditioner is installed.

BRIEF DESCRIPTION OF THE DRAWINGS

[0030]

Fig. 1 is a diagram of the outer appearance of an air conditioner according to an embodiment.
Fig. 2 is a cross sectional diagram of a case where an air conditioner according to an embodiment is cut along a line II-II in Fig. 1.
Fig. 3 is an overview diagram of the inside of a casing in a case where a support member is fixed in the casing according to an embodiment and is a diagram of a case where the casing, a bottom frame, and an indoor fan are removed from an air conditioner.
Fig. 4 is an overview diagram of a cleaning unit.
Fig. 5 is a diagram where the vicinity of the cleaning unit in Fig. 2 is enlarged.
Fig. 6 is a diagram of a case where the filter is taken out from the support member in Fig. 3.
Fig. 7 is an enlarged diagram of the vicinity of a top surface plate according to Fig. 2 and is a diagram where the support member and the filter are omitted from Fig. 2.
Fig. 8 is a diagram of the vicinity of the top surface of an air conditioner in a case where an air conditioner according to an embodiment is viewed from above.

DESCRIPTION OF EMBODIMENTS

[0031] An air conditioner according to the present invention will be described in detail below while referencing the drawings. Here, the following embodiment is a detailed example of the present embodiment and does not limited the technical scope of the present invention.

(1) Configuration

[0032] Fig. 1 is a diagram of the outer appearance of an air conditioner 100 according to an embodiment of the present invention. The air conditioner 100 is attached to an indoor wall surface or the like and is connected to an outdoor unit (which is not shown in the diagram) which is installed outside via a coolant pipe (which is not shown in the diagram). It is possible for the air conditioner 100 to also perform an automatic cleaning operation where a filter 25 and a brush 33 (Fig. 2) are automatically cleaned in addition to an indoor cooling operation and an indoor heating operation.

[0033] The air conditioner 100 is mainly provided with a casing 11, an indoor heat exchanger 13, an indoor fan 15, a bottom frame 17, the filter 25, a cleaning unit 30, a support member 40, and a suction resistance section 50 as shown in Figs. 1 to 5.

[0034] Here, in the following description, references which express directions such as "up", "down", "left", "right", "front surface", and "back surface" are appropriately used, but the references express each of the directions in a state where the air conditioner 100 is installed on an indoor wall surface or the like in the state in Fig. 1.

(1-1) Casing

[0035] The casing 11 has a box shape which is long and slender in the horizontal direction (a W direction in Fig. 1) as shown in Fig. 1. In detail, the casing 11 forms a three dimensional space using a top surface plate 11a, a front surface plate 11b, and a back surface plate 11c as shown in Figs. 1 and 2, and the indoor heat exchanger 13, the indoor fan 15, the bottom frame 17, the cleaning unit 30, the support member 40, and the suction resistance section 50 are accommodated in this three dimensional space. The top surface plate 11a mainly configures the top surface of the casing 11 and the front surface plate 11b mainly configures the front surface of the casing 11. Here, an upper end of the front surface plate 11b is supported to rotate freely by a portion of the top surface plate 11a and can operate with a hinge system. The back surface plate 11c mainly configures the back surface of the casing 11. The air conditioner 100 is installed on the indoor wall surface by the back surface plate 11c being attached to an attaching plate (which is not shown in the diagram) which is installed on the indoor wall surface using a screw fastening or the like.

[0036] Then, a top surface suction opening 21 is provided in the top surface plate 11 a of the casing 11 from the front side across to the rear side of the top surface plate 11a. From the top surface suction opening 21, the indoor air on the vicinity of the top surface suction opening 21 is taken into the inside of the casing 11 due to driving of the indoor fan 15 and is sent to front side heat exchange sections 13a and 13b (which will be described later) and a rear side heat exchange section 13c (which will be described later) of the indoor heat exchanger 13. Here, an arrow A which is a dashed line in Fig. 2 represents the flow of indoor air which is sent to the indoor fan 15 via the top surface suction opening 21 and the front side heat exchange section 13b as an example.

[0037] In addition, the lower surface of the casing 11 is mainly configured by a bottom section 17a (which will be described later) of the bottom frame 17, and a lower surface suction opening 22 and a vent opening 23 are formed in the lower surface of the casing 11. The lower surface suction opening 22 is provided more to the wall side than the vent opening 23 and is linked with the inside of the casing 11 using a suction flow path 16. From the lower surface suction opening 22, the indoor air on the vicinity of the lower surface suction opening 22 is taken into the inside of the casing 11 due to driving of the indoor fan 15 and is sent to the rear side heat exchange section

13c (which will be described later) of the indoor heat exchanger 13 through the suction flow path 16. An arrow B which is a dotted line in Fig. 2 represents the flow of indoor air which is sent from the lower surface suction opening 22 to the rear side heat exchange section 13c as an example. The vent opening 23 is provided more to the front surface side of the air conditioner 100 than the lower surface suction opening 22 and is linked with the inside of the casing 11 using a vent flow path 18. From the vent opening 23, the indoor air is vented into a room through the vent flow path 18 after being sucked in from each of the suction openings 21 and 22 and subject to heat exchange with the indoor heat exchanger 13. An arrow C which is a dotted line in Fig. 2 represents the flow of indoor air which is sent from the vent flow path 18 into a room through the vent opening 23.

[0038] The suction flow path 16 is formed from the lower surface suction opening 22 along a flow path forming section 17b (which will be described later) of the bottom frame 17. The vent flow path 18 is formed from the vent opening 23 along the flow path forming section 17b of the bottom frame 17. That is, the suction flow path 16 and the vent flow path 18 are positioned to be adjacent to each other to interpose the flow path forming section 17b of the bottom frame 17.

[0039] Here, a horizontal flap 23a is attached in the vicinity of the vent opening 23 to rotate freely with regard to the casing 11. The horizontal flap 23 a can be driven by a flap motor (which is not shown in the diagram) and opens and closes the vent opening 23 according to the operating state of the air conditioner 100. Furthermore, the horizontal flap 23a carries out the role of changing the vent direction of the indoor air so as to guide the indoor air which is vented from the vent opening 23 in a direction which is intended by a user.

(1-2) Indoor Heat Exchanger

[0040] The indoor heat exchanger 13 is configured by a plurality of fins and a plurality of heat transfer pipes. The indoor heat exchanger 13 is attached to a portion of the bottom frame 17 in the inside of the casing 11. The indoor heat exchanger 13 performs heat exchanging between coolant and air which passes through the indoor heat exchanger 13 by functioning as an evaporator or a condenser according to the operating state of the air conditioner 100.

[0041] In particular, the indoor heat exchanger 13 according to the present embodiment has a shape which substantially is a shape like an inverted V in a side surface view where both ends are bent downward as shown in Fig. 2 and the indoor fan 15 is positioned below the indoor heat exchanger 13. In the present embodiment, out of the indoor heat exchanger 13 which has this shape, the heat exchange sections which cover the front of the indoor fan 15 is referred to the "front side heat exchange sections 13a and 13b" and the heat exchange section which covers the rear of the indoor fan 15 is referred to the "rear side heat exchange section 13c" for convenience in the following description. That is, the indoor heat exchanger 13 according to the present embodiment has a shape which substantially is a shape like an inverted V where the front side heat exchange sections 13a and 13b and the rear side heat exchange section 13c are connected at an apex 13d.

[0042] Here, a case is represented in Fig. 2 as an example where the front side heat exchange sections 13a and 13b have a shape which is folded again at the front to the indoor fan 15. That is, the front side heat exchange sections 13a and 13b are configured to be divided up into a portion which is positioned below in the up and down direction (that is, the front side heat exchange section 13a) and a portion which is position above in the up and down direction (the front side heat exchange section13b). However, it is sufficient if the front side heat exchange sections 13a and 13b are positioned so as to cover the front of the indoor fan 15 and need not be a configuration which is divided up in the up and down direction as shown in Fig. 2.

