US 20140315479A1

(19) United States

(12) Patent Application Publication

(10) Pub. No.: US 2014/0315479 A1

(43) Pub. Date: Oct. 23, 2014

CHO et al.

(54) **TURBO FAN AND CEILING TYPE AIR CONDITIONER USING THEREOF**

(71) Applicant: **LG ELECTRONICS INC.**, Seoul (KR)

(72) Inventors: **Namjoon CHO**, Seoul (KR); **Kyungrock KIM**, Seoul (KR); **Dongkeun YANG**, Seoul (KR)

(73) Assignee: **LG ELECTRONICS INC.**, Seoul (KR)

(21) Appl. No.: **14/049,517**

(22) Filed: **Oct. 9, 2013**

(30) **Foreign Application Priority Data**

Apr. 19, 2013 (KR) 1020130043388

Publication Classification

(51) **Int. Cl.**

F24F 1/00 (2006.01)
F04D 29/42 (2006.01)
F04D 29/28 (2006.01)

(52) **U.S. Cl.**

CPC ***F24F 1/0018*** (2013.01); ***F04D 29/282*** (2013.01); ***F04D 29/4213*** (2013.01); ***F04D 29/4226*** (2013.01)

USPC **454/233**; 416/187; 415/206; 454/234

(57) **ABSTRACT**

A turbo fan includes a main plate rotated by power provided from a fan motor, blades each having one end connected to the main plate to perform rotation movement, and a shroud having an inner circumferential part and an outer circumferential part, an other end of each of the blades connected to the shroud. The shroud includes a plurality of curved parts each having one side connected to the inner circumferential part and an other side connected to the outer circumferential part, the plurality of curved parts each having a predetermined curvature.

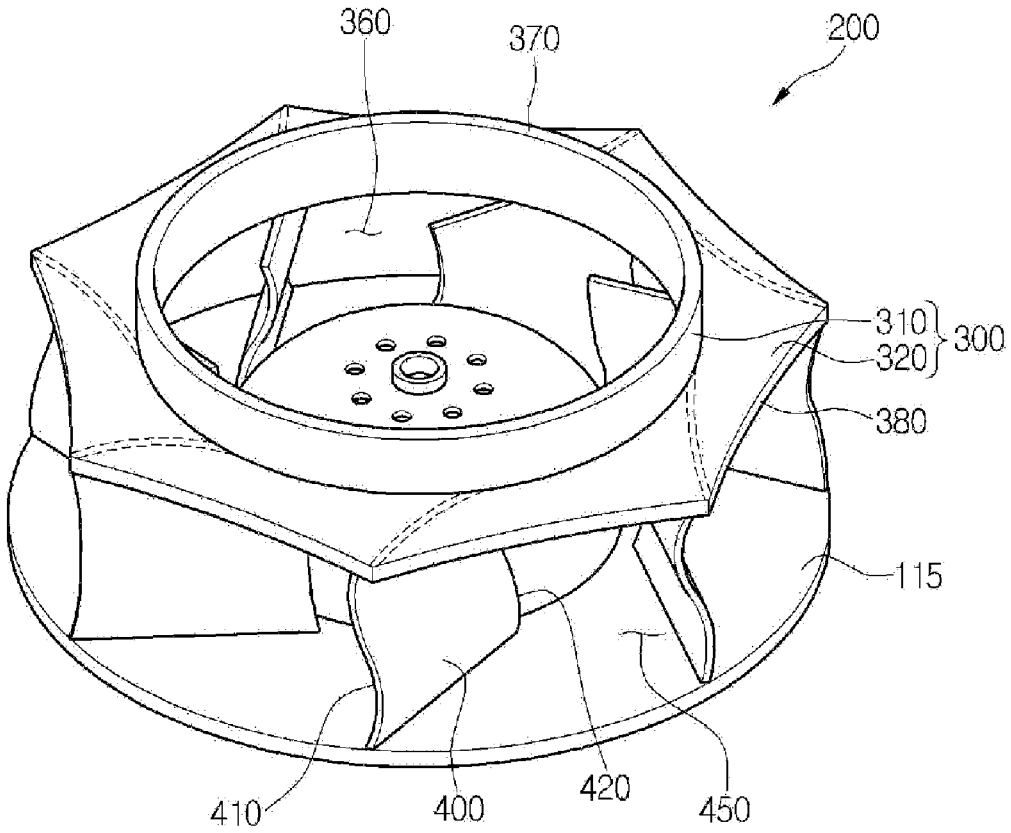
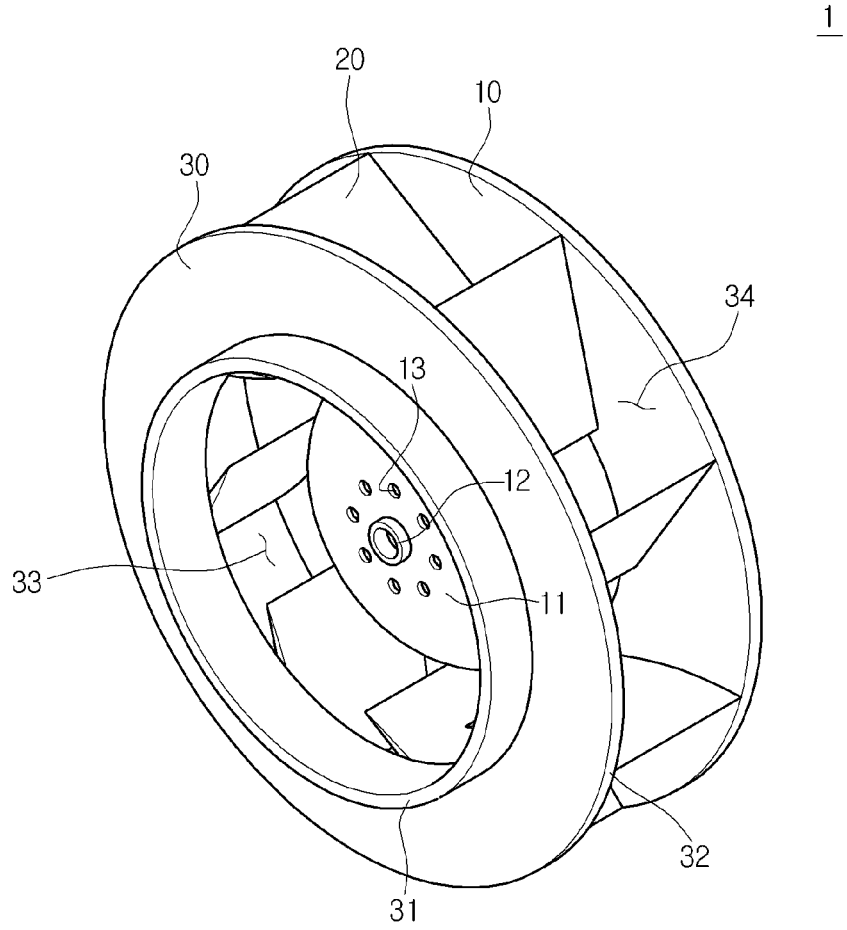


