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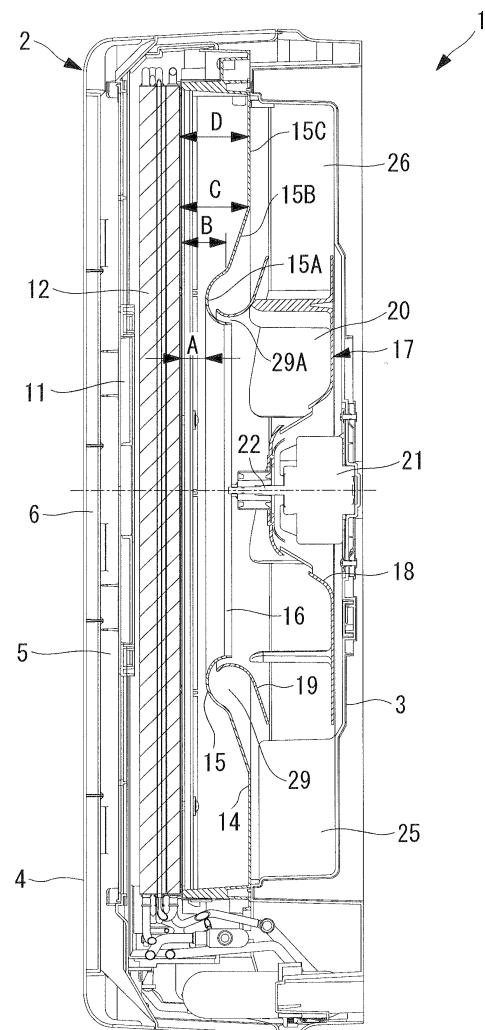
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(54) **Air conditioner**

(57) Provided is an air conditioner that is capable of enhancing capacity and efficiency by suppressing a reduction in the heat exchange efficiency, due to increasing the size of a heat exchanger, at portions far from an air inlet portion, and that is capable of preventing distortion of the bellmouth caused by increasing the size of the heat exchanger. In an air conditioner in which air taken in by a turbofan disposed in a casing from the front surface side of the casing and passing through a heat exchanger and a bellmouth is blown out in a radial direction, and the air is blown into the interior of a room from an air outlet provided on the casing, the distance between the heat exchanger and the bellmouth is minimum at an air inlet portion of the bellmouth and increases with increasing distance from the air inlet portion.

FIG. 2



Description

BACKGROUND OF THE INVENTION

1. FIELD OF THE INVENTION

[0001] The present invention relates to an air conditioner that includes a turbofan, that blows out air taken in from the front side via a heat exchanger and a bellmouth in a radial direction, and that blows out the air into the interior of a room from air outlets.

2. DESCRIPTION OF RELATED ART

[0002] A heretofore known air conditioner is provided with a turbofan requiring no fan case and configured to blow out air, which is taken in from the front side of the casing and has passed through a heat exchanger and a bellmouth, in a radial direction, and to blow out the conditioned air, rectified by a plurality of longitudinal louvers arranged along the longitudinal direction of respective air outlets, into the interior of a room from a plurality of air outlets provided around the turbofan (Japanese Unexamined Patent Application, Publication No. 2007-183010).

[0003] In such an air conditioner, as the aspect ratio of the heat exchanger (front view) becomes closer to 1, the ratio of the bellmouth and the air inlet portion of the turbofan relative to the front area of the heat exchanger becomes greater, making it possible to obtain a more uniform air intake level; therefore, the efficiency of the heat exchanger increases. Consequently, it is possible to make the distance between the heat exchanger and the bellmouth as small as possible, which makes it possible to reduce the size of the unit in the depth dimension; therefore, it is possible to make the unit more compact.

[0004] With the above-described air conditioner, however, when attempting to increase the size of the heat exchanger for further enhancing its capacity and efficiency, under the condition that the height dimension of the unit is restricted, it inevitably becomes necessary to increase the aspect ratio of the heat exchanger. In this case, with the bellmouth and the turbofan having air inlet portions of equal area, reduction in the heat exchange efficiency at portions far from the air inlet portion cannot be avoided; thus, a problem arises in that performance enhancement matching the increase in size of the heat exchanger cannot be achieved unless the distance between the heat exchanger and the bellmouth is increased (an increase in the depth dimension of the unit).

[0005] If the heat exchanger were increased in size by increasing the aspect ratio of the heat exchanger, it would be necessary for the bellmouth that fixes the heat exchanger also to be increased in the width-direction dimension. As a result, the bellmouth becomes distorted more easily, and increasing the strength of the bellmouth becomes an issue.

BRIEF SUMMARY OF THE INVENTION

[0006] The present invention has been conceived in light of the above-described situation, and an object thereof is to provide an air conditioner that is capable of enhancing the capacity and efficiency by suppressing a reduction in the heat exchange efficiency, due to increasing the size of a heat exchanger, at portions far from an air inlet portion, while maintaining the distance at an air inlet portion of a bellmouth fixed, and that is capable of preventing distortion of the bellmouth caused by increasing the size of the heat exchanger.

[0007] In order to solve the above-described problems, an air conditioner of the present invention adopts the following solutions.