(1-3) Indoor Fan

[0043] The indoor fan 15 is positioned on the inside of the casing 11 and is a closed loop fan with a substantially cylindrical shape which is long and slender in the W direction shown in Fig. 1. By being driven, the indoor fan 15 generates a flow of indoor air (refer to the arrows A, B, and C which are dotted lines in Fig. 2) which is supplied from the vent opening 23 into a room through the indoor heat exchanger 13 after having flowed in the indoor heat exchanger 13 (in detail, the front side heat exchange sections 13a and 13b and the rear side heat exchange section 13c) due to being sucked in from each of the top surface suction opening 21 and the lower surface suction opening 22.

[0044] A drive shaft of the indoor fan 15 is connected to an output shaft of an indoor fan motor (which is not shown in the diagram). It is possible to drive the indoor fan 15 by transferring the output of the indoor fan motor to the drive shaft of the indoor fan 15 via the output shaft when driving the indoor fan motor.

(1-4) Bottom Frame

[0045] The bottom frame 17 is configured by the bottom section 17a and the flow path forming section 17b.

[0046] The bottom section 17a is an element which configures at least a portion of the lower surface of the casing 11 and, out of the bottom frame 17, is exposed to the outside of the air conditioner 100. As a result, a user visually can recognize the bottom section 17a in a lower surface view of the air conditioner 100.

[0047] The flow path forming portion 17b is an element which is positioned inside of the casing 11 out of the bottom frame 17. The flow path forming portion 17b has a shape which extends upward from an end of the bottom section 17a and is bent along the shape of the indoor fan 15.

(1-5) Filter

[0048] The filter 25 is mainly positioned between the top surface plate 11 a of the casing 11 and the indoor heat exchanger 13, that is, on the upstream side with regard to the indoor heat exchanger 13 in the flow direction of the indoor air and is removably mounted inside the casing 11. The filter 25 covers the front side heat exchange sections 13a and 13b and the rear side heat exchange section 13c. Then, the filter 25 has a shape where a rear side end section 25b in the front and rear direction of the filter 25 is positioned below the apex 13d of the indoor heat exchanger 13. In more detail, the filter 25 according to the present embodiment substantially has a so-called reverse U shape where substantially the central portion extends along the top surface plate 11 a of the casing 11 and a front side end section 25a and the rear side end section 25b in the front and rear direction cover above the indoor heat exchanger 13 by hanging down below the apex 13d of the indoor heat exchanger 13.

[0049] Here, in the present embodiment, the rear side end section 25b of the filter 25 reaches to a position which substantially covers the rear side heat exchange section 13c and the front side end section 25a of the filter 25 reaches to a position which completely covers the front side heat exchange section 13b and partially covers a portion of the upper section of the front side heat exchange section 13a. Due to this, a portion of the filter 25 which faces the rear side heat exchange section 13c can remove dust from the indoor air which is mainly sucked in from the lower surface suction opening 22. A portion of the filter 25 which faces the front side heat exchange sections 13a and 13b can remove dust from the indoor air which is mainly sucked in from the top surface suction opening 21. That is, the filter 25 can prevent the surface of the indoor heat exchanger 13 from becoming unclean due to dust in the indoor air.

[0050] In this manner, the filter 25 is, for example, a mesh which is plain weave or twill weave using thread made from resin, is formed in an annular shape (that is, the shape of an endless belt), and spans across a support frame (which is not shown in the diagram). Two of the filters 25 which span across the support frame are provided to line up on the right side and the left side in a front surface view of the air conditioner 100 as shown in Fig. 3. It is not possible for the filter 25 to maintain a stable shape by itself since reinforcing edges or ribs as are seen in typical filters are not provided in the filter 25. As a result, the filter 25 is held in the annular shape by spanning across the support frame.

(1-6) Cleaning Unit

[0051] The cleaning unit 30 is positioned inside the casing 11 in the vicinity of the filter 25, or in more detail, in the vicinity of the folding portion at a lower section of the filter 25 as shown in Fig. 5. The cleaning unit 30 is not only for cleaning the filter 25 but also performs cleaning of the brush 33 (which will be described later) which directly cleans the filter 25, and has a cleaning unit frame 31, a filter driving section 32, the brush 33, a brush driving section 34, a brush cleaning section 35, a dust receiving section 37, and a compression roller 38 as shown in Figs. 2 to 6.

[0052] The cleaning unit frame 31 has a long and slender shape along the longitudinal direction (the W direction in Fig. 1) of the air conditioner 100 as shown in Fig. 4 and the brush 33 is removably attached inside the cleaning unit frame 31. In addition, an opening section 31a is formed in the upper surface of the cleaning unit frame 31 as shown in Fig. 5 and the cleaning unit frame 31 is positioned further below the folding portion at the lower section of the filter 25. As a result, a portion of the brush 33 is exposed to the space above the cleaning unit frame 31 via the opening section 31a of the cleaning unit frame 31 and comes into direct contact with the filter 25 via the opening section 31a.

[0053] The filter driving section 32 causes the filter 25 to travel around and is configured by a roller 32a, a roller motor (which is not shown in the diagrams), and the like. A fabric base which is so-called pile weave is adhered to the circumference surface of the roller 32a. The fabric base on the circumference surface of the roller 32a enters into the mesh of the filter 25 and it is difficult for sliding to occur between the roller 23a and the filter 25. The output shaft of the roller motor is connected to the rotation shaft of the roller 32a. The roller 32a rotates and the filter 25 travels around due to the roller motor being driven.

[0054] The brush 33 has a long and slender shape along the longitudinal direction of the air conditioner 100 in the same manner as the cleaning unit frame 31 as shown in Fig. 4 and has a shape where a cross section, which is orthogonal with the longitudinal direction, is substantially a circle. The brush 33 removes dust from the filter 25 by coming into direct contact with the filter 25. The brush 33 is configured using a core material 33a and a plurality of wires 33b which are provided in the circumference surface of the core material 33a, and the wires 33b have a length so that the wires 33b come into contact with the filter 25. In addition, the brush 33 is provided to be able to rotate with regard to the cleaning unit frame 31.

[0055] The brush driving section 34 is for rotating the brush 33 and is configured by, for example, a stepping motor. That is, the output shaft of the brush driving section 34 which is a motor is connected with the rotation shaft of the brush 33 and the brush 33 rotates by the stepping motor being driven. For example, moving of the filter 25 is stopped when the brush 33 is rotated, and conversely, the brush 33 is in a state where rotation is stopped when the filter 25 is moving. That is, the filter driving section 32 and the brush driving section 34 alternately can move the filter 25 or the brush 33.

[0056] The brush cleaning section 35 is attached to the cleaning unit frame 31 as shown in Fig. 4. As shown in Fig. 5, the brush cleaning section 35 is arranged along a rotation shaft direction of the brush 33, protrudes from the back surface of the cleaning unit frame 31 toward the brush 33, and is tilted in a direction which is opposite to the rotation direction of the brush 33 (that is, the direction of the arrow in the portion of the brush 33 in Fig. 5). Due to this, it is possible for the brush cleaning section 35 to scrape off dust from between the wires 33b of the brush 33 in a case where the brush 33 is rotated in the direction of the arrow in Fig. 5.

[0057] The dust receiving section 37 is positioned below the brush 33 and the brush cleaning section 35 in a state of being attached to the cleaning unit frame 31 as shown in Figs. 2 and 5. Dust which is scraped off from the brush 33 using the brush cleaning section 35 is retained in the dust receiving section 37. In addition, since the dust receiving section 37 is removably attached to the cleaning unit frame 31, a user can easily dispose of the dust which is retained in the dust receiving section 37 by taking out the dust receiving section 37 from the cleaning unit frame 31 and the casing 11.