Fig.1



- RELATED ART -

Fig.2

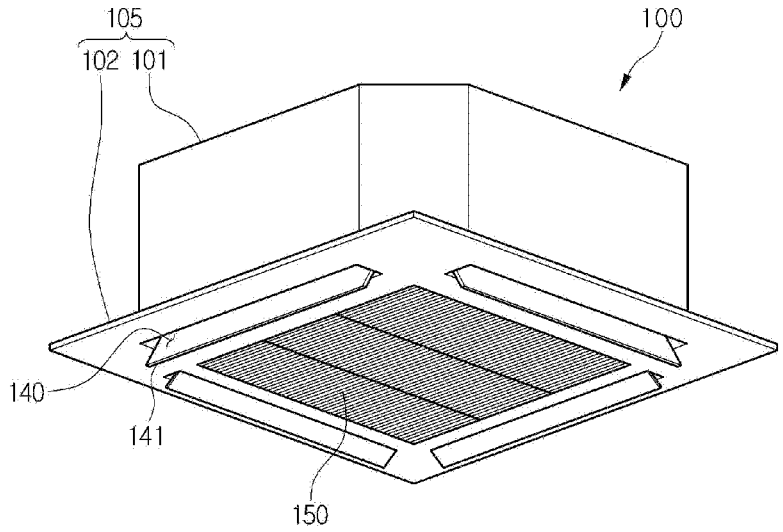


Fig.3

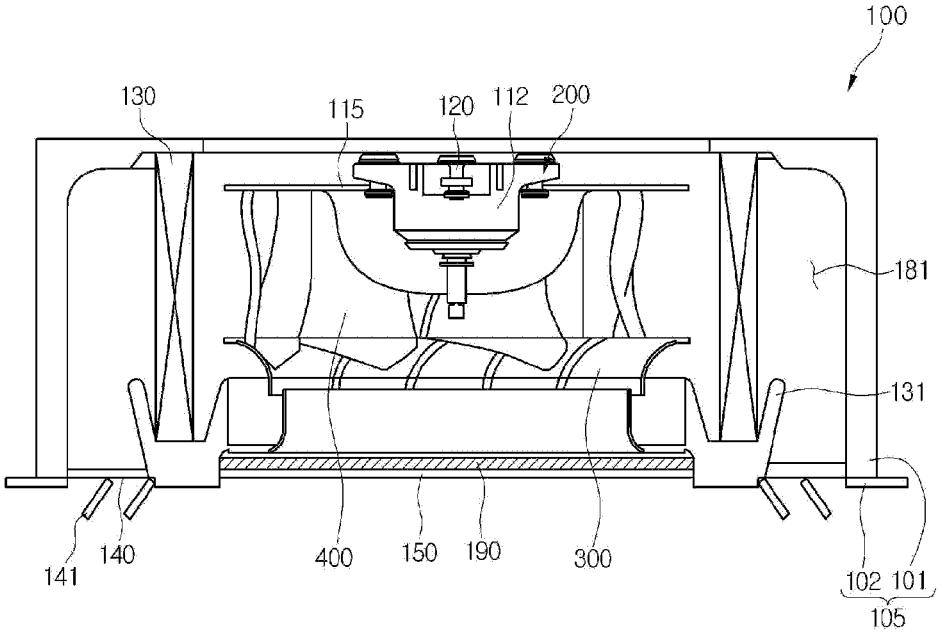

100
130
115
120
112
200
181
131
141
140
400
150
190
300
102
101
105

Fig.4

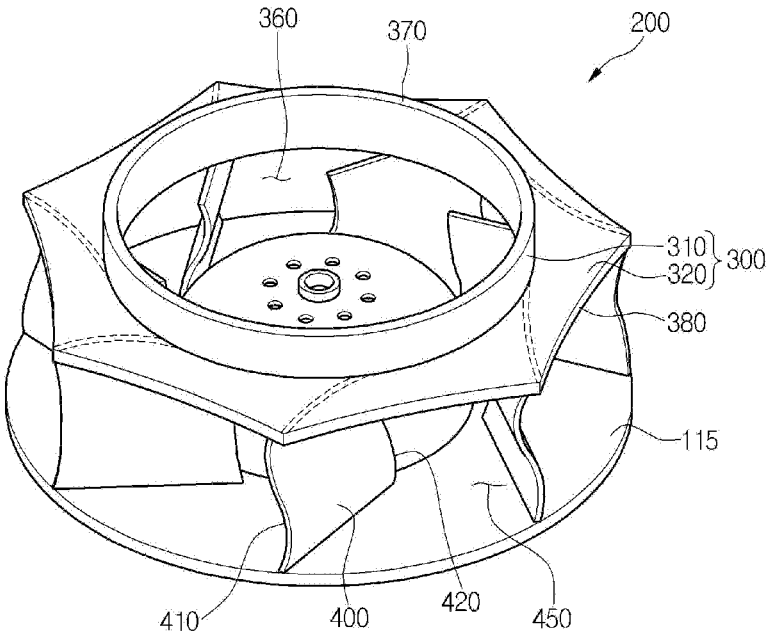


Fig.5

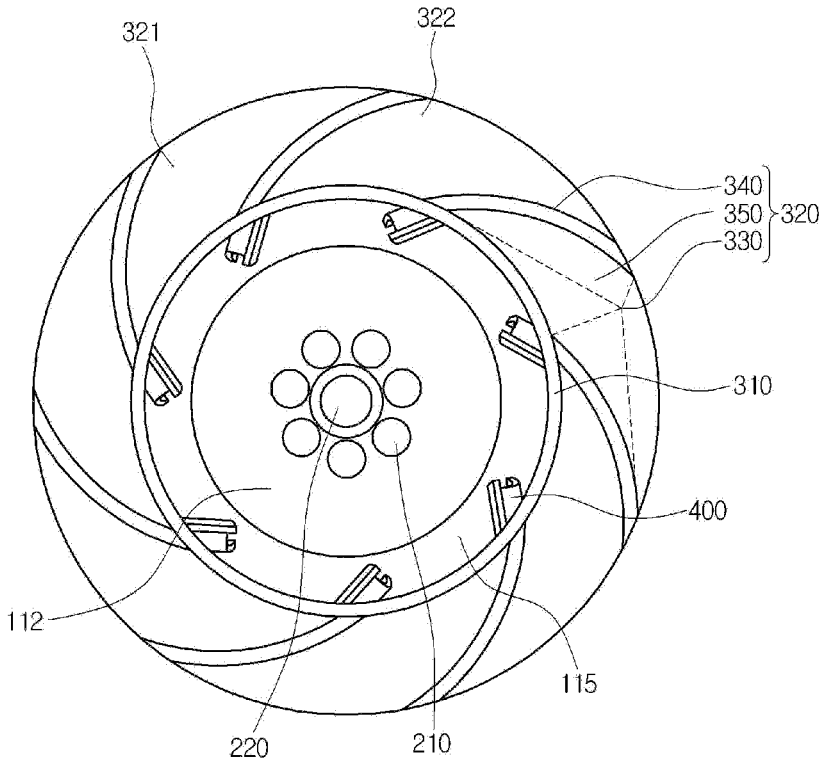


Fig.6

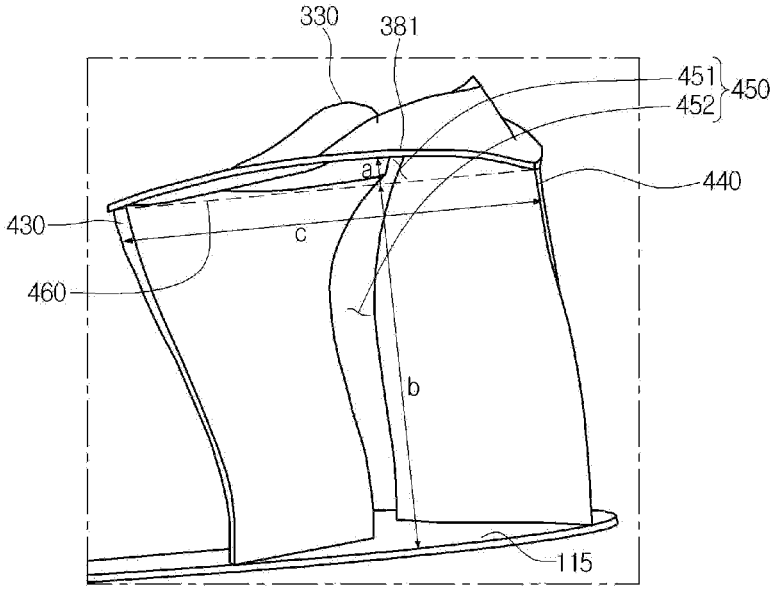


Fig.7

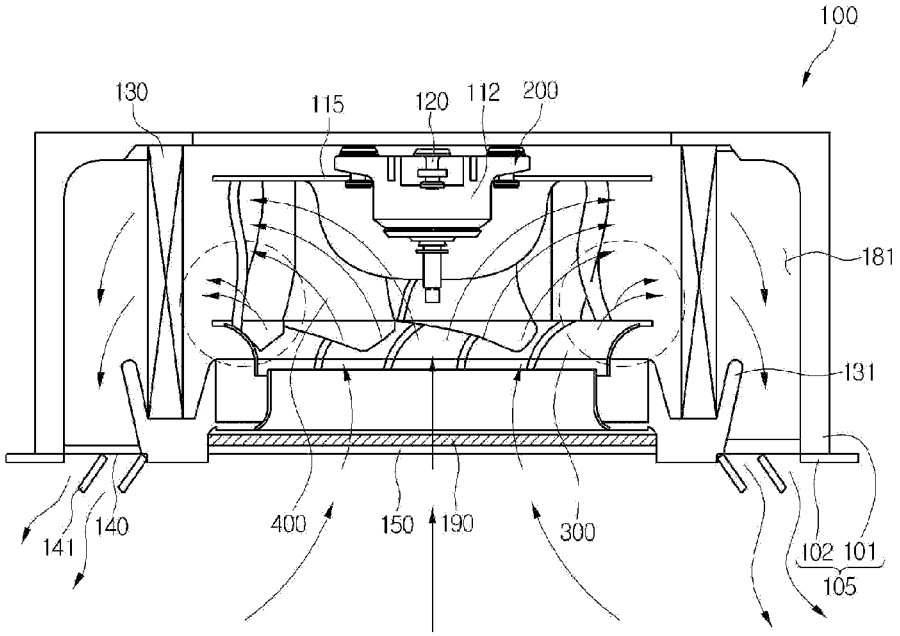
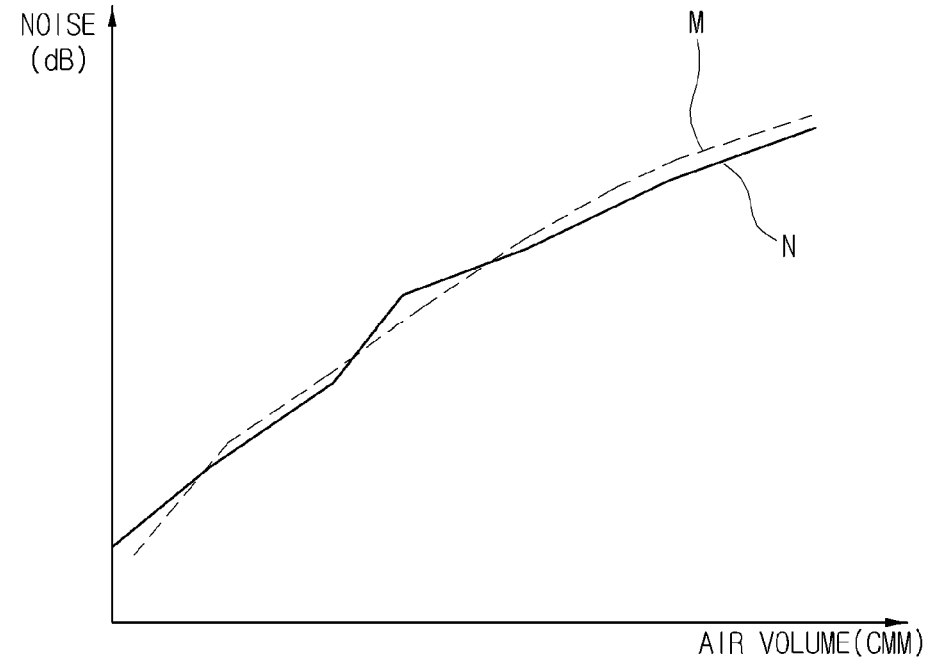

100
130
115
120
112
200
181
131
141
140
400
150
190
300
102
101
105

Fig.8



TURBO FAN AND CEILING TYPE AIR CONDITIONER USING THEREOF

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] The present application claims priority under 35 U.S.C. 119 and 35 U.S.C. 365 to Korean Patent Application No. 10-2013-0043388 (filed on Apr. 19, 2013), which is hereby incorporated by reference in its entirety.

BACKGROUND

[0002] The present disclosure relates to a turbo fan and a ceiling type air conditioner using the same.

[0003] In general, ceiling type air conditioners are devices that are positioned in an indoor ceiling to discharge heat-exchanged air into an indoor space after suctioning indoor air from the ceiling. In such a ceiling type air conditioner, air is suctioned through a suction hole defined in a central portion of the ceiling type air conditioner, and then, the suctioned air is heat-exchanged by a heat exchanger disposed within