That is, in an air conditioner according to one aspect of the present invention, in which air taken in by a turbofan disposed in a casing from the front surface side of the casing and passing through a heat exchanger and a bellmouth is blown out in a radial direction, and the air is blown into the interior of a room from an air outlet provided on the casing, the distance between the heat exchanger and the bellmouth is minimum at an air inlet portion of the bellmouth and increases with increasing distance from the air inlet portion.

[0008] With the aspect described above, the distance between the heat exchanger and the bellmouth is minimized at the air inlet portion of the bellmouth and increases with an increasing distance from the air inlet portion; therefore, even when the heat exchanger is increased in size, it is possible to secure a sufficiently large channel downstream of the heat exchanger at portions far from the air inlet of the bellmouth, reducing the pressure loss therein and thus increasing the airflow volume that passes through the heat exchanger. As a result, reduction in the heat exchange efficiency, due to increasing the size of the heat exchanger, at portions far from the air inlet portion can be suppressed without increasing the distance (the depth dimension of the unit) at the air inlet portion of the bellmouth, and thus it is possible to provide a compact high-capacity high-efficiency air conditioner.

[0009] With the aspect described above, in the above-described air conditioner, the heat exchanger may be formed in a horizontally elongated rectangular shape with an aspect ratio of 1 or greater, and the distance between the heat exchanger and a horizontally elongated portion of the bellmouth, which has a shape corresponding to the heat exchanger, increases with increasing distance from the air inlet portion of the bellmouth.

[0010] With the aspect described above, the heat exchanger has a horizontally elongated rectangular shape with an aspect ratio of 1 or greater and the distance between the heat exchanger and a horizontally elongated portion of the bellmouth, whose shape corresponds to that of the heat exchanger, increases with increasing distance from the air inlet portion of the bellmouth; therefore, even when the size of the heat exchanger is increased, into a horizontally elongated rectangular shape with an

aspect ratio of 1 or greater, due to dimensional restrictions (dimensional restriction in the height direction), a sufficiently large channel is secured downstream of the heat exchanger in the horizontally elongated portion, and thus it is possible to reduce the pressure loss therein. Therefore, when a heat exchanger is to be increased in size into a horizontally elongated rectangular shape, it is possible to realize reduction of the size of the air conditioner and to enhance the capacity and efficiency thereof by suppressing a reduction in the heat exchange efficiency in the horizontally elongated portion.

[0011] With the aspect described above, one of the above-described air conditioners may be configured so that a recirculation channel for recirculating part of airflow blown out from the turbofan is formed between a bell-shaped air inlet portion of the bellmouth and a shroud of the turbofan, which is disposed facing the air inlet portion of the bellmouth, and the air inlet portion of the bellmouth that forms the recirculation channel has a curved surface that protrudes toward the heat exchanger and an inclined surface that is connected to the curved surface at an angle with respect to a site at which the distance from the heat exchanger is increased.

[0012] With the configuration describe above, because of the configuration wherein a recirculation channel is formed between the air inlet portion of the bellmouth and the shroud of the turbofan disposed facing the air inlet portion, and part of the airflow blown out from the turbofan by a pressure difference between the front and the back of the fan is recirculated, it is possible to enhance the efficiency of the turbofan and to reduce noise therefrom by suppressing separation of the airflow at the shroud surface of the turbofan. In addition, because the air inlet portion of the bellmouth that forms this recirculation channel has a shape having a curved surface that protrudes toward the heat exchanger and an inclined surface that is connected from the curved surface at an angle with respect to the site at which the distance from the heat exchanger is increased, it is possible to attach the airflow to be recirculated smoothly to the shroud surface by ejecting it along the curved surface. Accordingly, it is possible to take the maximum advantage of the efficiency enhancements and the noise reduction of the turbofan due to the recirculation of blown-out air.

[0013] With the configuration described above, in one of the above-described air conditioners, the bellmouth may be provided with ribs in a radiating fashion around the air inlet portion.

[0014] With the configuration described above, because ribs are provided in a radiating fashion around the air inlet portion of the bellmouth, even when the aspect ratio of the heat exchanger is increased, and thus the bellmouth, which fixes it, is also increased in size, the strength of the bellmouth can be increased by ribs provided in a radiating fashion around the air inlet portion without hindering the flow of secondary air that has passed through the heat exchanger. Therefore, it is possible to prevent distortion caused by increasing the as-

pect ratio of the bellmouth.

[0015] The air conditioner according to one aspect of the present invention is an air conditioner in which air taken in by a turbofan disposed in a casing from the front surface side of the casing and passing through a heat exchanger and a bellmouth is blown out in a radial direction, and the air is blown into the interior of a room from an air outlet provided on the casing, wherein the heat exchanger is formed in a horizontally elongated rectangular shape with an aspect ratio of 1 or greater; and the bellmouth, which is formed in a shape corresponding to the heat exchanger, is provided with ribs in a radiating fashion around its air inlet portion thereof.

[0016] With the aspect described above, because the heat exchanger has a horizontally elongated rectangular shape with an aspect ratio of 1 or greater and ribs are provided in a radiating fashion around the air inlet portion of the bellmouth having a shape corresponding to the heat exchanger, even when the heat exchanger is increased in size into a horizontally elongated rectangular shape with an aspect ratio of 1 or greater, and thus the bellmouth, which fixes it, is also increased in size, aiming for enhancing the capacity and efficiency of the air conditioner, it is possible to increase the strength of the bellmouth due to the ribs provided in a radiating fashion around the air inlet portion, without hindering the flow of secondary air that has passed through the heat exchanger. Accordingly, it is possible to realize the capacity and the efficiency enhancements of the air conditioner and it is additionally possible to prevent distortion caused by increasing the aspect ratio of the bellmouth.