[0058] The compression roller 38 is a member with a cylindrical rod shape and is rotatably supported by the cleaning unit frame 31. Here, the compression roller 38 is positioned so as to be in contact with the brush 33 in the vicinity of the brush cleaning section 35 as shown in Fig. 5. Due to this, the compression roller 38 rotates in the opposite direction to the rotation direction of the brush 33 by following the rotation of the brush 33 when the brush is rotated in the direction of the arrow in Fig. 5. Since dust which is retained in the dust receiving section 37 is compressed using the compression roller 38, a comparatively large amount of dust can enter the dust receiving unit 37. Furthermore, dust with comparatively high viscosity is reliably sent to the dust receiving section 37 due to rotating of the compression roller 38.

(1-7) Support Member

[0059] The support member 40 is positioned above the front side heat exchange sections 13a and 13b and the rear side heat exchange section 13c as shown in Fig. 2 and supports the filter driving section 32 and the brush driving section 34 which are portions of the cleaning unit 30 as shown in Figs. 3 and 6. Then, when the filter 25 is mounted in the air conditioner 100, the filter 25 is inserted inside of the air conditioner 100 from the front surface side of the casing 11 along the support member 40, and the support member 40 guides the filter 25 to the back surface side of the casing 11 and supports the filter 25. Furthermore, the support member 40 has a shape where a rear side end section 40b, which is an end section on the lower side of the support member 40 and an end section on the rear side of the support member 40 in the front and rear direction, is positioned below and to the rear side of the apex 13d of the indoor heat exchanger 13.

[0060] In more detail, a substantially central portion of the the support member 40 extends along the top surface plate 11a of the casing 11, and the support member 40 has a shape where a front side end section 40a and the rear side end section 40b in the front and rear direction cover above the indoor heat exchanger 13 by hanging down below the apex 13d of the indoor heat exchanger 13. That is, when focusing on only the front side end section 40a and the rear side end section 40b, the support member 40 substantially has a so-called reverse U shape.

[0061] Then, as shown in Figs. 3 and 6, the support member 40 has a left side portion 42 and a right side portion 43 which are positioned to interpose a partition section 41 where substantially the center of the support member 40 in the left and right direction extends in the front and rear direction, and as shown in Fig. 3, the filter 25 which spans across the support frame is mounted onto the upper surfaces of the left side portion 42 and the right side portion 43. When being mounted into the casing 11, the filter 25 is first inserted from the front surface side of the casing 11 into the casing 11 in the state of Fig. 6 and slides along the upper surfaces of the left side portion 42 and the right side portion 43 of the support member 40 until the rear side end section 25b of the filter 25 reaches the vicinity of the rear side end section 40b of the support member 40. Due to this, the filter 25 is mounted on the upper surface of the support member 40 as shown in Fig. 3. As a result, a sliding mechanism to slide the filter 25 is provided at the respective left and right end sections 42a, 42b, 43a, and 43b of the left side portion 42 and the right side portion 43 and the end surfaces of the filter 25 which spans across the support frame face each other at the respective left and right end sections 42a, 42b, 43a, and 43b of the left side portion 42 and the right side portion 43 in a front surface view of the support member 40 as shown in Fig. 6. In detail, the sliding mechanism is formed using a groove, a plurality of protrusions, and the like. That is, the sliding mechanism at the respective left and right end sections 42a, 42b, 43a, and 43b of the left side portion 42 and the right side portion 43 is configured to move the filter 25 on the support member 40 and this is an effective configuration not only during mounting of the filter 25 into the casing 11 but even in cases where the filter 25 is moved during cleaning of the filter 35.

(1-8) Suction Resistance Section

[0062] The suction resistance section 50 impedes the flow of air which is sucked in from the top surface suction opening 21 and is positioned in the vicinity of the top surface suction opening 21 which faces the rear side heat exchange section 13c as shown in Figs. 2, 7, and 8. Here, Fig. 7 is an enlargement of a cross section of inside the casing 11 in the vicinity of the top surface plate 11 a in Fig. 2 and the support member 40 and the filter 25 are omitted from Fig. 2. Fig. 8 is a diagram of the vicinity of the top surface plate 11a in a case where the air conditioner 100 is viewed from above.

[0063] In more detail, the suction resistance section 50 according to the present embodiment is configured from a different member to the top surface plate 11a, the front surface plate 11b, and the back surface plate 11 c which configure the casing 11, and is mounted on a rear side portion 21 a of the top surface suction opening 21 which faces the rear side heat exchange section 13c. That is, the suction resistance section 50 is a different member which is positioned to the rear side and above the indoor fan 15 in the top surface suction opening 21. Furthermore, in other words, the suction resistance section 50 is a different member which is positioned above the rear side heat exchange section 13c and on the rear side of the apex 13d of the indoor heat exchanger 13 in the front and rear direction of the air conditioner 100, but not positioned toward the center of the top surface suction opening 21, and is positioned on the back surface plate 11c side. Here, the rear side portion 21a of the top surface suction opening 21 is a portion from the apex 13d of the indoor heat exchanger 13 to the back surface plate 11 c of the casing 11. Accordingly, as shown in Fig. 8, the rear side heat exchange section 13c are positioned inside the casing 11 which faces the rear side portion 21a, and the front side heat exchange sections 13a and 13b are positioned inside the casing 11 which faces a front side portion 21b which is from the apex 13d of the indoor heat exchanger 13 to the front surface plate 11b of the casing 11.

[0064] Here, the materials for the suction resistance section 50 may be the same as the material for the casing 11 and composed of, for example, resin. Alternatively, the suction resistance section 50 may be composed of metal or the like.

[0065] Then, the suction resistance section 50 is provided to span the entire length in the longitudinal direction (that is, the W direction in Fig. 1) of the top surface suction opening 21 in the left and right direction, and has a long and slender shape which is substantially a rectangle in the left and right direction in an upper surface view of the air conditioner 100 as shown in Fig. 8.

[0066] Here, Figs. 2, 7, and 8 according to the present embodiment represent a case where the suction resistance section 50 comes into contact with the back surface plate 11c of the casing 11 so that there are no gaps and extends to the front surface side of the casing 11 (that is, the front surface plate 11b side of the casing 11) as an example. Furthermore, Fig. 8 expresses a case where the suction resistance section 50 comes into contact with both a left side end section 11d and a right side end section 11e of the casing 11 as an example.

[0067] In this manner, the amount of indoor air which is sucked in from the rear side portion 21 a of the top surface suction opening 21 is reduced due to the suction resistance section 50 closing off the rear side portion 21 a of the top surface suction opening 21 and the indoor air which is sucked in from the top surface of the casing 11 to inside the casing 11 is sucked in via a portion of the top surface suction opening 21 which is mainly not closed off (in detail, the front side portion 21b and a portion of the rear side portion 21a which is not closed off). As a result, the amount of increase in the indoor air which is sucked in from the top surface suction opening 21 is suppressed to a certain extent due to the suction resistance section 50 even in a case where the air conditioner 100 according to the present embodiment is installed in environmental conditions such that there is an increase in the indoor air which is sucked in from the top surface suction opening 21 in a case where it is assumed that the suction resistance section 50 is not provided.

[0068] Here, the "environmental conditions" are conditions which express in what type of environment is the location where the air conditioner 100 is installed. As the environmental conditions, examples include, for example, that the distance between the ceiling of the room and the top surface of the air conditioner 100 is relatively narrow at the installation location of the air conditioner 100 and the like.