the ceiling type air conditioner. The air-conditioned air may be discharged into the indoor space through a discharge part disposed on a circumferential portion of the ceiling type air conditioner to adjust a temperature and moisture of the indoor space.

[0004] Particularly, the air suctioned through the suction hole may be guided in movement by a turbo fan disposed within the ceiling type air conditioner. That is, the turbo fan may suction air in an axial direction with respect to the turbo fan and discharge in a radius direction of the turbo fan.

[0005] FIG. **1** is a perspective view of a turbo fan according to a related art.

[0006] Referring to FIG. **1**, a turbo fan **1** according to a related art may include a main plate **10** rotating by power provided from a motor, a plurality of blades **20** radially arranged on the main plate **10** and integrated with the main plate **10**, and a shroud **30** coupled to ends of the blades **20** to face one surface of the main plate **10**.

[0007] Also, the turbo fan **1** may further include a hub **11** accommodating the motor therein, a boss part **12** having a shaft hole in a central portion of the hub **11** so that the motor is shaft-coupled to the shaft hole, and a vent part **13** defined in a surface of the hub **11** to cool the motor. The vent part **13** may introduce cold air into the motor therethrough to decrease a temperature of the motor.

[0008] The shroud **30** may have an inner circumference **31** and an outer circumference **32** so that air is introduced into the turbo fan **1** and then discharged radially. A suction hole **33** suctioning air may be defined in a central portion of the shroud **30**. Also, a discharge hole **34** discharging the suctioned air may be defined in a circumferential direction between the main plate **10** and the shroud **30**.

[0009] According to the related art, air suctioned into the turbo fan **1** through the suction hole **33** may be discharged to the outside of the turbo fan **1** through the discharge hole **34**. The discharge hole **34** may be defined as a space between the shroud **30** and the main plate **10**.

[0010] However, when the ceiling type air conditioner is changed in operation mode or operates for a long time, an amount of air introduced into the turbo fan **1** through the suction hole may gradually increase. Thus, when the suctioned air is discharged to the outside through the discharge hole **34**, a large amount of air may be discharged through a predetermined area to cause air flow noises.

SUMMARY

[0011] Embodiments provide a turbo fan which reduces air flow noises when air suctioned therein is discharged to the outside thereof and a ceiling type air conditioner using the same.