[0017] In the aspect described above, one of the above-described air conditioners may be configured so that, when the radius of an arc that forms the air inlet portion is defined as R, the ribs are provided at outer positions where the distance from the air inlet portion is equal to dimension R or greater.

[0018] With the configuration described above, because ribs are provided at outer positions at which the distance from the air inlet portion is equal to dimension R or greater, where R is the radius of the arc forming the air inlet portion, when secondary air that has passed through the heat exchanger passes through the air inlet portion of the bellmouth and flows into the turbofan, it is possible to have the ribs not to hinder this airflow. Accordingly, it is possible to reliably ensure sufficient strength of the bellmouth with an increased size without reducing the efficiency of air intake into the turbofan.

[0019] According to the present invention, even when the heat exchanger is increased in size, a sufficiently large channel can be secured downstream of the heat exchanger at portions far from the air inlet portion of the bellmouth, and the airflow volume passing through the heat exchanger can be increased by reducing pressure loss therein; therefore, it is possible to suppress reduction in the heat exchange efficiency at the portions far from the air inlet portion due to increasing the size of the heat exchanger without increasing the distance at the air inlet

portion of the bellmouth (the depth dimension of the unit), and thus it is possible to provide a compact high-capacity high-efficiency air conditioner.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

[0020]

Fig. 1 is a longitudinal-sectional view of an air conditioner according to a first embodiment of the present invention, taken through the center of rotation of its turbofan.

Fig. 2 is a cross-sectional view of the air conditioner shown in Fig. 1, taken through the center of rotation of its turbofan.

Fig. 3A is plan view of a bellmouth of an air conditioner according to a second embodiment of the present invention.

Fig. 3B is a sectional view of the bellmouth of the air conditioner according to the second embodiment of the present invention.

Explanation of Reference Signs

[0021]

- 1: air conditioner
- 2: casing
- 7: upper air outlet
- 9: lower air outlet
- 12: indoor heat exchanger (heat exchanger)
- 14: bellmouth
- 15: air inlet portion
- 15A: curved surface
- 15B: inclined surface
- 15C: site at which the distance from the indoor heat exchanger is increased
- 16: air inlet
- 17: turbofan
- 19: shroud
- 29: recirculation channel
- 30: radial rib
- A, B, C, D: distance between the indoor heat exchanger and the bellmouth
- R: radius of an arc at the air inlet portion

DETAILED DESCRIPTION OF THE INVENTION

[0022] Embodiments of the present invention will be described below, referring to the drawings.

First Embodiment

[0023] A first embodiment of the present invention will be described below, using Figs. 1 and 2.

Fig. 1 shows a longitudinal-sectional view of an air conditioner 1 according to a first embodiment of the present

invention, taken through the center of rotation of its turbofan 17, and Fig. 2 shows a cross-sectional view of the air conditioner 1, taken through the center of rotation of its turbofan 17. An upward-downward bidirectionally blowing floor-standing air conditioner is illustrated as an example of the air conditioner 1, the air conditioner 1 having a horizontal rectangular casing 2 formed of a base 3 and a front panel 4.

[0024] The front surface of the front panel 4 is provided with an air inlet 5 from which air is taken in from the interior of a room; and inlet grilles 6 are provided at the air inlet 5. In addition, an upper air outlet 7 is provided horizontally in the width direction at the edge extending from the front surface to the top of the front panel 4; and the upper air outlet 7 can be opened and closed by a horizontal louver 8 that is rotatably provided at the opening. Furthermore, a lower air outlet 9 is provided horizontally in the width direction at the lower portion of the front panel 4; and the lower air outlet 9 can be opened and closed by a horizontal louver 10 that is rotatably provided at the opening.

[0025] In the casing 2, an air filter 11, behind which a plate-fin-tube shaped indoor heat exchanger (heat exchanger) 12 is fixedly provided, is detachably disposed behind the inlet grilles 6. The indoor heat exchanger 12 is connected to devices on the outdoor unit side (not shown) via refrigerant pipes, thereby forming a known refrigeration cycle. A drain pan 13 is disposed at the lower portion of the indoor heat exchanger 12 and is configured so as to catch drain water, condensing on and dripping from the surface of the indoor heat exchanger 12 during cooling and dehumidifying modes, and to drain the drain water to the exterior via a drain hose (not shown).

[0026] On the downstream side of the indoor heat exchanger 12, a bellmouth 14, for guiding the air passing through the indoor heat exchanger 12 to a turbofan 17 provided downstream thereof, is fixedly provided in the casing 2 and integrally with the indoor heat exchanger 12. In the central portion of the bellmouth 14, an air inlet portion 15 is formed so as to face the turbofan 17, and a circular bell-shaped air inlet 16 is formed in the air inlet portion 15. In addition, the turbofan 17 is provided downstream of the bellmouth 14 so as to face the bell-shaped air inlet 16.

[0027] The turbofan 17 includes a base plate 18, a shroud 19, and a plurality of blades 20 and is rotationally driven about a horizontal axis via a motor 21 because the central portion of the base plate 18 is fixed to the distal end of a rotation shaft 22 of the motor 21 that is fixedly provided on the base 3. Conditioned air, blown out in a radial direction via the turbofan 17, is blown outward from the outer circumference of the turbofan 17 at a certain angle with respect to the tangential direction thereof.