[0069] Here, to what extent the suction resistance section 50 closes off the rear side portion 21 a of the top surface suction opening 21 will be described. The suction resistance section 50 according to the present embodiment closes off the top surface suction opening 21 to the extent that the speed of air which is sucked in from the lower surface suction opening 22 is approximately 0.5 m/sec or more irrespective of the actual conditions of the environmental conditions in which the air conditioner 100 is installed. In detail, in a case where the area of the rear side portion 21a of the top surface suction opening 21 is 100%, the suction resistance section 50 closes off approximately 30% or more of the rear side portion 21a. Furthermore, it is preferable that the suction resistance section 50 close off approximately 50% or more of the rear side portion 21a. Figs. 2, 7, and 8 according to the present embodiment express a case where the suction resistance section 50 closes off approximately 60% of the rear side portion 21a as an example.

[0070] Due to this, it is possible for the ratio of the amount of indoor air which is sucked in from the top surface suction opening 21 and the amount of indoor air which is sucked in from the lower surface suction opening 22 to be reliably suppress from depending on and varying due to environmental conditions in which the air conditioner 100 is installed. Accordingly, it is possible to reduce the degree of variation in the ratio of the amount of indoor air which is sucked in from the top surface suction opening 21 and the amount of indoor air which is sucked in from the lower surface suction opening 22 and it is possible to suppress a phenomenon, where the lower surface suction opening 22 does not function, being generated depending on different circumstances due to differences in environmental conditions in which the air conditioner 100 is installed.

[0071] Here, it is possible to appropriately determine the specific numerical value for what extent to which the suction resistance section 50 closes off the rear side portion 21a of the top surface suction opening 21 on the basis of calculations, simulations, experiments, or the like in further consideration of loss in pressure and the like in addition to the condition that the amount of wind from the indoor fan 15 is the lowest amount of wind, the condition that approximately 30% or more or approximately 50% or more of the rear side portion 21a is closed off, and the condition that the speed of air which is sucked in from the lower surface suction opening 22 is approximately 0.5 m/sec or more.

(1-9) Other Configurations

[0072] In addition to the above, the air conditioner 100 is provided with an indoor control section (which is not shown in the diagram) which performs controlling of various devices which configure the air conditioner 100. The indoor control section is a microcomputer which is configured by a CPU and a memory and is accommodated in a front portion of the casing 11. For example, the indoor control section is connected to the flap motor and the indoor fan motor, and performs control of opening and closing of the horizontal flap 23a and control of the angle of the horizontal flap 23a, control of the amount of wind from the indoor fan 15, and the like by performing drive control of the motors.

(2) Characteristics

(2-1)

[0073] The top surface suction opening 21 and the lower surface suction opening 22 are provided in the air conditioner 100 according to the present embodiment, and the top surface suction opening 21 which faces the rear side heat exchange section 13c is closed off using the suction resistance section 50. Due to this, the amount of indoor air which is sucked in from the top surface suction opening 21 is suppressed due to the suction resistance section 50. As a result, the amount of increase in the indoor air which is sucked in from the top surface suction opening 21 is suppressed to a certain extent due to the suction resistance section 50 even in a case where the air conditioner 100 according to the present embodiment is installed in environmental conditions such that there is an increase in the indoor air which is sucked in from the top surface suction opening 21 if it is assumed that the suction resistance section 50 is not provided. Accordingly, it is possible to reduce the degree of variation in the ratio of the amount of indoor air which is sucked in from the top surface suction opening 21 and the amount of indoor air which is sucked in from the lower surface suction opening 22 and it is possible to suppress a phenomenon, where the lower surface suction opening 22 does not function, being generated depending on different circumstances due to differences in environmental conditions.

[0074] Furthermore, by reducing the degree of variation in the ratio of the amount of indoor air which is sucked in from the top surface suction opening 21 and the amount of indoor air which is sucked in from the lower surface suction opening 22, variation in the amount of indoor air which flows to the indoor heat exchanger 13, which is caused by environmental conditions, is reduced. That is, it is possible for the amount of indoor air which flows to the indoor heat exchanger 13 to be substantially constant irrespective of environmental conditions in which the air conditioner 100 is installed. Accordingly, it is possible to prevent the performance of the air conditioner 100 differing due to the installation location.

(2-2)

[0075] In particular, the suction resistance section 50 is positioned in the rear side portion 21a of the top surface suction opening 21 which faces the rear side heat exchange section 13c. Due to this, the amount of indoor air which is sucked in from the rear side portion 21a of the top surface suction opening 21 is reduced. As a result, it is possible to further reduce the degree of variation in the ratio of the amount of indoor air which is sucked in from the top surface suction opening 21 and the amount of indoor air which is sucked in from the lower surface suction opening 22.

(2-3)

[0076] In addition, the suction resistance section 50 is configured in a simple manner using a different member to the casing 11 and reliably closes off the rear side portion 21a of the top surface suction opening 21 in the casing 11.

(2-4)

[0077] In addition, the suction resistance section 50 is provided to span across the entire length of the top surface suction opening 21 in the longitudinal direction. Due to this, it is possible for the suction resistance section 50 to close off across the entire length of the top surface suction opening 21 in the longitudinal direction.

(2-5)

[0078] In addition, due to the suction resistance section 50 closing off approximately 30% or more of the rear side portion 21a of the top surface suction opening 21, it is possible for the lower surface suction opening 22 to reliably function by reducing the degree of variation in the ratio of the amount of indoor air which is sucked in from the top surface suction opening 21 and the amount of indoor air which is sucked in from the lower surface suction opening 22.

(2-6)

[0079] In particular, due to the suction resistance section 50 closing off approximately 50% or more of the rear side portion 21a of the top surface suction opening 21, it is possible to further reduce the degree of variation in the ratio of the amount of indoor air which is sucked in from the top surface suction opening 21 and the amount of indoor air which is sucked in from the lower surface suction opening 22.

(2-7)

[0080] In addition, in the present embodiment, the suction resistance section 50 impedes the indoor air which is sucked in from the rear side portion 21a of the top surface suction opening 21 to the extent that the speed of indoor air which is sucked in from the lower surface suction opening 22 is approximately 0.5 m/sec or more. Due to this, it is possible to reliably suppress the degree of variation, in the ratio of the amount of indoor air which is sucked in from the top surface suction opening 21 and the amount of indoor air which is sucked in from the lower surface suction opening 22, which depends on environmental conditions in which the air conditioner 100 is installed.

(3) Modified Examples

[0081] The embodiment of the present invention has been described below based on the drawings, but the detailed configuration is not limited by the embodiment described above and modifications are possible within a scope which does not depart from the gist of the invention.

(3-1) Modified Example A

[0082] In the embodiment described above, the suction resistance section 50 is described as being configured using a different member to the casing 11. However, the suction resistance section 50 may be configured using a portion of the casing 11. In this case, the suction resistance section 50 is configured by, for example, the top surface plate 11 a of the casing 11 being extended so as to reduce the top surface suction opening 21.

[0083] Due to this, it is possible to configure the suction resistance section 50 in a simple manner and costs can be limited compared to a case where the suction resistance section 50 is formed with a different member.

(3-2) Modified Example B

[0084] Figs. 2, 7, and 8 in the embodiment described above represent a case where the suction resistance section 50 comes into contact with the back surface plate 11 c of the casing 11 so that there are no gaps and extends to the front surface side of the casing 11. However, the suction resistance opening 50 may close off at least a portion of the rear side portion 21a of the top surface suction opening 21 in a state of being separated from the back surface plate 11c.

[0085] In addition, Fig. 8 in the embodiment described above expresses a case where the suction resistance section 50 comes into contact with both the left side end section 11d and the right side end section 11e of the casing 11. However, the suction resistance section 50 need not come into contact with and may be separated from the left side end section 11d and/or the right side end section 11e of the casing 11.

(3-3) Modified Example C

[0086] In addition, the suction resistance section according to the present invention is provided in order to impede the flow of indoor air which is sucked in from the rear side portion 21 a of the top surface suction opening 21 as described above. As a result, the suction resistance section may be provided so as to close off at least a portion of the rear side portion 21 a at a position which is separated downward from the top surface plate 11a of the casing 11.