[0012] In one embodiment, a turbo fan includes: a main plate rotated by power provided from a fan motor; blades each having one end connected to the main plate to perform rotation movement; and a shroud having an inner circumferential part and an outer circumferential part, an other end of each of the blades connected to the shroud, wherein the shroud includes: a plurality of curved parts each having one side connected to the inner circumferential part and an other side connected to the outer circumferential part, the plurality of curved parts each having a predetermined curvature.

[0013] In another embodiment, a ceiling type air conditioner includes: a case defining an outer appearance; a fan motor disposed within the case; a turbo fan disposed within the case to change a moving direction of air passing through the suction hole; and a heat exchanger disposed outside the turbo fan, wherein the turbo fan including: a main plate rotated by power provided from the fan motor; blades each having one end connected to the main plate to perform rotation movement; and a shroud having an inner circumferential part and an outer circumferential part, an other end of each of the blades connected to the shroud, wherein the shroud includes: a plurality of curved parts each having one side connected to the inner circumferential part and an other side connected to the outer circumferential part, the plurality of curved parts each having a predetermined curvature.

[0014] The details of one or more embodiments are set forth in the accompanying drawings and the description below. Other features will be apparent from the description and drawings, and from the claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015] FIG. **1** is a perspective view of a turbo fan according to a related art.

[0016] FIG. **2** is a perspective view illustrating an indoor unit of a ceiling type air conditioner according to an embodiment.

[0017] FIG. **3** is a cross-sectional view illustrating the indoor unit of the ceiling type air conditioner according to an embodiment.

[0018] FIG. **4** is a perspective view of a turbo fan according to an embodiment.

[0019] FIG. **5** is a plan view of the turbo fan according to an embodiment.

[0020] FIG. **6** is a front view of the turbo fan according to an embodiment.

[0021] FIG. **7** is a schematic view illustrating a flow of air passing through the ceiling type air conditioner according to an embodiment.

[0022] FIG. **8** is a graph illustrating a relationship between an air volume and a noise when the turbo fan according to an embodiment is applied to the ceiling type air conditioner.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0023] Reference will now be made in detail to the embodiments of the present disclosure, examples of which are illustrated in the accompanying drawings.

[0024] In the following detailed description of the preferred embodiments, reference is made to the accompanying drawings that form a part hereof, and in which is shown by way of illustration specific preferred embodiments in which the invention may be practiced. These embodiments are described in sufficient detail to enable those skilled in the art to practice the invention, and it is understood that other embodiments may be utilized and that logical structural, mechanical, electrical, and chemical changes may be made without departing from the spirit or scope of the invention. To avoid detail not necessary to enable those skilled in the art to practice the invention, the description may omit certain information known to those skilled in the art. The following detailed description is, therefore, not to be taken in a limiting sense.

[0025] FIG. **2** is a perspective view illustrating an indoor unit of a ceiling type air conditioner according to an embodiment, and FIG. **3** is a cross-sectional view illustrating the indoor unit of the ceiling type air conditioner according to an embodiment.

[0026] Referring to FIGS. **2** and **3**, a ceiling type air conditioner according to an embodiment may include an outdoor unit (not shown) installed in an outdoor space, an indoor unit **100** installed in an indoor space, and a refrigerant tube (not shown) connecting the outdoor unit (not shown) to the indoor unit **100** to allow a refrigerant to flow therethrough.

[0027] The indoor unit **100** may include a case **105** defining an outer appearance thereof, a turbo fan **200** disposed within the case **105**, a fan motor **120** coupled to the turbo fan **200** to provide power, and a heat exchanger **130** disposed outside the fan motor **120**.

[0028] The case **105** may include a main body **101** defining side surfaces thereof and a front panel **102** coupled to the main body **101** to define a front surface thereof.

[0029] Also, the main body **101** is installed in an indoor ceiling. The main body **101** may have an opened lower portion to communicate with a suction hole **150** defined in the front surface of the front panel **102**. Although the main body **101** is installed in the indoor ceiling in consideration of space availability or a sense of beauty, the installed location of the main body **101** is not limited thereto. For example, the main body **101** may be installed in an indoor sidewall.

[0030] The front panel **102** may be detachably coupled to the lower portion of the main body **101**. Also, the front panel **102** may be exposed to the indoor space so that air is suctioned into or discharged from the indoor unit **100**. The front panel **102** may cover the opened portion of the main body **101**. For example, the front panel **102** may have a square plate shape to cover the opening of the main body **101**. Also, the front panel **102** may include a suction hole **150** through which indoor air is suctioned and a discharge hole **140** through which air is discharged into the indoor space.

[0031] The suction hole **150** may be defined in a central portion of the front panel **102**. The discharge holes **140** may be symmetrically defined in four sides surrounding the suction hole **150**. The suction hole **150** may have a grill structure. Each of the discharge holes **140** may have a rectangular structure with a predetermined width and length. However, each of the suction hole **150** and the discharge holes **140** are not limited to a shape thereof.

[0032] Also, a filter **190** for removing various foreign substances contained in the air suctioned into the main body **101** through the suction hole **150** may be provided inside the front panel **102**.

[0033] The turbo fan **200** may include a hub **112** connected to a rotation shaft of the fan motor **120**, a main plate **115** rotated by the fan motor **120**, a plurality of blades **400** having one ends connected to the main plate **115** and arranged at a predetermined distance along a circumferential direction on the main plate **115**, and a shroud **300** facing the main plate **115** to connect the other ends of the plurality of blades **400** to the shroud **300**. The shroud **300** may guide an inflow of air into the suction hole **150** when the turbo fan **200** rotates.

[0034] The shroud **300** may include a plurality of mountain parts **330** protruding upward from one surface of the shroud **300** and a plurality of valley parts **340** disposed between the plurality of mountain parts **330**. That is, the shroud **300** may have a three-dimensional shape.