[0028] Air guiding channels 23 and 24, for guiding the conditioned air blown out from the turbofan 17 to the upper air outlet 7 and the lower air outlet 9, are formed between the base 4 and the bellmouth 14. Nose portions 25 and 26, corresponding to the upper air outlet 7 and

the lower air outlet 9 and that guide the conditioned air blown out from the turbofan 17 to the respective air outlets 7 and 9, are formed integrally with the base 3. In the upper air guiding channel 23, along the longitudinal direction of the upper air outlet 7, a plurality of mutually linked vertical louvers 27 are provided rotatably about a vertical axis; and in the lower air guiding channel 24, along the longitudinal direction of the lower air outlet 9, a plurality of mutually linked vertical louvers 28 are provided rotatably about a vertical axis.

[0029] In order to achieve further capacity and efficiency enhancements of the air conditioner 1, the indoor heat exchanger 12 is increased in size in this embodiment by making the indoor heat exchanger 12 a horizontally elongated rectangular shape with an aspect ratio of 1 or greater. This is because the height dimension of the unit is restricted. Accompanying the increase in size of the indoor heat exchanger 12, the bellmouth 14, disposed downstream thereof, is similarly formed in a horizontally elongated rectangular shape in the same way. Furthermore, due to the increase in size of the indoor heat exchanger 12 and the bellmouth 14, with the bellmouth 14 and the turbofan 17 having air inlet portion of equal area, the heat exchange efficiency is deteriorated at portions far from the air inlet portion 15. Therefore, the distance between the indoor heat exchanger 12 and the bellmouth 14 is set as follows by altering the shape of the bellmouth 14.

[0030] That is, the indoor heat exchanger 12 and the bellmouth 14 are formed in a horizontally elongated rectangular shape so as to satisfy the relationship $A < B \leq C \leq D$ at the portions far from the air inlet portion 15, where, as shown in Fig. 2, the distances between the indoor heat exchanger 12 and the bellmouth 14, distances B, C, and D, are gradually increased with increasing distance from the air inlet 16 of the bellmouth 14, while the distance A at the air inlet portion 15 of the bellmouth 14 is kept fixed. Accordingly, in the portions far from the air inlet 16 of the bellmouth 14, the configuration thereof is such that it is possible to make an air channel formed downstream of the indoor heat exchanger 12 a sufficiently large channel, and to increase the air volume passing through the indoor heat exchanger 12 by reducing the pressure loss at those portions.

[0031] The air inlet portion 15 of the bellmouth 14 is formed having a curved surface 15A that is substantially semicircular and that protrudes toward the indoor heat exchanger 12 and an inclined surface 15B that is connected from the outer edge of the curved surface 15A at an angle with respect to a site 15C at which the distance from the indoor heat exchanger 12 is increased, in order to form a recirculation channel 29 between the shroud 19 of the turbofan 17 and the air inlet portion 15, through which part of the airflow blown out of the turbofan 17 is recirculated. Here, the curved surface 15A is configured so as to form a ring-shaped recirculation air ejection channel 29A between the rounded surface on the inner circumference side of the shroud 19 and the curved sur-

face 15A, to be able to eject the recirculating airflow along the curved surface 15A, smoothly attaching it to the rounded surface of the shroud 19; and the inclined surface 15B is configured substantially parallel to an inclined surface of the shroud 19.

[0032] According to the present embodiment configured as described above, the following effects and advantages are afforded.

As the air conditioner 1 starts to operate, the turbofan 17 is rotated so that the air in the interior of a room is taken in from the air inlet 5 to the inside of the casing 2 via the inlet grilles 6. This air, after dust is removed therefrom by the air filter 11, is cooled or heated in the process of passing through the indoor heat exchanger (heat exchanger) 12, by heat exchange with refrigerant, is guided by the bellmouth 14 disposed downstream thereof, and is taken into the turbofan 17 from the bell-shaped air inlet 16.

[0033] The conditioned air, pressurized by the turbofan 17 and blown out in the radial direction from the outer peripheral part thereof, is blown out from the outer periphery of the turbofan 17, outward and at a certain angle with respect to the tangential direction thereof. This conditioned air is guided to the upper air outlet 7 and/or the lower air outlet 9 through the air guiding channels 23 and 24, while being guided by the nose portions 25 and 26 and is blown into the interior of the room, thus contributing to cooling or heating. The conditioned air is selectively blown into the interior of the room from both the upper air outlet 7 and the lower air outlet 9, or one of the two, depending on the blowing mode.

[0034] Here, in increasing the size of the indoor heat exchanger 12 to achieve further capacity and efficiency enhancements of the air conditioner 1, the indoor heat exchanger 12 is formed in a horizontally elongated rectangular shape whose aspect ratio is 1 or greater because of restrictions in the height dimension of the unit; and, correspondingly, the bellmouth 14 is also formed in a horizontally elongated rectangular shape. However, in this embodiment, the indoor heat exchanger 12 and the bellmouth 14 are formed in a horizontally elongated rectangular shape so as to set distances A through D between the indoor heat exchanger 12 and the bellmouth 14 in such a way that satisfies the relationship $A < B \leq C \leq D$ at the portions far from the air inlet portion 15, where, as shown in Fig. 2, the distance at the air inlet 15 of the bellmouth 14 is A, and distances B, C, and D are gradually increased with increasing distance from the air inlet portion 15.