INDUSTRIAL APPLICABILITY

[0087] As above, according to the present invention, it is possible to reduce the degree of variation in the ratio of the amount of indoor air which is sucked in from a top surface suction opening and the amount of indoor air which is sucked in from a lower surface suction opening and it is possible to suppress a phenomenon, where the lower surface suction opening does not function, being generated depending on different circumstances due to differences in environmental conditions. As a result, an air conditioner according to the present invention is effective as an indoor unit which is a wall mounting type and which is installed in various environmental conditions.

REFERENCE SIGNS LIST

[0088]

100	AIR CONDITIONER
11	CASING
11a	TOP SURFACE PLATE
11b	FRONT SURFACE PLATE
11c	BACK SURFACE PLATE
13	INDOOR HEAT EXCHANGER
13a, 13b	FRONT SIDE HEAT EXCHANGE SECTION
13c	REAR SIDE HEAT EXCHANGE SECTION
15	INDOOR FAN
17	BOTTOM FRAME
21	TOP SURFACE SUCTION OPENING
21a	REAR SIDE PORTION OF TOP SURFACE

	SUCTION OPENING
22a	FRONT SIDE PORTION OF TOP SURFACE SUCTION OPENING
22	LOWER SURFACE SUCTION OPENING
23	VENT OPENING
25	FILTER
30	CLEANING UNIT
32	FILTER DRIVING SECTION
34	BRUSH DRIVING SECTION
40	SUPPORT MEMBER
50	SUCTION RESISTANCE SECTION

CITATION LIST

PATENT LITERATURE

[0089] PTL 1: Japanese Unexamined Patent Application Publication No. 2001-311530

Claims

1. An air conditioner (100) which is a wall mounting type comprising:

a casing (11) which has a top surface suction opening (21) which is provided from the front side across to the rear side of the top surface and a lower surface suction opening (22) which is provided in the lower surface;
a fan (15) which is positioned inside the casing and generates a flow of air which is sucked in from the top surface suction opening and the lower surface suction opening;
a heat exchanger (13) is formed inside the casing by combining front side heat exchange sections (13a, 13b) which cover the front of the fan and a rear side heat exchange section (13c) which covers the rear side of the fan as a shape like an inverted V in a side surface view; and
a suction resistance section (50) which impedes the flow of air which is sucked in from the top surface suction opening (21) and where suction resistance at a portion of the top surface suction opening which faces the rear side heat exchange section is larger than suction resistance at a portion of the top surface suction opening which faces the front side heat exchange sections,
wherein the fan generates a flow of air which is sucked in from the top surface suction opening and the lower surface suction opening and flows to the rear side heat exchange section (13c), and the suction resistance section (50) is positioned in the top surface suction opening (21) which faces the rear side heat exchange section (13c).

2. The air conditioner (100) according to claim 1, wherein
the suction resistance section (50) is positioned in a rear side portion (21a) of the top surface suction opening (21) which faces the rear side heat exchange section (13c).

3. The air conditioner (100) according to claim 1 or 2, wherein
the suction resistance section (50) is configured using a portion of the casing (11).

4. The air conditioner (100) according to claim 1 or 2, wherein
the suction resistance section (50) is configured by a different member to the casing (11) and is mounted in the top surface suction opening (21).

5. The air conditioner (100) according to any one of claims 1 to 4, wherein
the suction resistance section (50) is provided to span across the entire length of the top surface suction opening (21) in the longitudinal direction.

6. The air conditioner (100) according to any one of claims 1 to 5, wherein
the suction resistance section (50) closes off approximately 30% or more of the rear side portion (21 a) of the top surface suction opening (21).

7. The air conditioner (100) according to claim 6, wherein
the suction resistance section (50) closes off approximately 50% or more of the rear side portion (21 a) of the top surface suction opening (21).

8. The air conditioner (100) according to any one of claims 1 to 7, wherein
the speed of air which is sucked in from the lower surface suction opening (22) is approximately 0.5 m/sec or more.

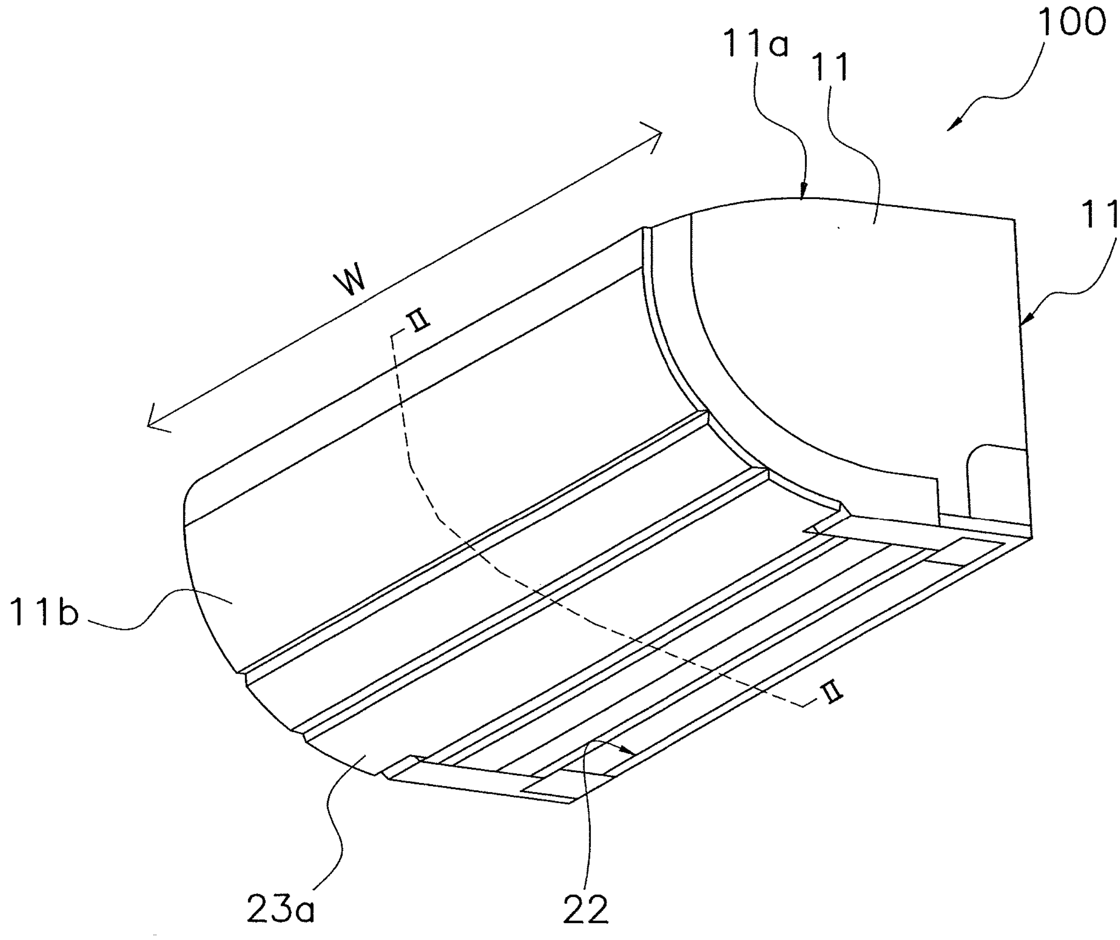
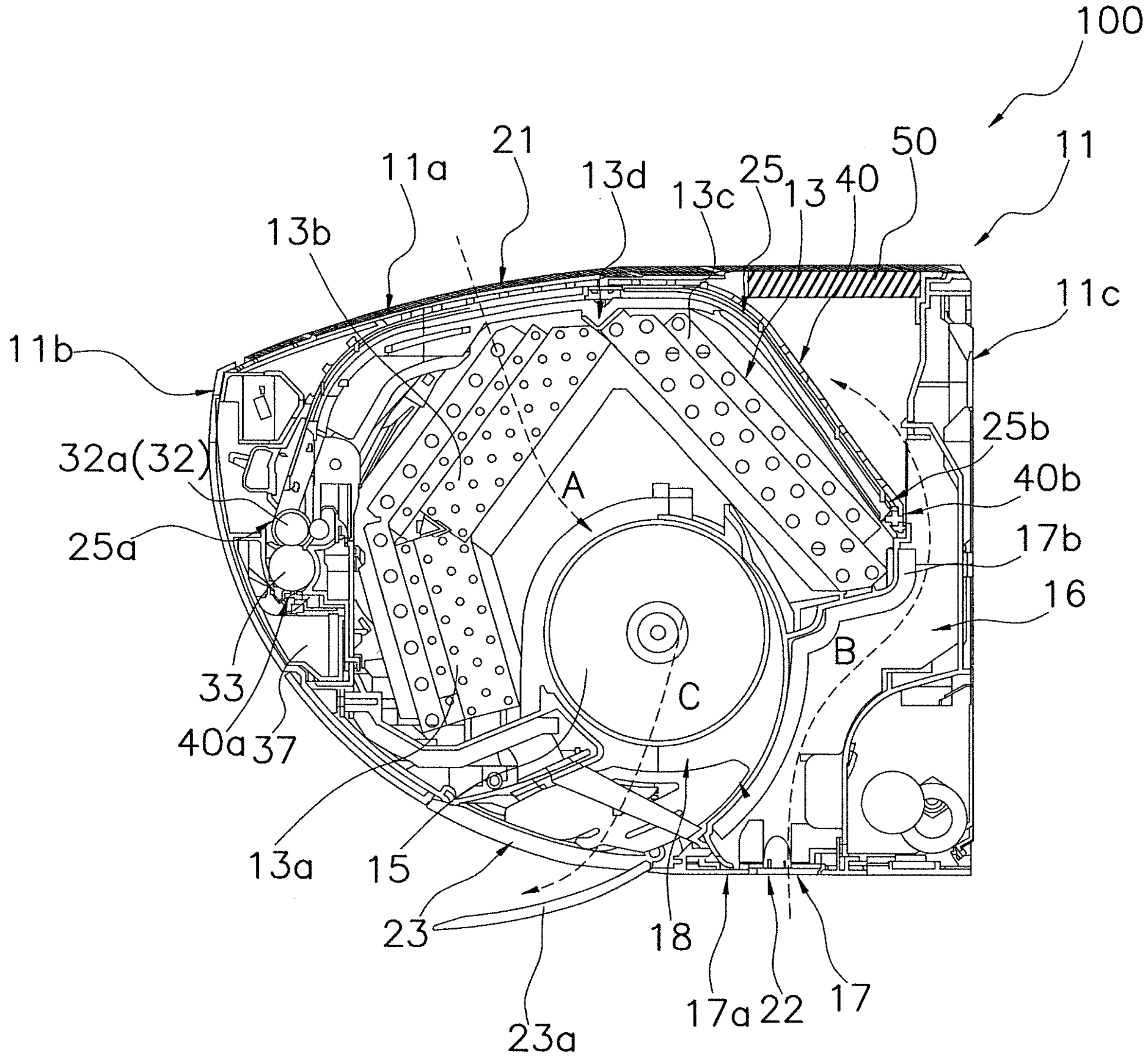