[0035] The turbo fan **200** may be disposed on a position corresponding to the suction hole **150** to improve suction efficiency of the air suctioned into the main body **101**. Particularly, as shown in FIG. **3**, the turbo fan **200** may be disposed to correspond to a vertical direction of the suction hole **150**.

[0036] Also, the turbo fan **200** may blow the indoor air suctioned through the suction hole **150** toward the heat exchanger **130**.

[0037] The heat exchanger **130** may surround the outside of the turbo fan **200**. For example, the heat exchanger **130** may have a square structure corresponding to a shape of each of the side surfaces of the main body **101**. The heat exchanger **130** may heat-exchange with the air suctioned into the main body **101** through the turbo fan **200**. Particularly, when the ceiling type air conditioner operates in a cooling mode, air passing through the heat exchanger **130** may decrease in temperature. On the other hand, when the ceiling type air conditioner operates in a heating mode, air passing through the heat exchanger **130** may increase in temperature.

[0038] A drain plate **131** accommodating condensed water generated when the refrigerant passing through the heat exchanger **130** is heat-exchanged with the indoor air may be disposed under the heat exchanger **130**. Also, a drain tube (not shown) for discharging the condensed water collected in the drain plate **131** to the outside may be connected to the drain plate **131**.

[0039] A guide passage **181** for guiding a flow direction of air may be defined in an outer portion of the inside of the main body **101**. Particularly, the guide passage **181** may guide the air heat-exchanged with the heat exchanger **130** toward the discharge hole **140**.

[0040] A vane **141** for controlling the flow direction of the air may be disposed in the discharge hole **140**. The vane **141** may be rotatable at a predetermined angle. Also, the vane **141** may be inclined outward from the front surface of the front panel **102**. This is done for providing air having a uniform wind speed to all indoor portions. However, the rotation direction of the vane **141** is not limited thereto. Also, the vane **141** is not limited to an arrangement, configuration, and operation method as described thereof.

[0041] Hereinafter, a detailed structure of the turbo fan **200** will be described.

[0042] FIG. **4** is a perspective view of a turbo fan **200** according to an embodiment, FIG. **5** is a plan view of the turbo fan according to an embodiment, and FIG. **6** is a front view of the turbo fan according to an embodiment.

[0043] Referring to FIGS. **4** to **6**, the turbo fan **200** according to an embodiment may include a main plate **115** rotated by a power provided from a fan motor, a hub **112** accommodating the fan motor therein, a plurality of blades **400** having one ends connected to the main plate **115** and arranged radially on the main plate **115**, and a shroud **300** connecting the other end of each of the plurality of blades **400** to the shroud **300** to guide a flow direction of air.

[0044] The hub **112** may include a boss part **220** shaft-coupled to the fan motor disposed at a central portion of the hub **112** and a vent part **210** providing a moving path of air. The vent part **210** may introduce cold air into the motor therethrough to decrease a temperature of the motor.

[0045] Each of the blades **400** may include a blade front end **420** disposed adjacent to the hub **112** and a blade rear end **410** spaced apart from the hub **112** to guide air flowing along the blades **400** to a heat exchanger (see reference numeral **130** of FIG. **3**).

[0046] A hollow portion providing a moving path of air may be defined in a central portion of the shroud **300**. That is, an air suction part **360** may be disposed in the hollow portion so that indoor air is suctioned into the turbo fan **200**. The air suctioned through the air suction part **360** may be discharged to the outside through an exhaust part **450** defined in a space between the plurality of blades **400**.

[0047] The shroud **300** may include an inner circumferential part **370** defining an inner circumferential surface of the shroud **300** and disposed adjacent to the air suction part **360** and an outer circumferential part **380** defining an outer circumferential surface of the shroud **300** and disposed adjacent to the exhaust part **450**.

[0048] Also, the shroud **300** may include a guide part **310** disposed adjacent to the inner circumferential part **370** to guide a flow direction of air and a curved part **320** connected to the guide part **310** and having a predetermined curvature. Particularly, the guide part **310** may guide a flow direction of air introduced into the turbo fan **200** through the suction part **360**. The curved part **320** may guide a flow of air so that the air guided into the turbo fan **200** through the guide part **310** is discharged to the outside through the exhaust part **450**.

[0049] The curved part **320** may be provided in plurality. Also, the plurality of curved part **320** may include a mountain part **330** disposed spaced away from the main plate **115** and a valley part **340** disposed spaced closer to the main plate **115** than the mountain part **330**. The curved part **320** may include a first curved part **321** and a second curved part **322** disposed adjacent to the first curved part **321**. Also, the valley part **340** may be disposed on a boundary surface between the first curved part **321** and the second curved part **322**.

[0050] The curved part **320** may further include an inclined part **350** connecting the mountain part **330** to the valley part **340**. The inclined part **350** may be defined as a surface connecting the mountain part **330** to the valley part **340**, a surface connecting the mountain part **330** to the outer circumferential part **380**, and a surface connecting the mountain part **310** to the guide part **310**.

[0051] Also, a surface on which the blades **400** and the shroud **300** meet may have a curvature radius less than that of the valley part **340**. That is, the valley part **340** may have a length greater than a length of the surface on which the blade **400** and the shroud **300** meet. This is done for smoothly guiding a flow of air into the exhaust part **450**.

[0052] When a point at which the outer circumferential part **380** of the shroud **300** and the blade **400** meet is referred to as a first contact **430**, and a point at which the outer circumferential part **380** of the shroud **300** and the next blade **400** meet, the point being disposed adjacent to the first contact **430**, is referred to as a second contact **440**, a space within the exhaust part **450** may be partitioned by an extension part **460** connecting the first contact **430** to the second contact **440**.

[0053] Particularly, the extension part **460** may be defined as a virtual line connecting the first contact **430** to the second contact **440**. The exhaust part **450** may include a first exhaust part **451** disposed at an upper side with respect to the extension part **460** and a second exhaust part **452** disposed at a lower side with respect to the extension part **460**.