[0035] Thus, even when the indoor heat exchanger 12 is increased in size, it is possible to make an air channel formed downstream of the indoor heat exchanger 12 in the portions far from the air inlet 15 of the bellmouth 14 a sufficiently large channel; therefore, it is possible to increase the air volume passing through the indoor heat exchanger 12 by reducing the pressure loss at those portions. Accordingly, reduction in the heat exchange efficiency at the portions far from the air inlet portion 15 due

to upsizing of the indoor heat exchanger 12 can be suppressed without increasing the distance A (the depth dimension of the unit) at the air inlet portion 15 of the bellmouth 14, and consequently, it is possible to obtain a compact high-capacity high-efficiency air conditioner 1.

[0036] With the configuration in the present embodiment, the recirculation channel 29, for recirculating part of the airflow blown out from the turbofan due to a pressure difference between the front and the back of the fan, is formed between the air inlet portion 15 of the bellmouth 14 and the shroud 19 of the turbofan 17 disposed facing this air inlet portion 15; therefore, the recirculating airflow prevents separation of airflow at the inner circumferential surface of the shroud 19 of the turbofan 17, making it possible to enhance the efficiency of the turbofan 17 and to reduce the noise therefrom.

[0037] The air inlet portion 15 of the bellmouth 14 that forms the recirculation channel 29 has the curved surface 15A that protrudes toward the indoor heat exchanger 12 and the inclined surface 15B that is connected from this curved surface 15A at an angle with respect to the site 15C at which the distance from the indoor heat exchanger 12 is increased, thus forming the ring-shaped recirculation air ejection channel 29A between the curved surface 15A and the rounded surface on the inner circumferential side of the shroud 19; therefore, the airflow to be recirculated is ejected along the curved surface 15A and thus can be smoothly attached to the rounded surface of the shroud 19. Thus, it is possible to take the maximum advantage of the effects of enhanced efficiency and noise reduction of the turbofan 17 due to the recirculation of the blown-out air.

Second Embodiment

[0038] Next, a second embodiment of the present invention will be described using Fig. 3A and 3B.

This embodiment differs from the above-described first embodiment in that a bellmouth 14 is configured having ribs 30. The other aspects are the same as the first embodiment, and thus a description thereof is omitted.

As shown in Fig. 3A and 3B, in this embodiment, a plurality of radial ribs 30 that extend radially from the center of an air inlet 16 are provided around an air inlet portion 15 of a bellmouth 14 that has a horizontally elongated rectangular shape corresponding to the shape of an indoor heat exchanger 12.

[0039] The radial ribs 30 are provided in a radiating fashion, having their starting ends at outer positions where the distance from the air inlet portion 15 is at least equal to dimension R or greater, where R is the radius of an arc that forms the air inlet portion 15 of the bellmouth 14.

[0040] As described above, by having a configuration in which the indoor heat exchanger 12 is formed in a horizontally elongated rectangular shape with an aspect ratio of 1 or greater and the radial ribs 30 are provided in a radiating fashion around the air inlet portion 15 of

the bellmouth 14 that has a shape corresponding to this indoor heat exchanger 12, even when the indoor heat exchanger 12 is increased in size into a horizontally elongated rectangular shape with the aspect ratio of 1 or greater, with the aim of enhancing the efficiency of the air conditioner 1 and reducing noise therefrom, simultaneously increasing the size of the bellmouth 14 in the same way, it is possible to increase the strength of the bellmouth 14 by the radial ribs 30 provided in a radiating fashion around the air inlet portion 15 without hindering the flow of the secondary air that has passed through the indoor heat exchanger 12. Accordingly, it is possible to realize capacity and efficiency enhancements of the air conditioner 1, and, simultaneously, to prevent distortion caused by increasing the aspect ratio of the bellmouth 14.

[0041] In providing the radial ribs 30 on the bellmouth 14, the radial ribs 30 are provided in a radiating fashion, having their starting ends at outer positions where the distance from the air inlet portion 15 is equal to the dimension R or greater, where R is the radius of an arc that forms the air inlet portion 15 of the bellmouth 14; therefore, it is possible not to hinder the flow of the secondary air that has passed through the indoor heat exchanger 12. Therefore, it is possible to reliably ensure sufficient strength of the bellmouth 14 with an increased size without reducing the efficiency of air intake into the turbofan 17.

[0042] The present invention is not limited to the embodiments described above, and various modifications can be made without departing from the spirit thereof. For example, in the embodiments described above, examples of upward-downward bidirectionally blowing floor-standing air conditioners are described; however, the present invention is not limited to upward-downward bidirectionally blowing floor-standing air conditioners and can be effectively applied to an air conditioner 1 including a turbofan 17 wherein attempts are made to improve its capacity and efficiency by means of increasing the size of an indoor heat exchanger 12.

[0043] The curved surface 15A that forms the air inlet portion 15 of the bellmouth 14 may be a circular arc surface or a rounded surface similar thereto, or may be a rounded surface that is capable of smoothly guiding the airflow to the air inlet 16 and of ejecting a recirculation airflow to the turbofan 17 in such a manner that it can smoothly attach to the rounded surface of the shroud 19.