FIG. 1



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13d
13c
25
13
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50
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13b
11c
11b
25b
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C
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22
17
23a

FIG. 2

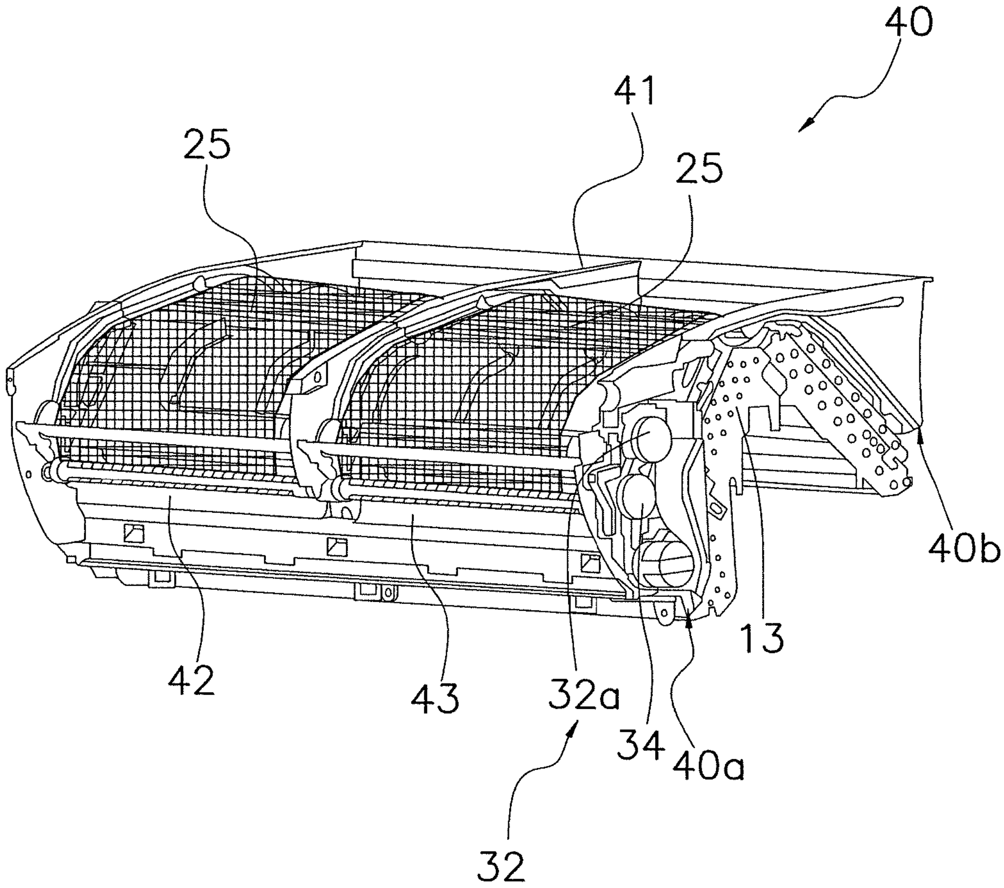

FIG. 3

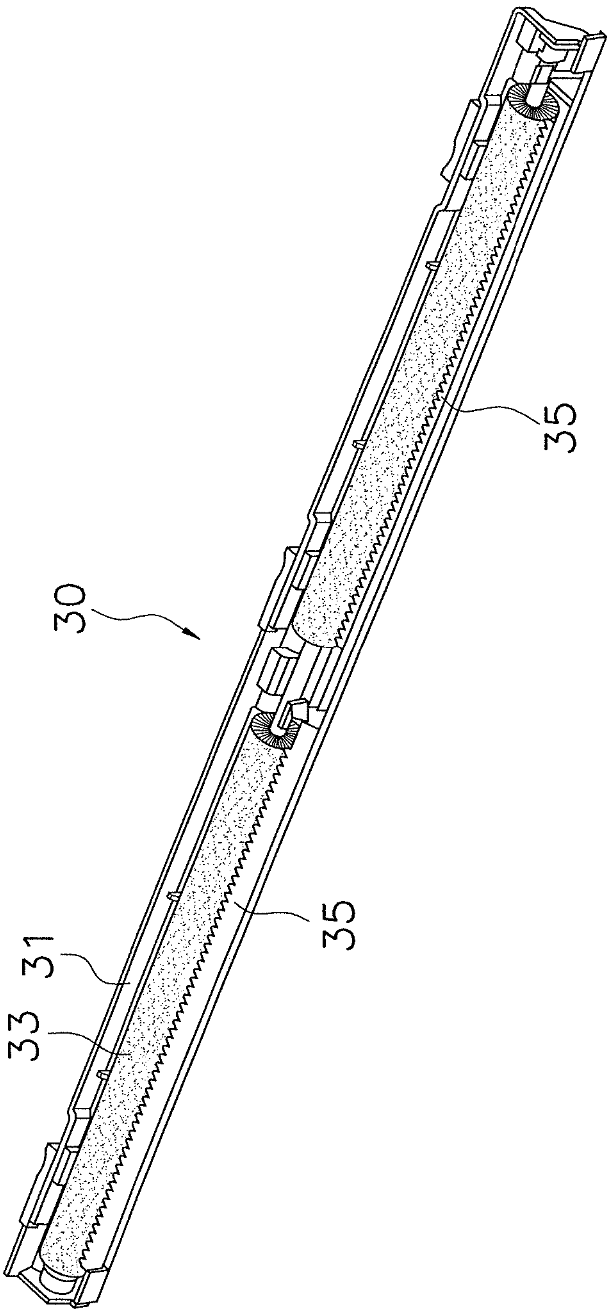

FIG. 4

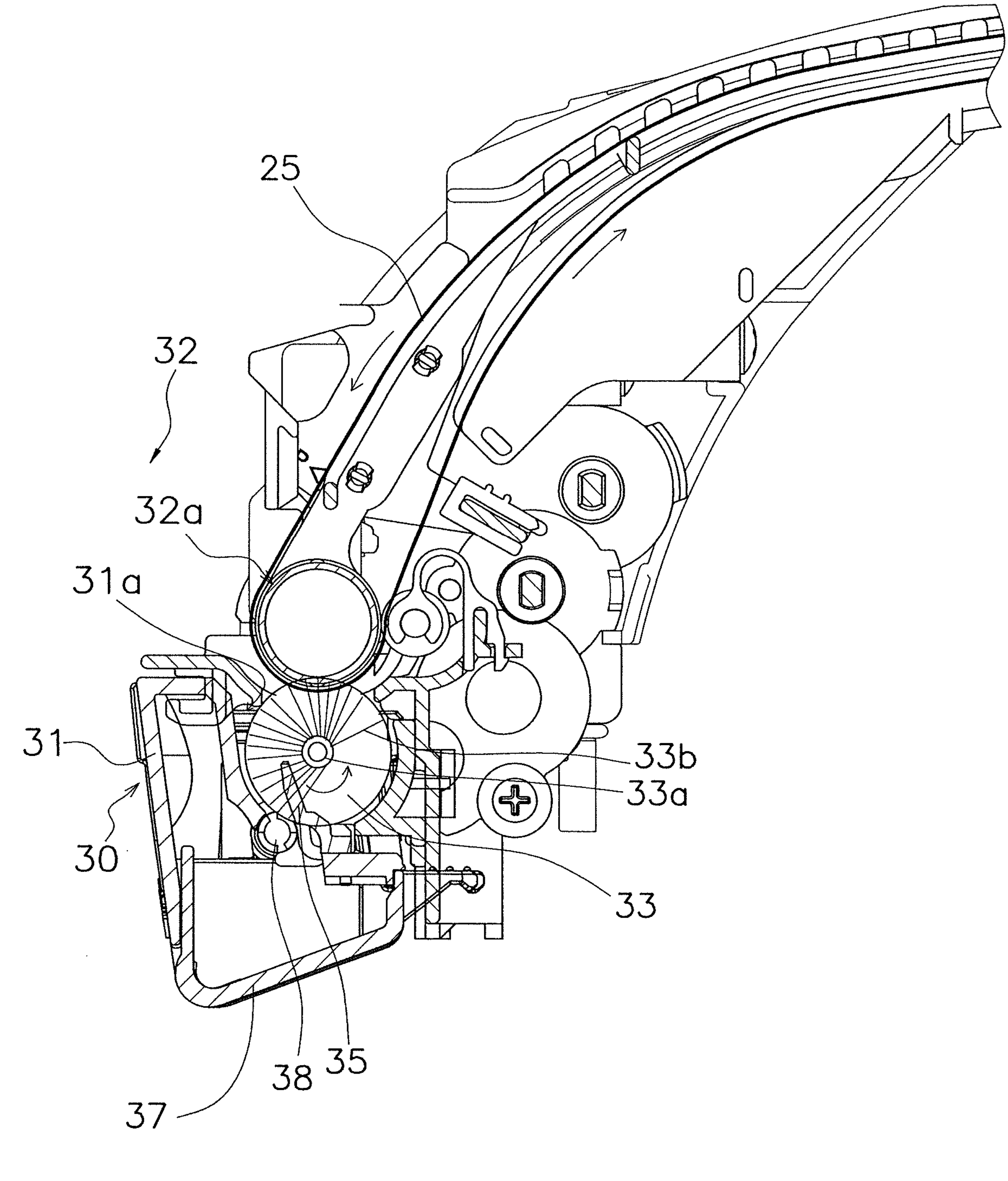

FIG. 5

FIG. 6

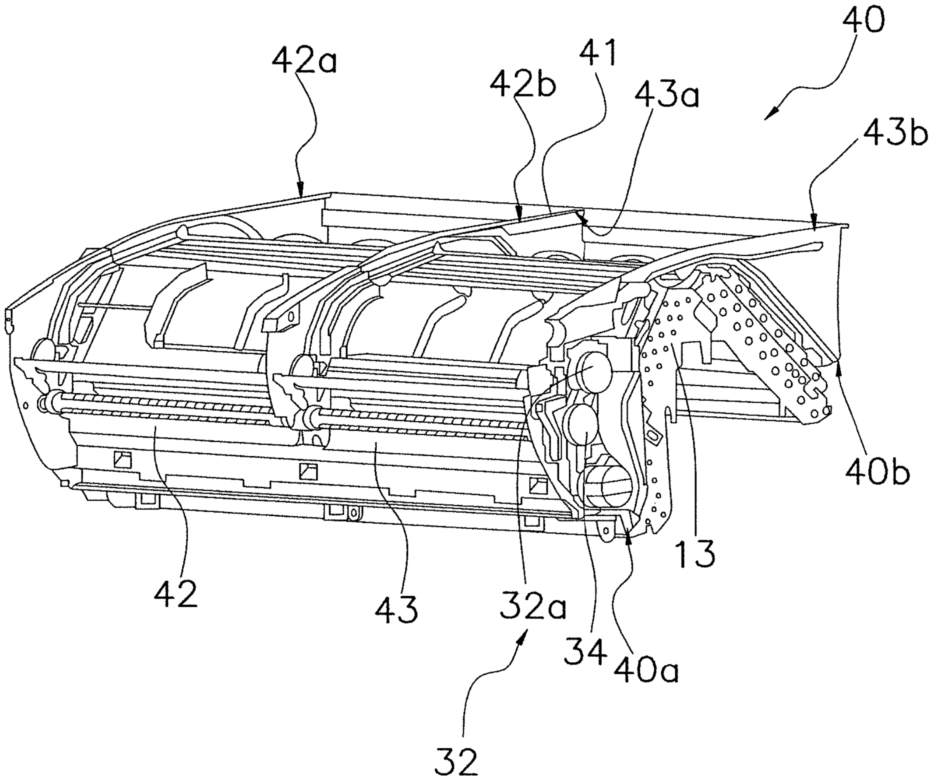
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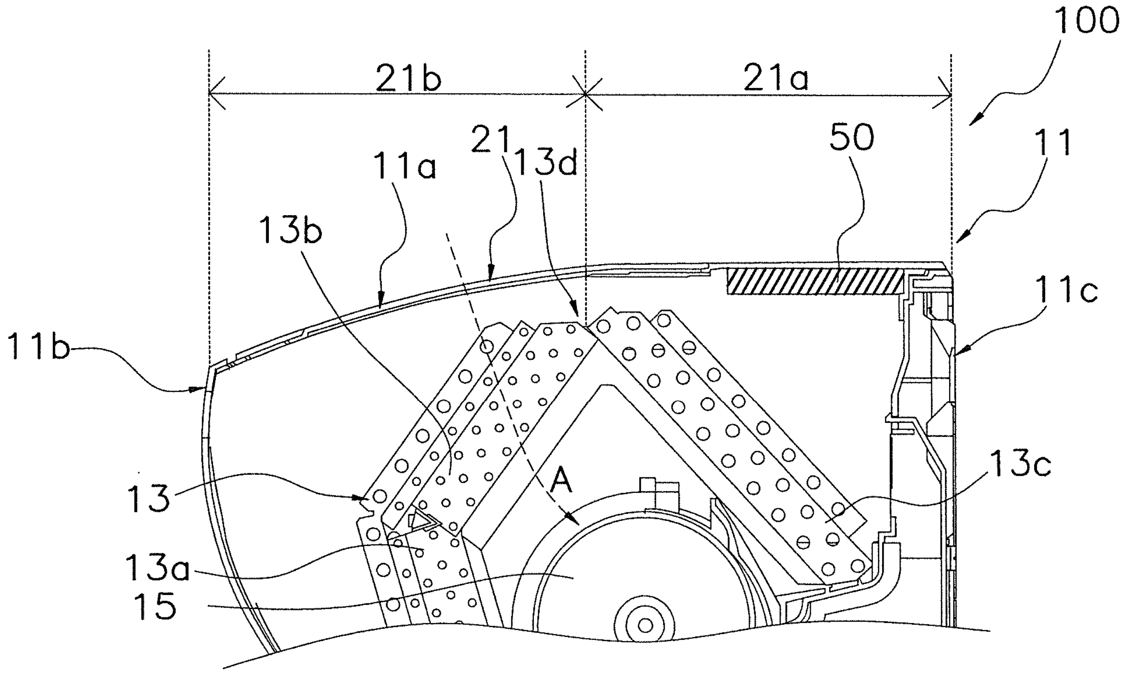
FIG. 7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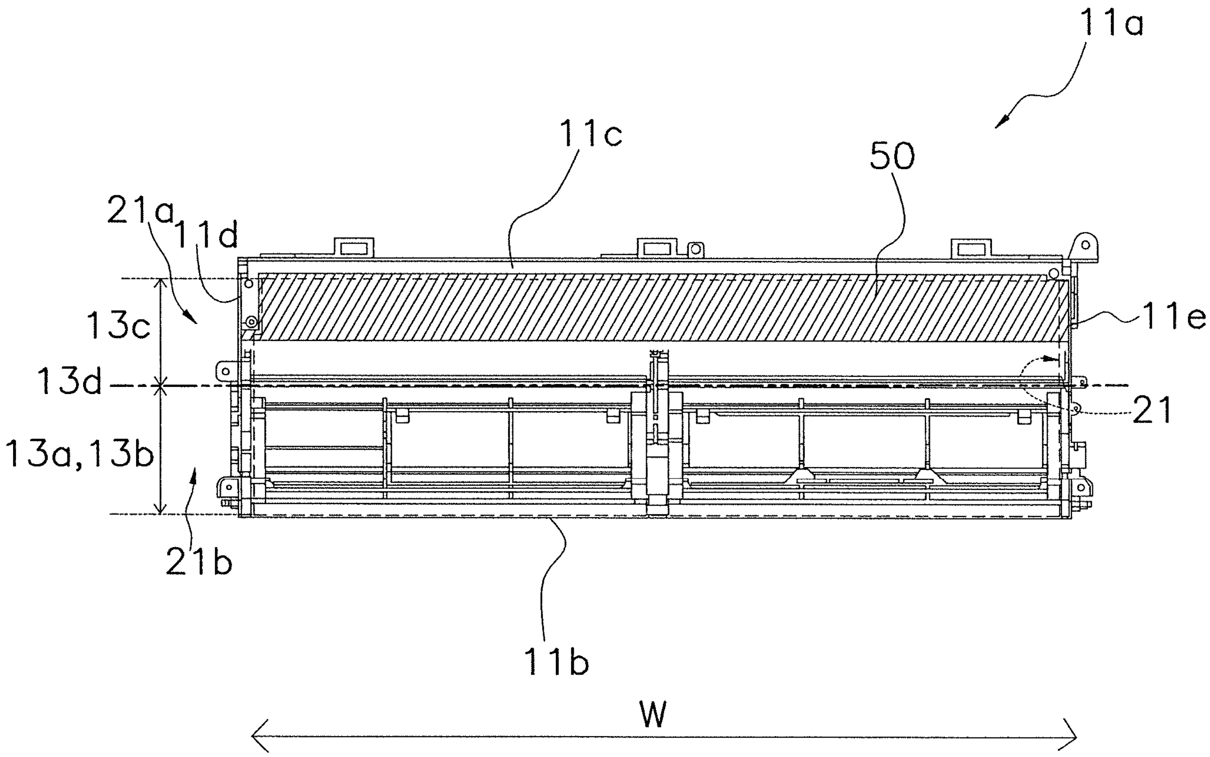

FIG. 8

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2013/053340

A. CLASSIFICATION OF SUBJECT MATTER
F24F13/20(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)
F24F13/20

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

Jitsuyo Shinan Koho	1922-1996	Jitsuyo Shinan Toroku Koho	1996-2013