[0054] According to the related art, the turbo fan may include one exhaust part. However, the turbo fan **200** according to an embodiment may further include the first exhaust part **451** because the outer circumferential part **380** of the shroud **300** having a predetermined curvature and the second exhaust part **452**. Thus, air introduced into the turbo fan **200** may be discharged to the outside through the first exhaust part **451** as well as the second exhaust part **452** increasing an air flow space, compared to the turbo fan of the related art, thereby reducing air flow noises.

[0055] The turbo fan **200** according to an embodiment may further include a rotation shaft (not shown) providing a rotation center of the main plate **115**. If a central line (not shown) is a virtual line defined when the rotation shaft (not shown) and the virtual line extending through the mountain part **330** extend in parallel, with respect to the central line (not shown), a distance between the mountain part **330** and the inner circumferential part **370** may be greater than a distance between the mountain part **330** and the outer circumferential part **380**. That is, with respect to a flow direction of air passing through the shroud **300**, a flow space of air introduced into the shroud **300** may be less than that of air discharged from the shroud **300**.

[0056] Thus, the air passing through the shroud **300** may more smoothly flow. Also, a pressure loss of the air passing through the shroud **300** may be reduced.

[0057] With respect to the outer circumferential part **380**, a point disposed spaced furthest away from the main plate **115** may be defined as a protrusion **381**. When a distance between the protrusion **381** and the extension part **460** is a, and a distance between the extension part **460** and the main plate **115** is b, a value of a/b may be greater than about 0.05 and less than about 0.05. That is, a distance between the first exhaust part **451** and the extension part **460** and a distance between the second exhaust part **452** and the extension part **460** may be decided according to a predetermined ratio.

[0058] Also, when a length of the extension part **460** is c, a value of a/c may be greater than about 0.02 and less than about 0.06. That is, the distance between the first exhaust part **451** and the extension part **460** and the length of the extension part **460** may be decided according to a predetermined ratio.

[0059] However, the present disclosure is not limited to the values of a, b, and c and the ratios among a, b, and c. For example, more various embodiments may be applied to the current embodiment.

[0060] Hereinafter, an operation process of the ceiling type air conditioner according to an embodiment will be described.

[0061] FIG. **7** is a schematic view illustrating a flow of air passing through the ceiling type air conditioner according to an embodiment.

[0062] FIG. **7** illustrates a flow of air on the basis of the structure of FIG. **3**. Thus, the same structure as that of FIG. **3** will be expressed as the same reference numeral.

[0063] Referring to FIG. **7**, when the ceiling type air conditioner according to an embodiment operates, the indoor unit **100** connected to the outdoor unit (not shown) may operate. When the indoor unit **100** operates, the main plate **115** may rotate by driving of the fan motor **120**. As the main plate **115** rotates, the plurality of blades **400** connected to the main plate **115** may also rotate. When the plurality of blades **400** rotate, indoor air may be suctioned through the suction hole **150** defined in the center of the front panel **102** of the indoor unit **100**. The suctioned air may pass through the filter **190** to filter foreign substances. Also, a flow of the suction air may be guided into the turbo fan **200** by the shroud **300**. Particularly, the air may be suctioned into the turbo fan **200** through the air suction part **360** that is a space defined by the inner circumferential part **370** of the shroud **300**.

[0064] The air introduced into the turbo fan **200** may be radially discharged by the rotation of the plurality of blades **400**. That is, the air introduced into a lower portion of the turbo fan **200** may be discharged in a lateral direction by the operation of the turbo fan **200**.

[0065] The shroud **300** may include a plurality of curved parts **320**. The plurality of curved parts **320** may include a plurality of mountain parts **330**, a plurality of valley parts **340**, and an inclined part **350** connecting each of the mountain part **330** to each of the valley parts **340**. The inclined part **350** may include the protrusion **381** protruding from the extension part in one direction. Thus, the air suctioned into the turbo fan **200** may be discharged to the outside along the first exhaust part **451** defined by the protrusion **381** and the second exhaust part **452** communicating with the first exhaust part **451**.

[0066] A portion of air discharged from the blades may pass through the heat exchanger **130** and then be heat-exchanged with a refrigerant flowing into the heat exchanger **130**. The heat-exchanged refrigerant may be discharged into the indoor space through the discharge hole **140**. Also, the plurality of vanes **141** may be disposed in the discharge hole **140** to adequately condition the indoor space.

[0067] FIG. **8** is a graph illustrating a relationship between an air volume and noise when the turbo fan according to an embodiment is applied to the ceiling type air conditioner.

[0068] Referring to FIG. **8**, when the ceiling type air conditioner to which the shroud according to the related art is applied operates, the more an air volume increases, the more the noise may increase (M). On the other hand, when the ceiling type air conditioner to which the shroud according to the current embodiment is applied operates, the more an air volume increases, the more the noise may relatively slightly increase (N) when compared to that of the related art (M).

[0069] The shroud **300** according to the current embodiment may include the plurality of mountain parts **330**, the plurality of valley parts **340**, and the inclined part **350** connecting each of the mountain part **330** to each of the valley parts **340**. Thus, the plurality of exhaust parts **450** may be defined in the turbo fan **200** by the plurality of mountain parts **330**, the plurality of valley parts **340**, and the inclined part **350**. That is, in the turbo fan **200** according to the current embodiment, since the exhaust part **450** has a relatively wide area when compared to the related art, the air flow space may increase. Thus, the flow noise of the air passing through the exhaust part **450** may be reduced, and it may prevent an inner air pressure of the exhaust part **450** from suddenly increasing.