Claims

1. An air conditioner in which air taken in by a turbofan disposed in a casing from the front surface side of the casing and passing through a heat exchanger and a bellmouth is blown out in a radial direction, and the air is blown into the interior of a room from an air outlet provided on the casing, wherein the distance between the heat exchanger and the bellmouth is minimum at an air inlet portion of the

bellmouth and increases with increasing distance from the air inlet portion.

2. The air conditioner according to Claim 1, wherein the heat exchanger is formed in a horizontally elongated rectangular shape with an aspect ratio of 1 or greater, and the distance between the heat exchanger and a horizontally elongated portion of the bellmouth, which has a shape corresponding to the heat exchanger, increases with increasing distance from the air inlet portion of the bellmouth. 5
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3. The air conditioner according to Claim 1 or 2, wherein a recirculation channel for recirculating part of airflow blown out from the turbofan is formed between a bell-shaped air inlet portion of the bellmouth and a shroud of the turbofan, which is disposed facing the air inlet portion of the bellmouth, and the air inlet portion of the bellmouth that forms the recirculation channel has a curved surface that protrudes toward the heat exchanger and an inclined surface that is connected from the curved surface at an angle with respect to a site at which the distance from the heat exchanger is increased. 15
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4. The air conditioner according to one of Claims 1 to 3, wherein the bellmouth is provided with ribs in a radiating fashion around the air inlet portion.

5. An air conditioner in which air taken in by a turbofan disposed in a casing from the front surface side of the casing and passing through a heat exchanger and a bellmouth is blown out in a radial direction, and the air is blown into the interior of a room from an air outlet provided on the casing, wherein the heat exchanger is formed in a horizontally elongated rectangular shape with an aspect ratio of 1 or greater; and the bellmouth, which is formed in a shape corresponding to the heat exchanger, is provided with ribs in a radiating fashion around its air inlet portion thereof. 30
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6. The air conditioner according to Claim 4 or 5, wherein, when the radius of an arc that forms the air inlet portion is defined as R, the ribs are provided at outer positions where the distance from the air inlet portion is equal to dimension R or greater. 45