Kokai Jitsuyo Shinan Koho	1971-2013	Toroku Jitsuyo Shinan Koho	1994-2013

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.
Y	JP 2001-65909 A (Fujitsu General Ltd.), 16 March 2001 (16.03.2001), paragraphs [0012], [0013]; fig. 1 to 3 & US 6338382 B1 & EP 1079184 A2 & AU 5343600 A & TW 449654 B & AU 776343 B & KR 10-2001-0021408 A & CN 1286383 A	1,2,4-8
Y A	JP 2001-116346 A (Fujitsu General Ltd.), 27 April 2001 (27.04.2001), paragraphs [0013] to [0015]; fig. 1 (Family: none)	1,2,4-8 3

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

* Special categories of cited documents:
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"E" earlier application or patent but published on or after the international filing date
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"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
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"&" document member of the same patent family

Date of the actual completion of the international search 01 May, 2013 (01.05.13)	Date of mailing of the international search report 14 May, 2013 (14.05.13)
Name and mailing address of the ISA/ Japanese Patent Office	Authorized officer
Facsimile No.	Telephone No.

Form PCT/ISA/210 (second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT

International application No. PCT/JP2013/053340

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 2001-280645 A (Fujitsu General Ltd.), 10 October 2001 (10.10.2001), claims 1, 4; paragraphs [0022], [0023], [0025]; fig. 1, 2 (Family: none)	1-8
A	JP 2000-205644 A (Fujitsu General Ltd.), 28 July 2000 (28.07.2000), fig. 2(A) (Family: none)	1-8
A	JP 10-19340 A (Fujitsu General Ltd.), 23 January 1998 (23.01.1998), paragraphs [0011] to [0013]; fig. 2 (Family: none)	1-8
A	JP 2003-130386 A (Fujitsu General Ltd.), 08 May 2003 (08.05.2003), paragraphs [0009] to [0013]; fig. 1, 2 (Family: none)	1-8

Form PCT/ISA/210 (continuation of second sheet) (July 2009)

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2001311530 A **[0003] [0089]**