[0070] Although embodiments have been described with reference to a number of illustrative embodiments thereof, it should be understood that numerous other modifications and embodiments can be devised by those skilled in the art that will fall within the spirit and scope of the principles of this disclosure. More particularly, various variations and modifications are possible in the component parts and/or arrangements of the subject combination arrangement within the scope of the disclosure, the drawings and the appended claims. In addition to variations and modifications in the component parts and/or arrangements, alternative uses will also be apparent to those skilled in the art.

What is claimed is:

1. A turbo fan comprising:
- a main plate rotated by power provided from a fan motor;
- a plurality of blades, each blade having one end connected to the main plate to perform rotation movement; and
- a shroud having an inner circumferential part and an outer circumferential part, an other end of each of the blades connected to the shroud,
- wherein the shroud comprises:
- a plurality of curved parts, each curved part having one side connected to the inner circumferential part and an other side connected to the outer circumferential part, the plurality of curved parts each having a predetermined curvature.

2. The turbo fan according to claim **1**, wherein at least one of the plurality of curved parts comprises a mountain part spaced away from the main plate.

3. The turbo fan according to claim **2**, wherein the plurality of curved parts comprise a first curved part and a second curved part disposed adjacent to the first curved part,
- a valley part disposed on a boundary surface between the first curved part and the second curved part, the valley part being disposed spaced closer to the main plate than the mountain part; and
- an inclined part connecting the mountain part to the valley part, the inclined part having the predetermined curvature.

4. The turbo fan according to claim **3**, wherein each of the plurality of curved parts comprises the mountain part, and the mountain part and the valley part are alternately disposed with respect to each other along a circumferential direction of the shroud.

5. The turbo fan according to claim **2**, further comprising:
- a rotation shaft providing a rotation center of the main plate, and
- a central line that is a virtual line defined when the rotation shaft and the virtual line extending through mountain part extend in parallel, wherein a distance between the mountain part and the inner circumferential part is greater than a distance between the mountain part and the outer circumferential part with respect to the central line.

6. The turbo fan according to claim **2**, wherein an angle of a slope of a surface connecting the mountain part to the inner circumferential part is less than a slope of a surface connecting the mountain part to the outer circumferential part.

7. The turbo fan according to claim **1**, wherein a first contact is a point at which the outer circumferential part and a blade meet, and a second contact is a point at which the outer

circumferential part and an adjacent blade meet, the extension part defined as a virtual line connecting the first contact point and the second contact point. and a protrusion is a point at the outer circumferential part disposed spaced furthest away from the main plate,

wherein when a distance between the protrusion and the extension part is a, and a distance between the extension part and the main plate is b, a value a/b is set according to a predetermined ratio.

8. The turbo fan according to claim **7**, wherein when a length of the extension part is c, a value of a/c is set according to a predetermined ratio.

9. The turbo fan according to claim **7**, further comprising an exhaust part disposed between the plurality of blades to provide a moving path of the air,

wherein the exhaust part comprises:

a first exhaust part disposed at an upper side of the extension part; and

a second exhaust part communicating with the first exhaust part, the second exhaust part disposed at a lower side of the extension part.

10. The turbo fan according to claim **9**, wherein at least one of the first and second exhaust parts is defined as a space in which the outer circumferential part and the extension part are disposed.

11. The turbo fan according to claim **3**, wherein the valley part has a length greater than a length of a surface at which the blade meets the shroud.

12. The turbo fan according to claim **3**, wherein the valley part has a curvature radius greater than a curvature radius of a surface at which the blade meets the shroud.

13. A ceiling type air conditioner comprising:

a case defining an outer appearance, the case having a suction hole;

a fan motor disposed within the case;

a turbo fan disposed within the case to change a moving direction of air passing through the suction hole; and

a heat exchanger disposed outside the turbo fan,

wherein the turbo fan comprising:

a main plate rotated by power provided from the fan motor;

a plurality of blades, each blade having one end connected to the main plate to perform rotation movement; and

a shroud having an inner circumferential part and an outer circumferential part, an other end of each of the blades connected to the shroud,

wherein the shroud comprises:

a plurality of curved parts, each curved part having one side connected to the inner circumferential part and an other side connected to the outer circumferential part, the plurality of curved parts each having a predetermined curvature.

14. The ceiling type air conditioner according to claim **13**, wherein at least one of the plurality of curved parts comprises a mountain part spaced away from the main plate.

15. The ceiling type air conditioner according to claim **14**, wherein the plurality of curved parts comprise a first curved part and a second curved part disposed adjacent to the first curved part,

a valley part disposed on a boundary surface between the first curved part and the second curved part, the valley part being disposed spaced closer to the main plate than the mountain part; and

an inclined part connecting the mountain part to the valley part, the inclined part having the predetermined curvature.

16. The ceiling type air conditioner according to claim **13**, wherein a first contact is a point at which the outer circumferential part and a blade meet, and a second contact is a point at which the outer circumferential part and an adjacent blade meet, the extension part defined as a virtual line connecting the first contact point and the second contact point. and a protrusion is a point at the outer circumferential part disposed spaced furthest away from the main plate,

wherein when a distance between the protrusion and the extension part is a, and a distance between the extension part and the main plate is b, a value a/b is set according to a predetermined ratio.

17. The ceiling type air conditioner according to claim **16**, further comprising an exhaust part disposed between the plurality of blades to provide a moving path of the air,

wherein the exhaust part comprises:

a first exhaust part disposed at an upper side of the extension part; and

a second exhaust part communicating with the first exhaust part, the second exhaust part disposed at a lower side of the extension part.

18. The ceiling type air conditioner according to claim **14**, further comprising:

a rotation shaft providing a rotation center of the main plate, and

a central line that is a virtual line defined when the rotation shaft and the virtual line extending through mountain part extend in parallel, wherein a distance between the mountain part and the inner circumferential part is greater than a distance between the mountain part and the outer circumferential part with respect to the central line.

* * * * *