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FIG. 1

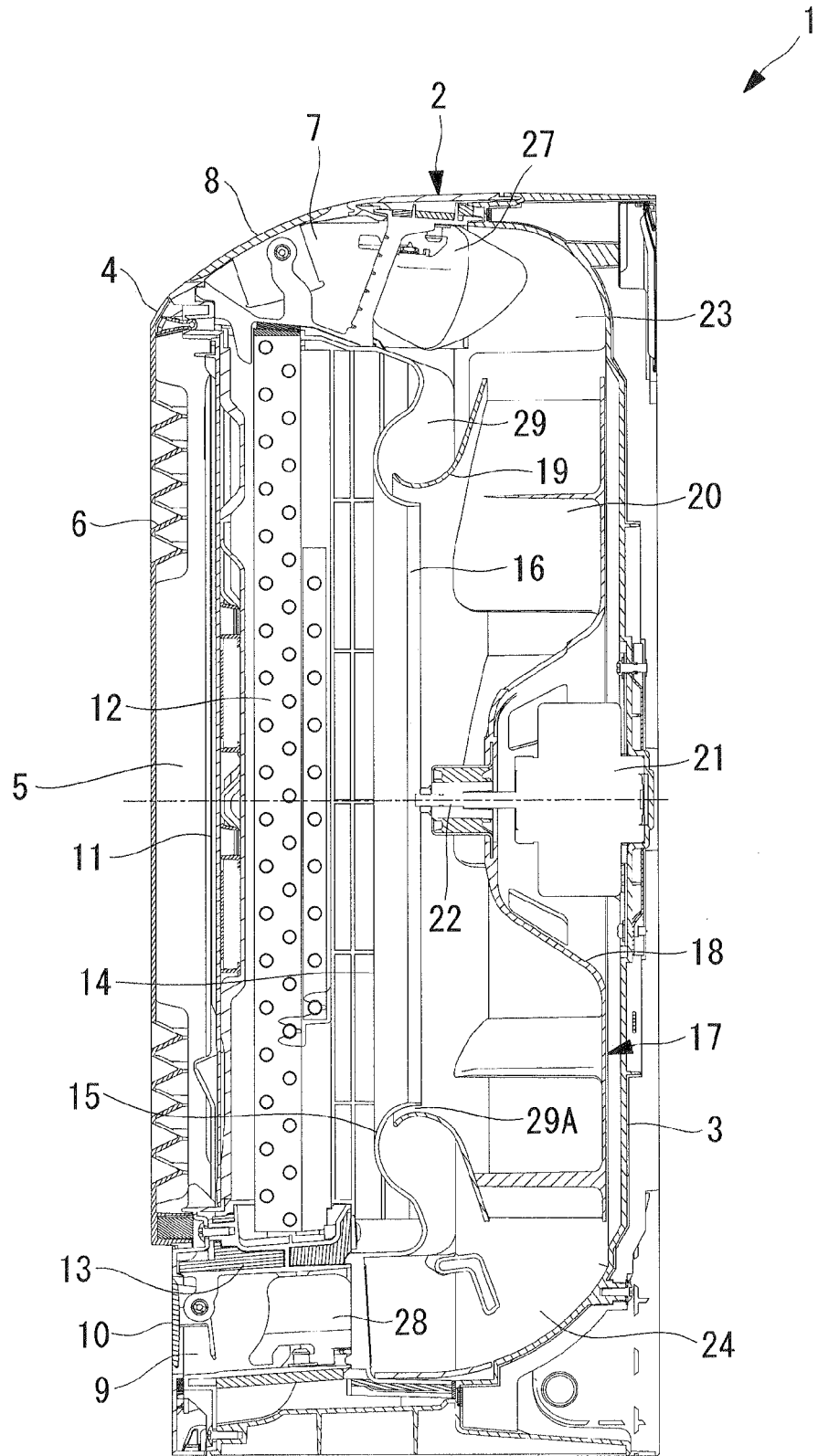


FIG. 2

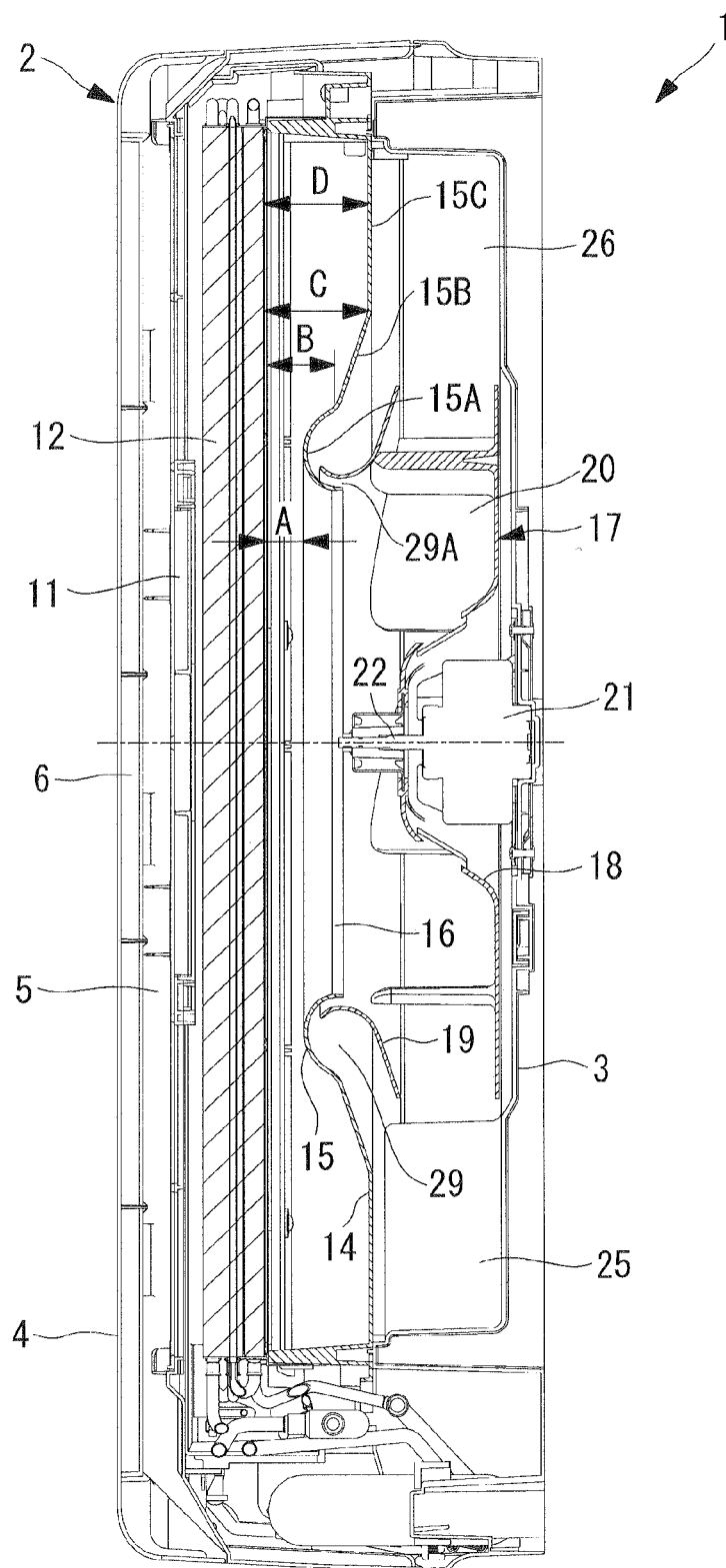


FIG. 3A

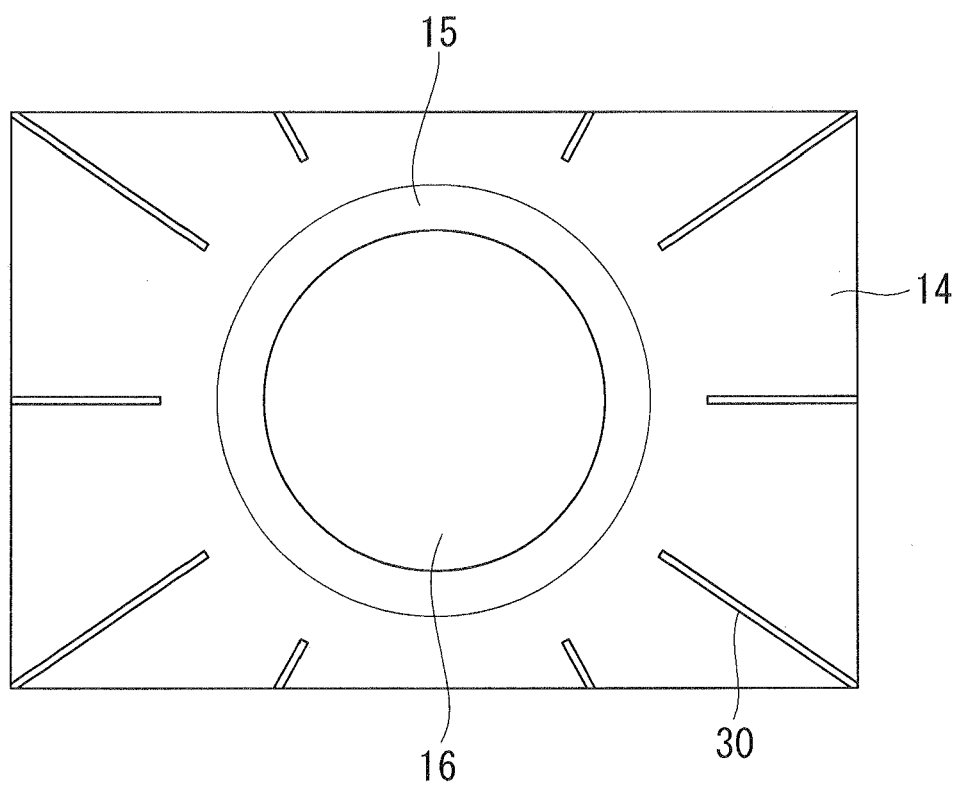
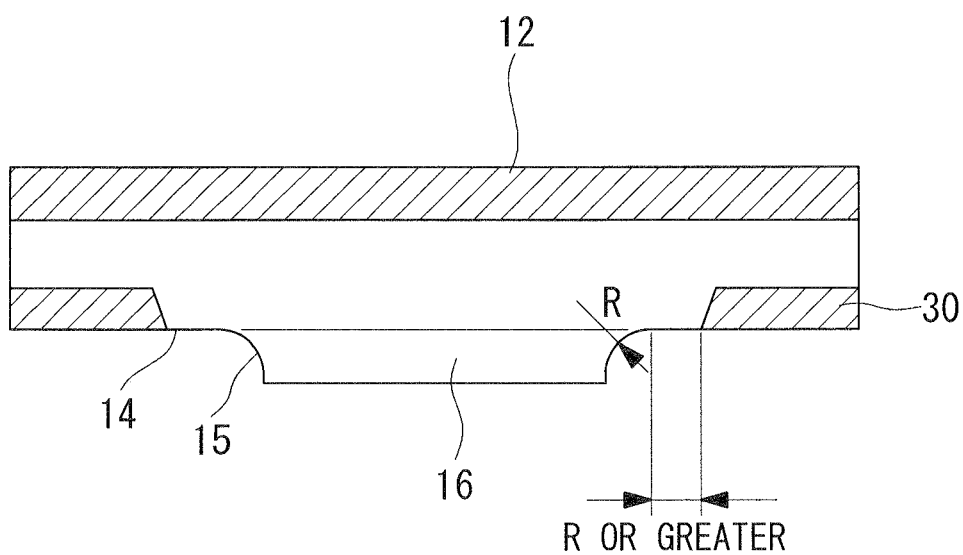


FIG. 3B





EUROPEAN SEARCH REPORT

Application Number
EP 09 16 8406

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	WO 2007/074952 A2 (LG ELECTRONICS INC [KR]; KIM JEONG HUN [KR]; SONG HYE YOUNG [KR]; KIM) 5 July 2007 (2007-07-05)	1-3	INV. F24F1/00 F24F13/08
Y	* paragraph [0050] - paragraph [0055]; figures 2,6-8 *	1-6	
Y,P	WO 2009/011350 A1 (DAIKIN IND LTD [JP]; OHYAMA SHINGO [JP]; ZHENG ZHIMING [JP]) 22 January 2009 (2009-01-22) * figures 4,5 *	1-6	
X	EP 1 526 339 A2 (LG ELECTRONICS INC [KR]) 27 April 2005 (2005-04-27)	1-3	
Y	* paragraph [0120] - paragraph [0126]; figures 43,44 *	1-6	
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (IPC)
			F24F
Place of search		Date of completion of the search	Examiner
Munich		14 January 2010	Valenza, Davide
CATEGORY OF CITED DOCUMENTS		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document			

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EPO FORM 1503 03-82 (P04C01)



Application Number

EP 09 16 8406

CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing claims for which payment was due.

☐ Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due and for those claims for which claims fees have been paid, namely claim(s):

☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due.

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

see sheet B

☐ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.

☒ As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.

☐ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:

☐ None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:

☐ The present supplementary European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims (Rule 164 (1) EPC).



**LACK OF UNITY OF INVENTION
SHEET B**

Application Number

EP 09 16 8406

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

1. claims: 1-4

Air conditioner comprising a turbofan disposed in a casing, a heat exchanger and a bellmouth, wherein the distance between the bellmouth and the heat exchanger is minimum at an air inlet portion of the bellmouth and increases with increasing distance from the air inlet portion.

2. claims: 5-6

Air conditioner comprising a turbofan disposed in a casing, a heat exchanger and a bellmouth, wherein the bellmouth is provided with ribs in radiating fashion around its air inlet portion thereof.

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 09 16 8406

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

14-01-2010

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EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

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